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R100 Scottish Isles Fibre-optic Project

Marine Environmental Appraisal - Inner Hebrides

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R100 Scottish Isles Fibre-optic Project

Marine Environmental Appraisal - Inner Hebrides

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GLOSSARY

AA
Appropriate Assessment

AEZs
Appropriate archaeological exclusion zone

AIS
Automatic Identification System

ALAPR
As Low As Reasonably Practicable

AP
articulated pipe

AWAC
armour wire anchor clamp

BAP
Biodiversity Action Plan

BGS
British Geological Society

BMH
Beach Manhole

BP
Best Practice

Bq
becquerels

BT
British Telecommunications plc

BTO
British Trust for Ornithology

BU
Branching Unit

CBA
Cable Burial Assessment

CCW
Countryside Council for Wales

CD
Chart Datum

CES
Crown Estate Scotland

CHSR
Conservation of Habitats and Species Regulations

cm
Centimetre

COHSR
Conservation of Offshore Habitats and Species Regulations

COLREGs
Convention on the International Regulations for Preventing Collisions at Sea

DBA
Desk Based Assessment

DEFRA
Department for Environment, Food and Rural Affairs

DSE
Direct Shore End

DTS
Desk-top Study

EEZ
Exclusive Economic Zone

EMEC
European Marine Energy Centre

EMODnet
European Marine Observation Data Network

EPA
Environmental Protection Agency

EPS
European Protected Species

EU
European Union

EUNIS
European Nature Information System

FAS
Fishing Activity Study

FCS
Favourable Conservation Status

FEAST
Feature Activity Sensitivity Tool

FLMAP
Fishing Liaison Mitigation Action Plan

FLO
Fishing Liaison Officer

FPO
Fish Producers Organisation

GeMS
Geodatabase of Marine Features adjacent to Scotland

GES
Good Environmental Status

GIS
Geographical Information System

Global Marine
Global Marine Systems Ltd

GM
Global Marine Systems Ltd

GMG
Global Marine Group

HDPE
High Density Polyethylene

HES
Historic Environment Scotland

HF
High frequency

HM
Her Majesty

HRA
Habitats Regulations Assessment

ICES
International Council for the Exploration of the Sea

ICG-C
Intercessional Correspondence Group on Cumulative Effects

ICG
Intercessional Correspondence Group

ICPC
International Cable Protection Committee

INIS
Invasive Non-indigenous Species

Intertek
Intertek Energy & Water Consultancy Services

IoM
Isle of Man

IRL
Ireland

iSPM
Inorganic suspended particulate material

IUCN
International Union for Conservation of Nature

JNCC
Joint Nature Conservation Committee

KM
Kilometre

LAT
Lowest Astronomical Tide

LF
low frequency

Long Term Effect
Effects lasting fifteen to sixty years

LSE
Likely Significant Effect

LWM
Low Water Mark

M
Metre

MAIB
Marine Accident Investigation Branch

MarLIN
Marine Life Information Network

MARPOL
The International Convention for the Prevention of Pollution from Ships

Mbps
Megabits per second

MCAA
Marine and Coastal Access Act

MCA
Maritime and Coastguard Agency

MEA
Marine Environmental Appraisal

Medium Term Effect
Effects lasting seven to fifteen years

MHWS
Mean High-Water Spring

mm
Millimetre

MOD
Ministry of Defence

MLV
Main lay vessel

MMMP
Marine Mammal Mitigation Plan

MMO
Marine Management Organisation

MPA
Marine Protected Areas

MS
Marine Scotland

MSFD
Marine Strategy Framework Directive

MSI
Maritime Safety Information

MS-LOT
Marine Scotland Licensing Operations Team

MSLOT
Marine Scotland Licensing Operations Team

mSv/y
Millisievert per year

MU
Management Unit

NCMPA
Nature Conservation Marine Protected Area

NM
Nautical Mile

NMP
National Marine Plan

NMPi
National Marine Plan interactive

NRA
Navigational Risk assessment

NtM
Notice to Mariners

OOS
Out-of-service

ORJIP
Offshore Renewables Joint Industry Programme

OREI
Offshore Renewable Energy Installation

ORS
Old Red Sandstone

PAC
Pre-Application Consultation

PAD
Pressures-Activity Database

PAIH
Potential Annex I habitat

PCE
potential cumulative effect

PLB
Post Lay Burial

PLIB
Post lay inspection and burial

PLGR
Pre-lay grapnel run

PLN
Port Letter Number

PLSE
Pre-Lay Shore End

PMF
Priority Marine Features

PSA
Projects Protected Sites Screening Assessment

pSPA
proposed Special Protection Areas

PTS
Permanent Threshold Shift

R100
Reaching 100%

R100 Project Area
Orkney, Shetland and Inner Hebrides

RBMP
River Basin Management Plans

RC
Route Clearance

RIFG
Regional Inshore Fisheries Group

RNLI
Royal National Lifeboat Institution

ROV
Remotely Operated Vehicle

RPL
Route Position List

RYA
Royal Yachting Association

SAC
Special Areas of Conservation

SEA
Strategic Environmental Assessment

SEL
Exposure to sound

SEPA
Scottish Environment Protection Agency

Short Term Effect
Effects lasting one to seven years

SMWWC
Scottish Marine Wildlife Watching Code

SNCB
Statutory Nature Conservation Body

SOLAS
Safety of Life at Sea

SPA
Special Protection Areas

SPL
Sound Pressure Level

SSPO
Scottish Salmon Producers Organisation

SSSIs
Sites of Special Scientific Interest

SWFPA
Scottish White Fish Producers Association

TAC
Total Allowable Catch

TTS
temporary threshold shift

UK
United Kingdom

UKHO
United Kingdom Hydrographic Office

USBL
Ultra Short Baseline

VHF
Very High Frequency

VHPM
Vessel Hours Per Month

VMS
Vessel Monitoring System

WFD
Water Framework Directive

ZOI
zone of influence

1. INTRODUCTION

1.1 Purpose of this Report

This Marine Environmental Appraisal (MEA) has been prepared in support of marine licence applications being made for telecommunications cable installation within territorial waters under the Marine Scotland Act 2010 (hereafter referred to as MS Act 2010).

This MEA has been prepared on behalf of British Telecommunication plc (BT) for the R100 Project, in accordance with the requirements of the MS Act 2010 for installation of four cables within the Inner Hebrides area.

1.2 Overview of the Project

BT is proposing to install and operate 16 new telecommunications cables to extend superfast broadband (30 Megabits per second (Mbps) +) coverage in three geographical areas of Scotland; Orkney, Shetland Islands and the Inner Hebrides. These new cables will form part of the Scottish Government's 'Reaching 100%' (R100) programme contracted to BT. Global Marine Group (GMG) has been contracted to supply and install the system. Intertek is GMG's Subconsultant for the preparation of the marine licences. As part of the R100 Project, BT & Global Marine will install 16 new cables in the following geographical areas:

- Orkney – 7 cables
- Shetland and Fair Isle – 5 cables
- Inner Hebrides - 4 cables

Figure 1-1 (Drawing reference: P2308-LOC-001-D) shows the wider project area and the cable routes which fall within each geographical area.

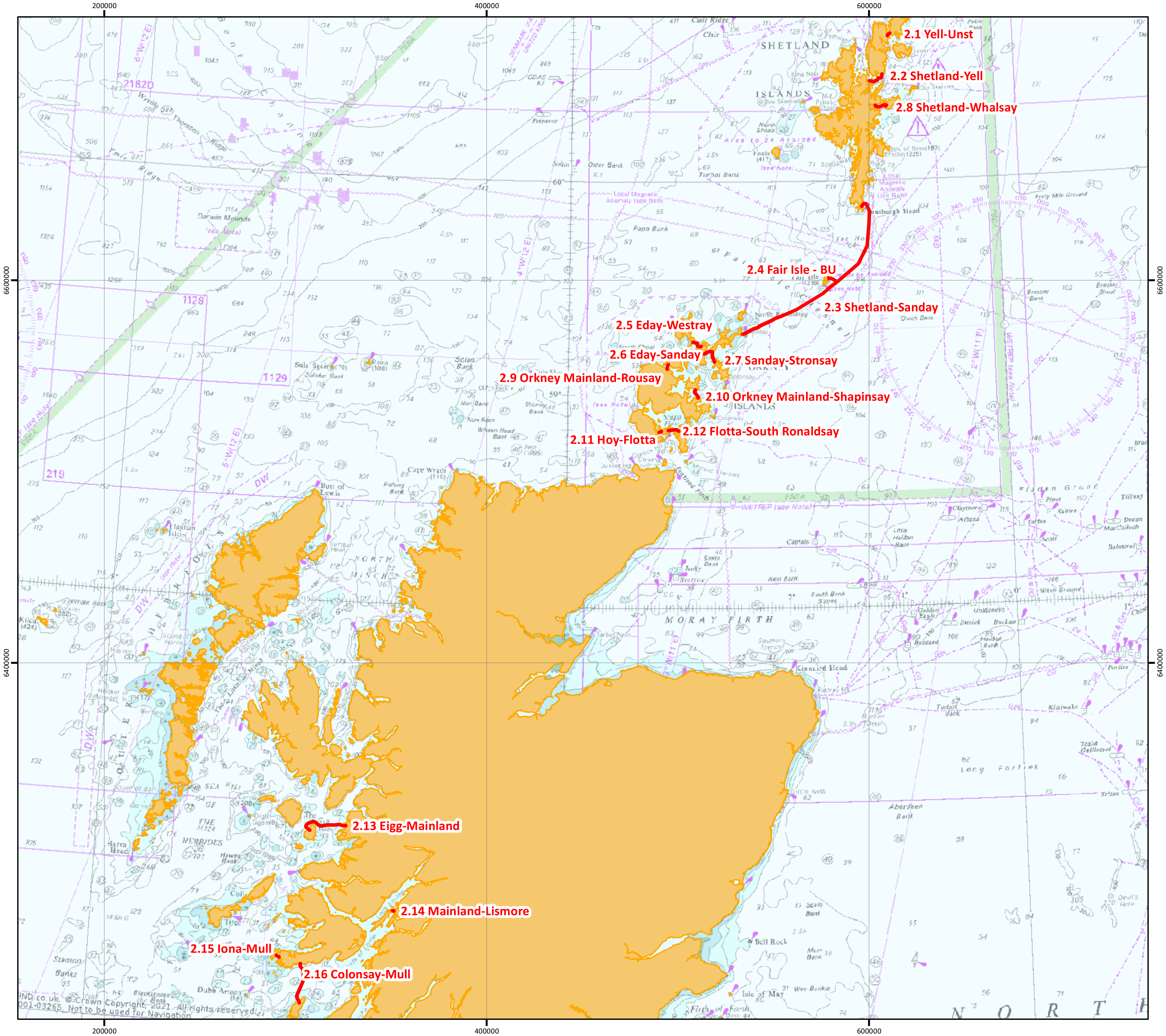
A separate MEA and supporting documents have been prepared per geographical area. This MEA will cover the Inner Hebrides geographical area, Figure 1-2: Project Location Overview (Drawing reference P2308-LOC-001-D_IH).

Within Inner Hebrides, the Project proposes installation of four subsea fibre-optic cables between mean high-water springs (MHWS) at the following landfall locations:

- Cable 2.13 – Eigg to Mainland
- Cable 2.14 – Mainland to Lismore
- Cable 2.15 – Iona to Mull
- Cable 2.16 – Colonsay to Mull

Each cable listed above will have a separate marine licence application supported by this MEA and supporting documents. Each cable marine licence application will be for an application corridor, hereafter referred to as the cable corridor. The cable corridor covers a width of 500m within which the cable route will be installed. A corridor is applied for so that there is scope for refining the cable route following the identification of any environmental and engineering constraints identified as part of the consenting and route engineering process. The MEA has assumed that the cable route could be positioned anywhere within the cable corridor.

The Project is anticipated to take approximately 2-3 months within the Inner Hebrides geographical area to complete. Installation is planned to commence in Q2 2022. The exact timings of the Project are subject to approval of the marine licence applications and will be dependent upon the offshore works, marine licensing and onshore permits and conditions. Notifications will be issued at an agreed schedule prior to operations closer to the project commencement.



SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

LOCATION OVERVIEW
Cable Application Corridors

Drawing No: P2308-LOC-001	D

Legend

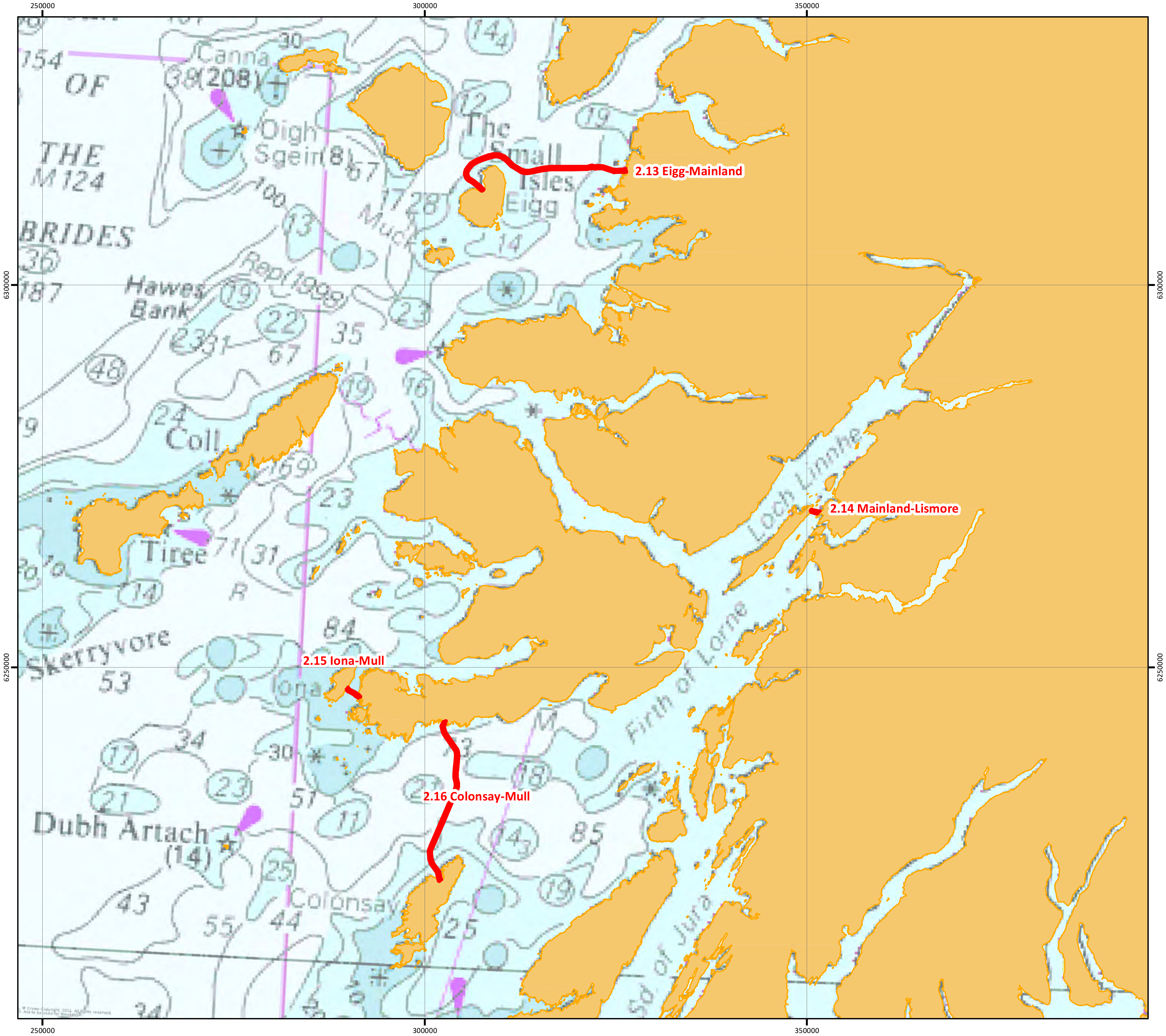
Cable Route Application Corridor

NOTE: Not to be used for Navigation

Date	12 October 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ONS; MarineFind; ESRI;
File Reference	J:\P2308\Mxd\01_LOC\ P2308-LOC-001.mxd
Created By	Chris Dawe
Reviewed By	Abigale Nelson
Approved By	Paula Daglish

BT Global Marine intertek

0 25 50 75 100 km



SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

LOCATION OVERVIEW
Cable Route Application Corridors - Inner Hebrides

Drawing No: P2308-LOC-001_IH	D

Legend

Cable Route Application Corridor

N
W E
S

NOTE: Not to be used for Navigation

Date	18 October 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ONS; MarineFind; ESRI;
File Reference	J:\P2308\Mxd\01_LOC\ P2308-LOC-001_IH.mxd
Created By	Chris Dawe
Reviewed By	Abigale Nelson
Approved By	Paula Daglish

BT Global Marine intertek

0 5 10 15 20 km

1.3 Project Need

The Scottish Government has made the commitment that every home and business in Scotland should have access to superfast broadband of 30Mbps, the R100 Programme. This Project is part of R100 programme and will extend superfast broadband coverage across Orkney, Shetland and the Inner Hebrides.

The Project will enhance the existing provision of telecommunication infrastructure to the Scottish Islands. This is especially important as digital connectivity has played a vital role in support efforts to keep people safe during the Covid-19 lockdown and will be pivotal in plans for strategic economic recovery from the pandemic.

1.4 Consent Requirements and Relevant Legislation

1.4.1 Marine (Scotland) Act 2010

Installation and operation of submarine cables in Scottish waters requires a Marine Licence under Part 4 of the Marine (Scotland) Act 2010 (Scottish Parliament, 2010).

This MEA Report presents an overview of the baseline environment and provides an environmental assessment to support the Marine Licence applications through consideration of the potential effects of the Project to the marine environment.

1.4.2 The Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013

Prospective applicants for marine licences for certain activities are required under the marine plan to carry out early stakeholder engagement and public Pre-application Consultation that is appropriate, proportional and meaningful. In addition, the Marine Works and Marine Licensing (Miscellaneous Temporary Modifications) (Coronavirus) (Scotland) Regulations 2020 has made amendments to the Marine Licensing under the Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013 during the global pandemic. Due to the Covid-19 global pandemic, the Pre-application Consultation event for the R100 Project was held online and a separate report covering the online event is provided in Appendix B.

1.4.3 Scottish Crown Estate Act 2019

The Crown Estate Scotland (CES) own and manage the majority of the seabed out to the 12NM territorial limit. Permission is needed for rights to lay, maintain and operate cables on areas of seabed for which they are the landlord. A Crown Estate Scotland Lease will be required under the Scottish Crown Estate Act 2019 for the right to install and operate the cables within Scottish territorial waters.

1.4.4 Submarine Telegraph Act 1885

Under the Submarine Telegraph Act 1885, more recently updated by the Merchant Shipping Act 1995, submarine telegraph cables are to be protected. The act provides a code of conduct in relation to navigational safety and avoidance of damage to other ships and offshore assets. It is an offence to cause damage to a submarine telegraph cable under provision 58 of the Act.

1.4.5 Convention on the International Regulations for Preventing Collisions at Sea 1972

The Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs) was introduced to prevent collisions between two or more vessels. They apply to all vessels navigating on the sea. The COLREGS are industry best practice measures to minimise effects from marine operations. These measures will be applied where possible through the project activities.

1.4.6 Scottish National Marine Plan

The Scottish National Marine Plan (NMP) establishes policies and objectives to enable the sustainable development and management of Scotland's marine resources, in both Scottish inshore (out to 12NM) and offshore waters (12 to 200NM). The NMP details 21 general policies that are applicable to all future developments and uses within Scottish waters. The key policies relevant to this Project include, but are not limited to, the key topic areas of the MEA. These general policies are supplemented by sector-specific policies, enabling policies and objectives to be targeted at particular industries. With regards to this Project, the most relevant sectoral policy sections have been set out below.

1.4.6.1 Sea fisheries

The Sea Fisheries chapter of the NMP (Marine Scotland, 2021) details five marine planning policies that should be taken into account when developing within the vicinity of areas utilised for fishing purposes. Of these five, three are relevant to this Project. These are: Fisheries 1, Fisheries 2 and Fisheries 3.

1.4.6.2 Shipping Ports, Harbours and Ferries

The Shipping, Ports, Harbours and Ferries chapter of the NMP (Marine Scotland, 2021) details five marine planning policies that should be taken into account when considering developments. Of these five, two are relevant to cable installation activities of this Project. These are:

- Safeguarded access to ports and harbours and navigational safety;
- Safeguarded essential maritime transport links to island and remote mainland communities.

1.4.6.3 Submarine Cables

The Submarine Cables chapter of the NMP (Marine Scotland, 2021) details five marine planning policies that should be taken into account when considering cable developments. Of these policies, four are relevant to cable installation activities of this Project. The relevant policies are as follows:

- Protect submarine cables whilst achieving successful seabed user co-existence.
- Achieve the highest possible quality and safety standards and reduce risks to all seabed users and the marine environment.
- Support the development of a Digital Fibre Network, connecting Scotland's rural and island communities and contributing to world class connectivity across Scotland.
- Safeguard and promote the global communications network.

In addition to these objectives, the NMP details four planning policies to be considered in the development of new submarine cable projects. These are: Cables 1, Cables 2, Cables 3, and Cables 4.

1.4.7 Scottish marine regions

After multiple years of public consultation and specialist studies establishing the support for, and potential areas of marine regions in Scottish waters (Scottish Government, 2015), the Scottish Marine Regions Order 2015 came into force on the 13th May 2015 and details the boundaries of the final eleven Scottish marine regions (Scottish Parliament, 2015). Three cables within Inner Hebrides (Cables 2.14, 2.15 and 2.16) are within the West Highlands Marine Region, and one (Cable 2.13) is within the Argyll Marine Region. Within these marine regions, Regional Marine Plans will be developed by Marine Planning Partnerships. These partnerships are comprised of groups of local marine stakeholders, allowing for more focused decision making by the local community to target the issues specific to each marine region.

1.4.8 Argyll and Bute Local Development Plan

Cables 2.14, 2.15 and 2.16 fall within the area of the Argyll and Bute Local Development Plan 2 (LDP), which was adopted in 2020. For coastal areas, protection of wild areas is deemed important. The plan details several policies under it's High Quality Environment section, which relate to the coastal environment in which any planning application will be assessed (Argyll and Bute Council, 2021). The effects to these are considered in the physical and biological chapters of this MEA.

1.4.9 West Highland and Islands Local Development Plan

Cable 2.13 falls within the area of the West Highland and Islands LDP, which was adopted in 2019. The LDP does not have a dedicated coastal policy, but does have area-specific policies for Eigg (a landfall location), in addition to policies on Environment and Heritage which are applicable to the coastal environment, and in which any planning application will be assessed (The Highland Council, 2021). The effects to these are considered in the physical and biological chapters of this MEA.

1.4.10 Crown Estate Scotland Seabed Lease

The Crown Estate Scotland (CES) own and manage the majority of the seabed out to the 12NM territorial limit. Permission is needed for rights to lay, maintain and operate cables on areas of seabed for which they are the landlord. A Crown Estate Scotland Lease will be required for the right to install and operate all cables, as they fall within Scottish territorial waters.

1.4.11 Habitats Regulations Assessment (HRA)

Regulation 63(1) of The Conservation of Habitats and Species Regulations 2017 (CHSR) and Regulation 28 (2) of The Conservation of Offshore Habitats and Species Regulations 2017 (COHSR) (collectively referred to as the 'Habitat Regulations') require that any plan or project which has the potential to adversely affect a European Site, no matter how far away from that site, be subject to the Habitats Regulations Assessment (HRA) process in order to determine whether an Appropriate Assessment is required. This is to ensure protection of European Sites, including Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Ramsar sites. The effects to these are considered in the biological section of this MEA and supported by Appendix C – Protected Sites Assessment.

1.4.12 Marine Protected Areas (MPA)

Marine Protected Areas are marine areas which are designated for nature conservation, protection of biodiversity, demonstrating sustainable management, and protecting national heritage. The Nature Conservation MPA network consists of 30 MPAs: 17 MPAs under the Marine (Scotland) Act 2010 in Scottish territorial waters and 13 MPAs under the Marine and Coastal Access Act 2009. The effects to these are considered in the biological section of this MEA and supported by Appendix C – Protected Sites Assessment.

1.4.13 Sites of Special Scientific Interest (SSSI)

Sites of Special Scientific Interest (SSSIs) are areas of land that have been scientifically identified as being of the highest degree of conservation value. In Scotland, SSSIs were first designated under the National Parks and Access to the Countryside Act 1949 and are now designated under the Nature Conservation (Scotland) Act 2004. The effects to these are considered in the biological section of this MEA and supported by Appendix C – Protected Sites Assessment.

1.4.14 Water Framework Directive

The European Union (EU) WFD (2000/60/EC) was established in the year 2000. In Scotland, this is bound by The Water Environment (Controlled Activities) (Scotland) Regulations 2011. The objective of the Water Framework Directive is to have good quality water bodies, which includes inland waters, estuaries and the marine environment to 1 nautical mile out to sea. These are assessed based on the biological, hydromorphological and chemical environments of the water body. A WFD Assessment has been undertaken in Section 4 - Physical Environment, to consider the predicted SLR and the effects at the cable land fall location.

1.5 Work undertaken to date

1.5.1 Cable Route Design

The selection of the R100 application corridors bring several engineering benefits, some of which include:

- Utilising an existing Beach Manhole (BMH) for the landward connections where possible;
- Reducing the number of cable crossings along the routes;
- Avoidance of reef areas or other sensitive habitats wherever practicable.

Cable route design has been informed by the following processes and is ongoing.

1.5.2 Desk-top Study

A Desk-top Study (DTS) was produced to inform pre-survey route planning and the marine cable route survey. The DTS provides comprehensive and accurate information for cable engineering, system installation, cable protection and identification of constraints relating to the R100 system.

As part of the DTS, site visits to all possible landing points were undertaken to gather information. Factors considered during route development included archaeology, seabed sediments, gradients, coastal erosion, currents and tides, fishing intensity and other marine users, restrictions and artificial hazards, and environmental designations.

1.5.3 Marine and intertidal surveys

Marine surveys were undertaken between May and September 2021. The objective of the surveys was to ascertain the seabed conditions within the 500m wide cable corridor prior to cable installation in relation to bathymetry, geology, ecology, marine archaeology and other seabed features detected during survey, e.g. infrastructure crossings, obstacles, wrecks, and man-made objects .

The following surveys have been undertaken:

- Geophysical survey
- Geotechnical survey
- Benthic survey – route 2.14: Mainland-Lismore
- Intertidal survey – all proposed landing points
- Phase 1 Habitat Surveys
- Otter Surveys
- Archaeological walkover survey (geophysical)

1.5.4 Consultation and stakeholder engagement

A variety of key stakeholders have been introduced to the project and invited to comment on the proposals directly and through the pre-application consultation phase . GM introduced the R100 Project to the key regulators (MS-LOT and CES) in May 2021. Intertek followed up by providing information to key stakeholders (MS-LOT, NatureScot, Historic Environment Scotland, Maritime & Coastguard Agency, Commissioners of Northern Lighthouses, MOD, SEPA, Marine Scotland Science and Royal Yachting Association Scotland) on the proposed content of the MEA report or to request for feedback on the approach and availability of data or information to inform the MEA and PSA. The consultation responses received are provided in Appendix B.

1.5.4.1 NatureScot

Consultation was been undertaken throughout the pre-application process with NatureScot. Meetings have been held throughout to ensure that the application provides a full balanced assessment of the protected sites and species and is presented in a way which is easily reviewed by the regulators and advisors. This has included early sight of the Projects approach and decision making process for the screening to be included in the Projects Protected Sites Screening Assessment (PSA). Consultation responses are provided in Appendix B.

1.5.4.2 Pre-Application Consultation (PAC)

PAC events were held in July 2021 to engage with the public and stakeholders. Due to the Covid 19 pandemic, The Marine Works and Marine Licensing (Miscellaneous Temporary Modifications) (Coronavirus) (Scotland) Regulations 2020 has made amendments to the existing regulations. In accordance with Section 24 of the Marine (Scotland) Act 2010, a report has been prepared and will form part of Marine Licence Application package (Appendix B).

1.5.4.3 Fishing Liaison Mitigation Action Plan (FLMAP)

A FLMAP was prepared to identify potential impacts of the Project to commercial fisheries and other marine users. It identifies measures to manage these impacts and presents measures on how these will be mitigated where required (Appendix B).

1.5.5 European Protected Sites and Species Risk Assessment

A European Protected Species (EPS) Risk and Protected Sites and Species Assessment was prepared prior to commencement of surveys in order to support application for an EPS Licence and a Basking Shark Licence. This assessment has been subsequently updated to include cable installation operations and forms the basis of this assessment (Appendix D).

1.5.6 Navigational Risk assessment (NRA)

An NRA has been completed for the cable installation, this comprised identification and assessment of potential hazards, and presents measures to manage these. As part of this process NRA Workshops were held in Kirkwall and Thurso which were attended by shipping and navigation stakeholders. Outputs from these workshops included identification of risk mitigation measures (Appendix E).

2. PROJECT DESCRIPTION

2.1 Section Overview

This chapter presents information on the planned installation of the marine components of the R100 cable system.

The key activities to be undertaken during installation are:

- Route preparation: pre-lay grapnel run (PLGR) and route clearance (RC);
- Cable installation (plough burial, surface lay);
- Cable landing; and
- Post lay inspection and burial (PLIB).

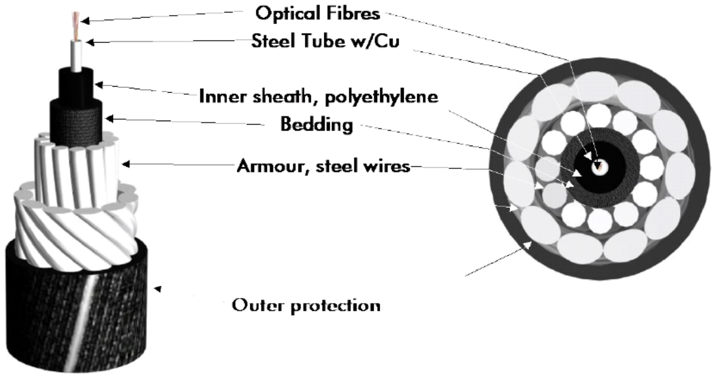
All products, equipment and/or vessel specifications detailed in this section are indicative. In the event that the Project does not/cannot use the specified equipment similar products will be selected.

2.2 Submarine Cable Description

Burial of the cable is required (where sediments allow) to protect the optical fibre transmission path over the entire service life of the system and prevent interaction with the seabed and other sea users.

The cable types to be used for the R100 project are armoured fibre optic cables, which are a resilient cable type suitable for installation within Scottish waters (Figure 2-1). The cable system will be unrepeatered (an 'unrepeatered system' is a cable system without optical amplifiers due to the short overall length). There will be no EMF emissions from the operating cable. The cable itself is between 25mm (single armour) and up to 46mm (rock armour) in diameter, depending on the level of cable armouring required. The optical fibres are contained within a gel filled stainless steel tube. This is surrounded by a polyethylene insulation layer. The construction of this core provides protection against water penetration and hydrogen. The core is further protected by layers of steel wire and an outer polypropylene yarn.

Figure 2-1 Cross section of URC-1 fibre optic cable (rock armour variant)



Source: Nexans (2008)

2.3 Landing Point

The R100 installations are additional cable connections where new BMH will be constructed for all landing points. Details of the landing points in the Inner Hebrides are provided in Table 2-1.

Table 2-1 Inner Hebrides marine licence application landfall sites (estimated BMH position)

Cable Corridor	Landing Point	Estimated BMH Latitude	Estimated BMH Longitude	Cable lengths (km)
2.13	Eigg	56° 54.867' N	6° 09.564' W	26.6km
	Mainland	56° 56.737' N	5° 51.298' W	
2.14	Mainland	56° 33.126' N	5° 24.892' W	1.4km
	Lismore	56° 33.249' N	5° 26.048' W	
2.15	Iona	56° 18.790' N	6° 21.977' W	2.6km
	Mull	56° 19.484' N	6° 23.904' W	
2.16	Colonsay	56° 06.019' N	6° 10.737' W	23.6km
	Mull	56° 17.568' N	6° 11.270' W	

Targeted burial depth between the BMH to Low Water Mark (LWM) is 2m. Offshore the target burial depth will be to 1m below the seabed. Depths are subject to survey and other potential constraints.

2.4 Route Preparation Works

The objective of route preparation (route clearance and PLGR) is to ensure that the route is, as far as reasonably possible, clear and free from debris in order that the installation is not hindered.

At the conclusion of these activities, the route shall be as far as reasonably possible:

- Clear of UXO. A UXO desk study has been carried out by Ordtek.
- Clear of any crossed out-of-service (OOS) submarine cable systems or as otherwise agreed with the system owners.
- Clear of any nearby chains, wires, ropes, warps, abandoned fishing equipment and other items of equipment located on the seabed.

2.4.1 Route clearance

2.4.1.1 Out of Service Cable

The presence of OOS cables have been identified during the DTS of the proposed cable routes, and subsequently verified during survey operations. These will be cleared and made safe in accordance with International Cable Protection Committee (ICPC) recommendation No.1 or managed as otherwise agreed with the systems owners. Prior to cable installation activities commencing, the vessel will move to the known position of each OOS cable, deploy the grapnel and start clearance activities.

Route clearance operations will include cutting the existing OOS cable, recovering the parted cable ends to deck, streaming each parted end back along the original OOS cable and then lowering each OOS cable end to the seabed using a slip line. This procedure for clearing the OOS cable is intended to ensure a clear passage for the burial operation and to minimise the likelihood of the OOS cable being fouled or hooked by other seabed users. Chain or clump weights will be used as cable end anchors to secure the cable ends in place and minimise the risk of fastening to fishing gear, in accordance with ICPC recommendations.

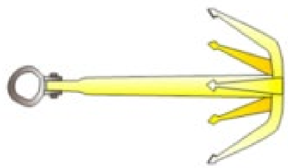
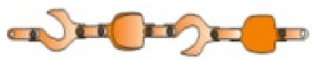
A range of cable recovery tools will be available for use, typically a 'Flatfish' cutting grapnel, de-trenching grapnel, and 'Rennie and Gifford' grapnel (see Figure 2-2), together with the necessary rigging equipment. In summary, route clearance operations shall include:

- Cutting the existing OOS cable at the cable route intersection;
- Recovering each end of the cut cable;
- Weighting the cable ends with clump weights or chain; and
- Lowering the weighted end to the seabed on slip ropes and laying each end back on the original OOS cable route.

2.4.2 Pre-lay grapnel run

PLGR will be conducted following route clearance works. Typical tools are shown in Figure 2-2 below, which will generally penetrate 0.4m - 1m into the seabed under suitable conditions. The specific grapnel rigging may vary depending on the seabed conditions identified on site.

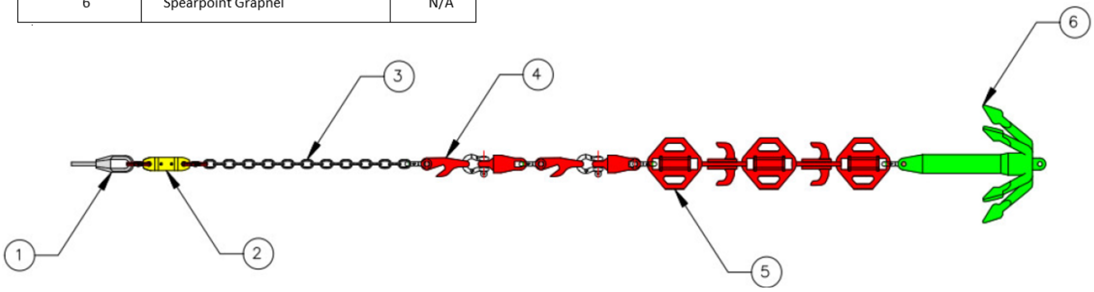
Figure 2-2 Typical PLGR Equipment

Spearpoint Grapnel	
Rennie Grapnel	
Gifford Grapnel	
Flatfish Grapnel (cutting and non-cutting variants used)	
De-trenching Grapnel	

A PLGR 'Grapnel Train' (Figure 2-3) will be deployed from the vessel to the seabed and the vessel will manoeuvre along the planned cable route paying out grappling rope/winch wire. The amount of grappling rope/winch wire to be paid out will be dependent on the depth of water. Once the grapnel train has been deployed the vessel will move along the planned cable route.

Figure 2-3 Typical PLGR Chain

Item No.	Description	SWL (Te)
1	48mm Winch Wire	100
2	Swivel	15
3	32mm chain, 20m	31.5
4	Gifford Assembly	13
5	Rennie Assembly	13
6	Spearpoint Grapnel	N/A



2.5 Cable installation

This section details the specific installation activities associated with the installation of the R100 project and follows the typical installation sequencing.

2.5.1 Installation vessels

The cable lay will be performed on a 24-hour basis to ensure minimal duration of navigational impact on other users and to maximise efficient use of suitable weather conditions and vessel and equipment time. The progress speed for plough installation is approximately 600m/hour with speed depending on seabed sediment conditions, achieving target burial depth and weather conditions. Cable may be surface laid in areas of hard ground or at cable crossing locations. Where the cable is surface laid, cable lay vessel speeds may increase up to 2km/hr.

In addition to the installation vessel, additional vessels may be involved with the operation if required by weather conditions, safety and best practice, although exact details may change, it is likely that the vessels to be used will consist of those outlined below. All vessels will comply with shipping requirements as set out in the Navigation Risk Assessment (Appendix E).

2.5.1.1 Main lay vessel (MLV)

The MLV is a specialist ship equipped with dynamic positioning systems, designed specifically to carry and handle long lengths of armoured fibre-optic cable (Figure 2-4). A plough and ROV will be mobilised to the vessel for cable laying activities. Following mobilisation, the cable will be loaded onto the ship at the cable factory and then transit to the worksite.

Figure 2-4 Typical MLV

2.5.1.2 Ancillary support vessel

In addition to the MLV, a dedicated ancillary vessel may be used for all ancillary operations, including Route Clearance, PLGR, Pre-Lay Inspection and PLIB operations. The ancillary support vessel will be equipped with a remotely operated vehicle (ROV).

2.5.1.3 Tug(s)

A tug may be required to support the MLV and/or the Ancillary support vessel due to the high currents that may be experienced across the work site.

Figure 2-5 Typical shallow water vessel

2.5.1.4 Multicat (or similar)

A multicat (Figure 2-6) can be mobilised to support either cable installation or cable burial operations in shallow water areas where the main lay vessel cannot access. The vessel would be mobilised with a small deck spread to support cable storage and installation equipment as cable engine and cable chute, along with a burial tool and support equipment.

Figure 2-6 Typical multicat

2.5.1.5 Barges

A self-propelled barge can be mobilised to support either cable installation or cable burial operations in shallow water areas where the main lay vessels or multicats cannot access. The vessel would be mobilised with a small deck spread to support cable storage and installation equipment as cable engine and cable chute, along with a burial tool and support equipment. Anchor/clump weights will be deployed from a support vessel or from the barge in advance of the works.

Figure 2-7 Barge

2.5.1.6 Shore end/ shallow water vessels

For all shore end and shallow water operations, multiple small inshore vessels (such as RIBs) will be used to support the cable pull in, the lowering of the cable onto the seabed and any burial of the cable in waters depths less than 15m (Figure 2-5).

2.5.1.7 Rock-placement vessel

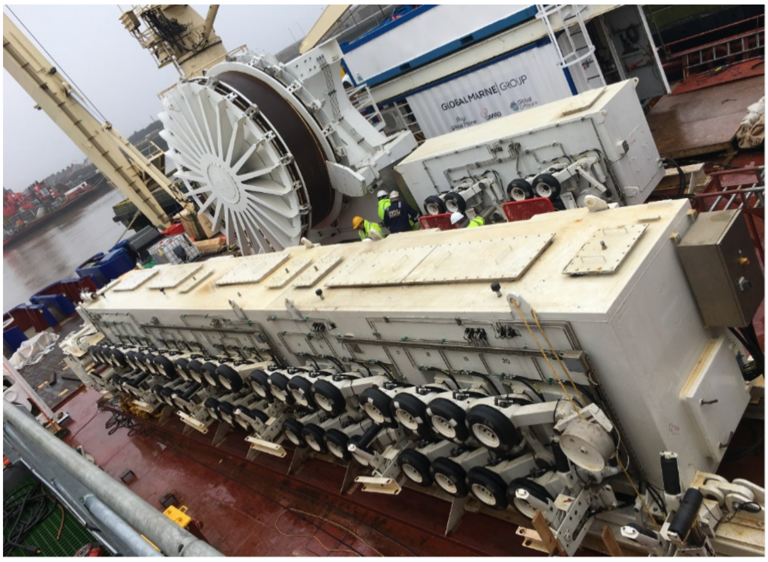
Additional rock may be required as a contingency measure to protect or stabilise the cable. Therefore, a rock placement vessel is included as a potential contingency for crossing agreements, stability or additional protection as required. The rock placement vessel will be equipped to carry sufficient rock material to provide the necessary protection. The vessel will utilise a fall pipe to accurately deposit rock from the vessel to the seabed in a controlled manner.

2.5.2 Cable lay and burial

Once the MLV arrives on site within the Inner Hebrides geographical area, the first shore end will be landed. At the time of writing it is not known which cable within Inner Hebrides will be installed first.

The MLV installs the cable by passing it through the on-board cable engine (Figure 2-8) which assists in moving the cable to the stern sheaves where the cable is over boarded and deployed to the seabed.

Figure 2-8 Typical Cable Engine



The MLV will lay away from the first shore end and bury the cable via the plough as described in Section 2.5.2.2 below. There will be certain sections (such as in areas of hard ground and at crossings (if any)) where the cable will be laid on the surface of the seabed and will not be ploughed (Section 2.5.3).

The MLV will continue plough burial to the second shore end position. After the second shore end has been landed PLIB will be conducted with an ROV to bury sections of the cable which have been surface laid, for planned post lay burial, or in sections of the seabed which were unsuitable for plough burial (Section 2.5.3). This process will then be repeated for the next cable.

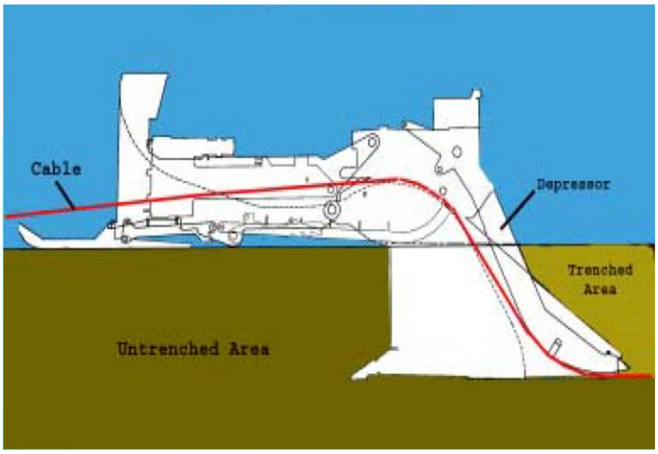
The key steps associated with the cable lay and burial are outlined below.

2.5.2.2 Plough installation

Simultaneous cable installation with plough burial is the planned method of installation where possible on the offshore routes. Once the shore end has been landed, the MLV will lay away from the shore end position and tow the plough behind the vessel. The cable feeds into a bell-mouth at the front of the plough and is guided down through the plough share to emerge in the trench (Figure 2-9).

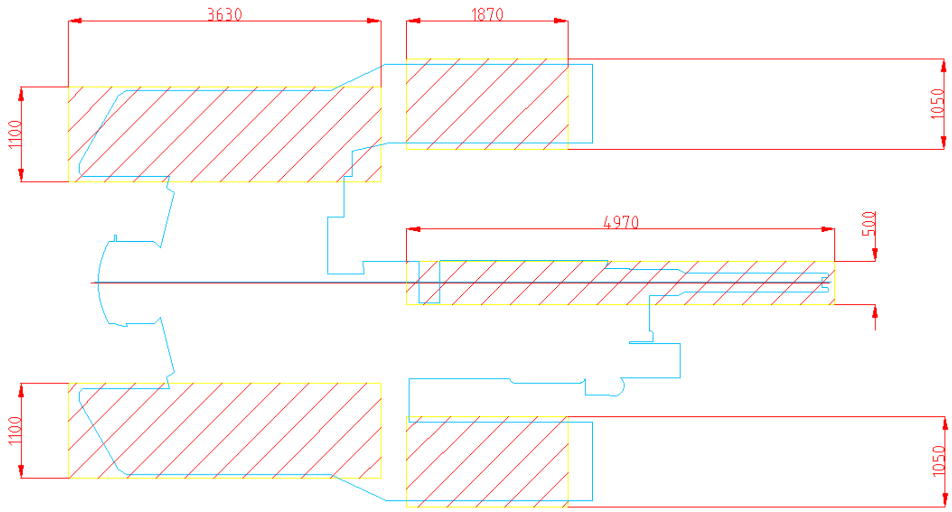
Hydraulically adjustable skids are used to provide steering on the plough and the share is used to vary the burial depth. On-board sensors ensure the cable passes through the plough in a safe manner before being buried. The sensors also record the burial depth achieved, for this Project the target burial depth is 1m subject to seabed conditions. The approximate speed of plough installation is 600m p/h which is approximately 0.3 knots.

Figure 2-9 Plough schematic



The skids have an approximate footprint of 7m²per skid, and the share footprint is approximately 2.45m². The plough share width is approximately 0.5m. The sections of the plough in contact with the seabed is outlined in Figure 2-10 and demonstrated by the hatched areas. The plough dimensions are indicative of the size of equipment to be used. Burial by plough will be carried out at a rate of approximately 600m/ hour (depending on sediment type).

Figure 2-10 Plough footprint



Note: measurements are in millimetres (mm)

2.5.3 Surface lay

Where conditions are unsuitable for plough burial, the cable will be surface laid. This could be in areas of hard seabed, where burial is not achievable, or at cable crossings.

Prior to the start of operations seabed topography will have been reviewed and the amount of slack required in the cable will have been determined. The cable will be installed using cable lay software to ensure that the lay angle, pay out speed, slack and tension fall within the design limits of the cable and to also ensure (where possible) that the cable naturally confirms to the seabed topography. The approximate speed of surface lay installation is 2000m p/h which is approximately 1 knot.

2.6 Cable Landing

2.6.1 Shore end installation

The two typical types of shore end landings that would be conducted for the R100 project include a Direct Shore End (DSE) or Pre-Lay Shore End (PLSE). The following standard practice will be undertaken for each shore end albeit with a slight variation in the sequence of events.

A beach and dive team, along with the necessary equipment and vessels to carry out the cable landings, will be mobilised to each site prior to the arrival of the MLV or ancillary support vessel.

A pre-lay diver swim survey of each route will be carried out prior to the arrival of the MLV/PLSE vessel, from the LWM to the agreed plough down point /proposed position of the MLV/PLSE vessel. Key positions, such as, alter courses, holding anchors, other in service and out of service cables, will be marked with temporary buoys or similar.

Beach inspections/walk overs will be undertaken prior to any operations taking place and photographic and video records taken.

The beach team will then prepare the landfall and position the equipment for cable pull in operations (position the quadrant and excavator) with due care and consideration for the environment and general public.

Once preparations have been completed and the MLV/PLSE vessel has arrived at the planned support vessel will transfer a messenger line will be transferred to the ancillary support vessel to take ashore. A diver will swim ashore through the surf zone with the messenger line and hand it to the beach team. The beach team will then pass the messenger line around a cable pull-in quadrant (if required), to assist the cable to be pulled in (a quadrant is used when no direct pull in from the vessel to the BMH is possible).

A hauling line will then be attached to the messenger line which will then be transferred back to the MLV/PLSE vessel for the cable to be attached for hauling ashore.

Under the control of the Beach Master, the second excavator will commence the pull in of the cable ashore which will be supported in the water by buoys attached to the cable on the MLV/PLSE as it is paid out (Figure 2-11). The excavator will slowly move along the beach while monitoring the cable tension under the control of the Beach Master.

Once the cable is ashore and confirmed to be in position over the planned Route Position List (RPL), divers in small support craft will commence the removal of the buoys allowing the cable to lay onto the seabed. During this process, the dive team will check that the cable is lying satisfactorily on the seabed.

The dive team will return the swivel and buoys back to the MLV/PLSE vessel.

Depending on if the shore end landing is a first or second end the MLV/PLSE will commence cable installation or move clear of the area.

Figure 2-11 Typical DSE landing from MLV

2.6.2 Beach Works

The seaward duct which provides access for the telecommunication cable in the intertidal area to the BMH will be exposed using an excavator. The beach team will then remove any duct cover and attach the pre-installed rope to the end of the cable on the beach and pull into the BMH and secure using an armour wire anchor clamp (AWAC) fitted to the wall of the BMH.

Generally, a trench of 2m depth will then be excavated (subject to beach/ soil conditions) using an excavator/breaker down the beach to the LWM and the cable/AP lowered into the bottom of the trench and the burial depth measured and recorded. After depth verification the trench will be backfilled.

On completion of the cable burial the beach profile will be restored, and all machinery, equipment and personnel removed from site.

2.6.3 Rock cutting

In the event that there is little sediment or rock outcropping between the proposed BMH location to LWM, limited and targeted rock cutting may be conducted if no other practical technique exists to provide acceptable cable protection. Rock cutting is not currently planned however may be a requirement for a short section (75m) for-Route 2.13 Mainland landing point and Route 2.14 Mainland landing point (15m) within the Inner Hebrides geographical area.

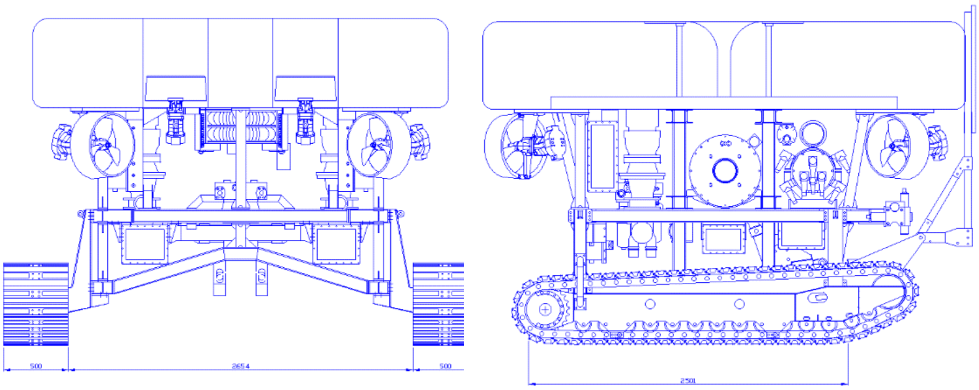
If required, any surface ground material will be excavated using an excavator bucket to create a spoil mound adjacent to and clear of the working area. The bucket will then be removed from the excavator and a rock breaker attached. The outcropping rock will then be broken using the rock breaker within the designated work area/ trench. The broken rock/ stones will then be removed from the trench using the excavator bucket to form a trench. The width of the rock cut trench is dependent on the cutting tool used but is likely to be approximately 0.3m wide and 0.5m deep. This process is then repeated until the trench has been excavated to the required specification. Post installation, the trench will then be backfilled with excavated material. In some instances, it may be necessary for the trench to be backfilled with a marine grade concrete (bentonite) or a mix of concrete or locally excavated material. Excavated rock material would then be relocated over the trench.

2.7 Post Lay Inspection and Burial

On completion of cable laying and plough burial operations there will be areas along the route where it has not been possible to utilise the plough such as In-Service cable crossings where the cable has been surface laid over the third-party cable. These areas of cable will be buried by means of a jetting ROV (Figure 2-12). This operation is referred to as PLIB. The jetting ROV is tracked to allow it to sit on the seabed and follow the cable whilst employing water pumps to inject seawater either side of the cable. This fluidises the seabed and allows the cable to sink below the surface. A typical jetting trencher ROV is shown in Figure 2-12 and Figure 2-13 with two 500mm wide tracks each with a seabed contact length of 2,500mm; the target burial depth is 1m. It should be noted that the seabed will naturally reinstate to its original profile shortly after completion of the works.

Figure 2-12 Typical ROV jetting trencher

Figure 2-13 Typical ROV Schematic



2.7.2 Inshore/ Shallow Water Post Lay Burial (PLB)

Inshore burial from the Low Water Mark (LWM) out to the position where depths are suitable for plough burial to commence often uses a diver assisted jet burial tool fitted with suitable burial jet legs for the target burial depth (Figure 2-14). The PLB equipment will be mobilised onto an ancillary support vessel which will undertake these operations separately to the MLV.

Figure 2-14 Typical diver assisted jet burial tool

An ancillary support vessel will set up close to the landfall and the burial tool will be deployed to the beach where the cable will be loaded into the tool. Having run up the water pump, the jet legs will then be lowered to the required PLB depth as it is slowly commencing burial. This operation will continue until the burial tool approaches the plough down position, when it will be recovered to the ancillary support vessel, and divers will post-lay bury the final section of cable using surface fed burial lances. PLB of the inshore section could also take place from the plough down position towards the beach.

2.7.3 Diver swim survey/ Mini ROV survey

Once burial operations have been completed a final diver or mini ROV swim survey pass will be conducted. This will provide a video survey of the trenched cable.

2.7.4 Cable jointing

The operations are planned for the MLV to install all cables without the requirement for jointing onboard. There are certain circumstances however where it may be necessary for the vessel to conduct jointing operations (adverse weather, emergency, unexpected high traffic levels). If jointing is required, joints will be constructed on board the vessel before the cable laying operation continues.

Where cable joints are required, the MLV may remain stationary for a number of up to several days to create one joint. If joints are required, sensitive areas, e.g., shipping channels, anchoring grounds, will be avoided as far as reasonably practicable.

2.8 Cable crossings

There is one known cable crossing required within the cable corridors within the Inner Hebrides geographical area. The cable crossing is on Route 2.14 Mainland – Lismore where the proposed cable will cross a BT telecommunication cable. An engineered cable crossing including rock protection, is only required for crossings with power cables or pipelines. Crossings with telecom cables only require protection against the cables touching, therefore Uraduct is applied to these crossings (see section 2.9.1 below) and no rock protection is required.

It is possible that some out of service (OOS) cables are within the Inner Hebrides cable corridors, however these will be removed prior to installation where possible (during route preparation works described in Section 2.4).

2.9 Proposed integral cable protection

2.9.1 High Density Polyethylene (HDPE) Protection (Uraduct ®)

High Density Polyethylene (HDPE) Protection, Uraduct ® (or similar), is currently the only planned cable protection method for all of R100 cable crossings (Figure 2-15). Uraduct® (or similar) is a well-established anti- abrasive method of cable protection which may be applied 50m either side of the cable crossing (100m in total per crossing). This will provide separation between the installed cable and existing asset. Once installed the Uraduct ® (or similar) is approximately 94mm in diameter. Post lay burial (Section 2.7) will be undertaken to bury the cable to a target depth of 1m if possible following surface lay, subject to the burial status of the crossed assets.

Figure 2-15 Typical High-Density Polyethylene Protection (HDPE) cable protection

2.9.2 Articulated pipe

For this Project, articulated pipe (AP) is planned to be fitted from the end of the BMH duct to the LWM or approx. 10m water depth contour subject to burial conditions (Figure 2-16). The maximum external diameter will be approximately 150mm. It may be that the length of AP installed may extend beyond the 10m contour in the event that seabed conditions prevent/ limit burial or where the cable is at risk of exposure and damage from external forces. The AP will also provide additional protection and stability to the cable in areas where it may move during storm conditions.

In some cases, the AP may require clamping and pinning to the seabed to ensure tidal conditions do not cause abrasion damage to the AP and cable. The clamping and pinning operations will be conducted by divers.

Figure 2-16 Articulated pipe

The approximate lengths of AP that may be included in the marine licence applications are provided in Table 2-2.

Table 2-2 Indicative articulated pipe lengths required for each landfall within the Inner Hebrides Geographical Area

Cable Route	Landfall	Length of Articulated Pipe (BMH to 10m depth contour)*
2.13	Eigg	780m
	Mainland	1850m
2.14	Mainland	610m
	Lismore	680m
1.15	Iona	2486m
	Mull	
2.16	Colonsay	890m
	Mull	1150m

*AP lengths may vary according to ground conditions at the time of installation.

2.9.3 Cable Stabilisation in High Currents

In some limited areas of exceptionally high current (and or where it is subject to storm surges) where cable protection by burial may not be fully achieved due to lack of sediments, additional mass may be added to the cable to assist in maintaining the cable in a stable position on the seabed. This would take the form of additional lengths of similar type submarine cable or inert metallic chain being bound to the R100 cable using a bundling machine and intermittent titanium straps or similar. This additional cable mass would be installed as an integral part of the cable during the main lay process, and burial by plough would not be attempted in these areas due to the high risk of damage to the seabed and subsea equipment. The bundled cable would be approximately 15cm in overall diameter.

2.10 Contingency measures

The proposed installation measures are detailed in the above project description. However, a number of contingency measures are included to allow a level of flexibility during the installation to allow decisions to be made during operations to ensure stability of the cable, and to ensure that the cable can be protected in unforeseen circumstances.

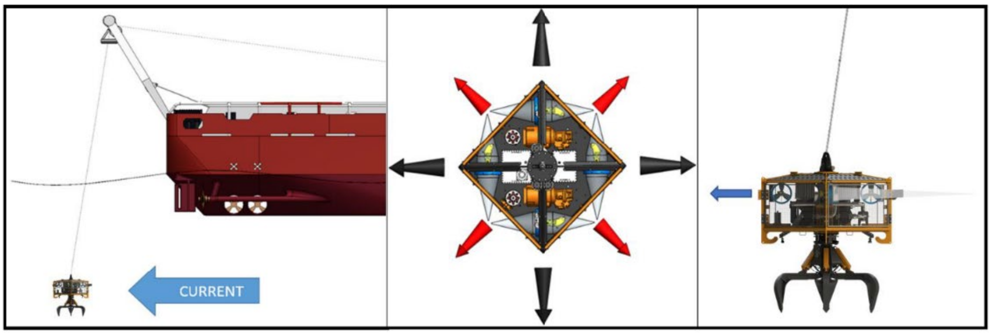
Conservation bodies on past projects have also noted that any additional or external protection should be included in any initial application to avoid subsequent applications being made post-installation. Therefore, whilst additional external protection such as rock bags are not expected or planned, a number have been included as a contingency.

In areas where cable burial is not possible due to seabed conditions, a number of contingency measures could be implemented to ensure safety of the cable and other sea users. This section details the contingencies included in this application.

2.10.1 Boulder relocation

There is currently no plan for any boulder removal activity on any of the R100 cable routes however, it may be necessary a limited number of targeted boulders from the cable route to allow adequate burial to be achieved during cable installation. If required, this will be undertaken using a crane on the MLV or ancillary support vessel to lift and relocate a boulder to a new position – and will simply be a minor relocation to move the obstruction from the line of the cable route and boulders will not be removed from the seabed. Boulder picking is typically conducted via a grab and can operate in currents up to 3knots (Figure 2-17).

Figure 2-17 Equipment used for boulder picking



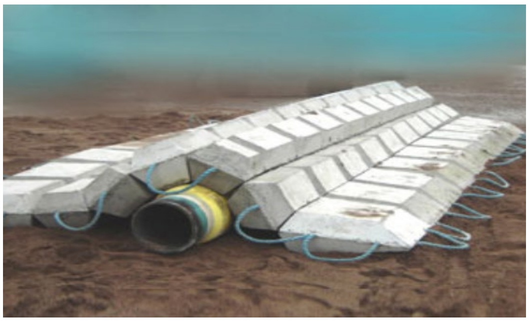
2.10.2 Concrete mattressing

Concrete mattresses (Figure 2-18) are matrices of interlinked concrete blocks which form a close-fitting layer over the cable to provide a strong protective cover to prevent potential impact and snagging by fishing gear or anchors. Typically, concrete mattresses are 6m long by 3m wide by 0.3m high.

The mattresses are usually installed via a crane from the MLV, multicat or ancillary support vessel; which lowers them one at a time or in batches using a purpose designed frame.

Mattresses are typically used in combination with rock protection e.g., at third-party asset crossings, or in areas where the main risk to cables is from fishing activities. Concrete mattresses have been included as a contingency measure and the worst-case number for each cable corridor is given in Table 2-4 below.

Figure 2-18 Concrete mattress



2.10.3 Rock bags

Rock bags are typically installed on top of the cable and are sized to suit each scenario dependant on current speeds and environmental conditions (Figure 2-19). The size and weight of the rock bags to be used will ultimately be dependent on the findings of the Cable Burial Assessment (CBA) and post installation survey results. The exact number will not be known until after the cable has been installed. A contingency number of rock bags has been provided per cable route (see Table 2-3 below). Typical dimensions of the rock bags likely to be used for R100 are shown in Table 2-3 below.

Table 2-3 Typical rock bag dimensions

Type	Mesh Size	Stuffing Stones *1 particle diameter	Weight of empty filter unit	Dimensions in meters, filter unit installed			Current velocity Ms^{-1}	
				Diameter	Height	Volume	Unit	Grouped
2 T Model	25mm	50*200mm	6kg	1.9m	0.4m	1.24m^3	3.1ms^{-1}	4.6 ms^{-1}
4 T Model	25mm	50*200mm	13kg	2.4m	0.6m	2.5m^3	3.4ms^{-1}	5.2 ms^{-1}
8 T Model	50mm	75*200mm	48kg	3.0m	0.7m	5.0m^3	3.9ms^{-1}	5.8 ms^{-1}

Figure 2-19 Rock bag deployment

2.10.4 Rock placement

No engineered cable crossings are proposed for cable installation within the Inner hebrides Geographical Area.

In the event of cable suspensions occurring along the route, rock may be placed instead of or in addition to rock bags to help mitigate these suspensions. The requirement for such mitigation will only be in sections of the route where the cable is surface laid / or burial cannot be achieved. The locations of such areas will not be known until after cable installation. The size of the berm will depend on the location, the site-specific anchor and fishing risks and the prevailing metocean conditions. The worst-case quantity of rock if required for this application has been included in the contingency measures per cable corridor.

2.11 Summary of Cable installation per cable corridor

2.11.1 Installation footprint

The R100 project within the Inner Hebrides geographical area consists of four cable installations each with a separate marine licence application to Marine Scotland Licensing Operations Team (MS LOT). The licensable activities occurring within each cable corridor and approximate footprints are provided in Table 2-4. Table 2-4 also provides the approximate footprints for worst case contingency external cable protection measures. The use of contingency external cable protection is not currently proposed but may be used at the time of installation if required.

Table 2-4 Summary of installation methods and footprints per licence application

Cable Route	PLGR / RC Note 1	Installation method Note 2 Approximate footprint of installation (width of tool x length of installation)					Contingency measures (worst case deposits)			
		Surface lay*	Plough Note 3 2.6m wide x length of cable corridor (worst case)	Trenching 2m deep x width of excavator bucket (assumed to be 2m)	Rock cutting Note 4 (Length x 0.5 burial x 0.3 width)	ROV Note 5	Boulder relocation Note 6	No. Rock Bags Note 7 3m diameter = 7m² per rock bag (8T bag)	No. Concrete Mattress Note 8 6m x 3m = 18m² per mattress	Bentonite Cement (m³) Note 9 (0.3m x 0.5m) x length of rock
Cable 2.13 Eigg - Mainland	✓		0.069km²	✓	✓ 11.25m³	✓		10 bags 70m²	3 mattress 54 m²	✓ 11.25m³
Cable 2.14 Mainland - Lismore	✓		0.004km²	✓	✓ 2.25m³	✓		10 bags 70m²	3 mattress 54 m²	✓ 2.25m³
Cable 2.15 Iona - Mull	✓		0.007km²	✓		✓		20 bags 140m²	3 mattress 54 m²	
Cable 2.16 Colonsay - Mull	✓		0.062km2	✓		✓	✓	10 bags 70m²	3 mattress 54 m²	

Note 1: PLGR is within the installation footprint of the plough and therefore is not an additional footprint.

Note 2: Cable corridor lengths are given in Table 2-1.

Note 3: Based on approximate measurements of an indicative plough to be used for the installation (Figure 2-10). This is subject to change depending on the availability and suitability of equipment at the time of installation.

Note 4: Rock cutting dimensions are for a wheel attachment to an excavator (Section 2.9.3) – applicable to Route 2.13 and 2.14 only.

Note 5: ROV dimensions are indicative of typical equipment used by Global Marine during cable installation for all sections of the route.

Note 6: Boulder relocation is not planned and will only be used, if necessary, as outlined in Section 2.3.1.

Note 7: As a contingency, rock installation has been included in the marine licence.

Note 8: To allow flexibility within the installation process the applicant has included a contingency deposit of concrete mattressing per cable corridor.

Note 9: A marine grade cement such as Bentonite or similar will be used to backfill any areas where rock cutting has taken place.

* Although the base case is for no surface lay in the Inner Hebrides geographical area, should cable burial not be achievable in any sections of the cable routes, surface lay may be required.

2.12 Indicative Programme

Following approval of the Marine Licence applications, cable installation is currently scheduled to commence in the Q2 2022 and be complete by the end of the 2023. Timings may vary due to weather and/or other operational reasons such as conditions found during survey. Indicative durations for the licensable activities are outlined in Table 2-5 below. Cable installation for the routes within the Inner Hebrides Application Area will take between 25 and 31 days per route with the longer durations for Routes 2.14 and 2.15 due to longer installation using a Multicat or similar. This is not the timescale for an installation vessel to be on site within the corridor but are worst case timings for each activity. Activities within the same cable corridor can occur simultaneously and all offshore works are likely to be completed within <>5-14 operational days per cable corridor.

Table 2-5 Worst case indicative timing of works

Activity (No of Days)	PLGR	Cable lay (Including cable landing)	PLIB	Diver / ROV Pre installation survey	Diver / ROW post install survey and shore end burial	Contingency (Rock bags/ Mattressing / rock placement)	No MLV installation (Multicat or similar)
Cable 2.13 Eigg - Mainland	3	3	2	2	14	2	N/A
Cable 2.14 Mainland - Lismore	Included in Diver/ROV post install survey and Shore End Burial	Included in NO MLV solution	Included in Shore End Burial	10	16	2	2.5
Cable 2.15 Iona - Mull	Included in Diver/ROV preinstall survey at Shore ends (if required)	Included in NO MLV solution	Included in Diver/ROV post install survey and Shore End Burial	10	16	2	2.5
Cable 2.16 Colonsay - Mull	2	3	2	2	14	2	N/A

* Contingencies will be carefully engineered in water depths less than 10m and therefore will not reduce the depth more than 5%

Notifications of works will be issued at an agreed schedule prior to operations closer to the project commencement. Following installation, the cables are expected to be in service and operational for at least 25-years.

The exact timing of the landfall works will be dependent upon the offshore works, marine licensing and onshore permits and conditions.

2.13 Mitigation

The R100 Project has been developed through an iterative process which involved seeking to avoid or reduce potential environmental effects through careful consideration of the routing of the marine cable. This was the first Project specific step in mitigating potential effects by seeking to avoid or reduce environmental disturbance as far as practicable.

The R100 Project within the Inner Hebrides geographical area includes a range of primary mitigation measures that have been ‘designed’ into the development proposals to demonstrate that the applicant will comply with national and international statute and best practice guidance as determined by the cable industry as a basic standard for how to proceed on a project. These design measures will help to reduce the effects of cable installation.

The design measures are detailed within each Section of the MEA (where relevant) and gathered in Table 2-6 below. For clarity, each design measure has been given an identification number for the source of the mitigation. Should project specific mitigation measures be required to further reduce the effects of cable installation, the mitigation measures have been proposed from within the MEA Report and supporting documents and are provided in Section 8 of this MEA.

Table 2-6 Project design measures

ID	Aspect	Design Measure	Source
COMP 1	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Project vessels will comply with the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs) – as amended, particularly with respect to the display of lights, shapes and signals.	International Maritime Organisation
COMP 2	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	The dropped object procedure will be followed, and any unrecovered dropped objects must be reported to the relevant authority (MS LOT) using their dropped object procedure, within 24 hours of the project becoming aware of an incident.	MS-LOT
COMP 3	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	'As-laid' co-ordinates of the cable route will be recorded and circulated to the UK Hydrographic Office (UKHO), KIS-ORCA service and any other relevant authorities. Cables will be marked on Admiralty Charts and KIS-ORCA charts (paper and electronic format).	Maritime and Coastguard Agency
COMP 4	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Where weather reduces visibility then vessel masters shall adhere to MGN guidelines and COLREGS to prevent collisions at sea.	International Maritime Organisation
COMP 5	Biological Section: Benthic and Intertidal Ecology	Ballast water discharges from Project vessels will be managed under the International Convention for the Control and Management of Ships' Ballast Water and Sediments standard.	International Maritime Organisation
COMP 6	Biological Section: Benthic and Intertidal Ecology	Project vessels will be equipped with waste disposal facilities (sewage treatment or waste storage) to IMO MARPOL Annex IV Prevention of Pollution from Ships standards.	International Maritime Organisation
COMP 7	Biological Section: Benthic and Intertidal Ecology	Control measures and shipboard oil pollution emergency plans (SOPEPs) will be in place and adhered to under MARPOL Annex I requirements for all project vessels.	International Maritime Organisation
COMP 8	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Should the project create potential hazards to shipping (such as cables temporarily buoyed off or reduction in water depth) along the cable routes, stakeholders will be informed immediately via a NtM distribution list including Kingfisher to ensure safety is upheld.	Maritime and Coastguard Agency
COMP 9	Human Environment - Archaeology	The Crown Estate's 'Protocol for Archaeological Discoveries' (The Crown Estate, 2014) will be implemented during installation works.	The Crown Estate
COMP 10	Human Environment - Archaeology	The locations of any wrecks or features of archaeological significance discovered during the project will be provided to Historic Environment Scotland and the UK Hydrographic Office (UKHO).	UKHO
BP 1	Human Environment: Commercial Fishing;	Early consultation with relevant contacts to notify of impending activity.	Global Marine

ID	Aspect	Design Measure	Source
	Shipping and Navigation; Other sea users		
BP2	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Notice to Mariners will be published to inform sea users via Notices to Mariners, Kingfisher Bulletins and MCA and UKHO. Vessels will be requested to remain at least 1NM away from cable vessels during installation operations.	Maritime and Coastguard Agency
BP3	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	An onshore Fishing Liaison Officer (FLO) will be provided for the project. The FLO will follow the Fishing Liaison Mitigation Action Plan (FLMAP). The FLO will continue in this role during installation process.	Maritime and Coastguard Agency and Global Marine installation requirement
BP4	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	The UKHO will be informed of installation activities in order to issue navigational warnings via NAVTEX/VHF/MF as appropriate.	Maritime and Coastguard Agency
BP5	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Guidance provided by the UKHO and International Convention for the Safety of Life at Sea (SOLAS) recommend that fishing vessels should avoid trawling over installed seabed infrastructure (UKHO 2020). Vessels are advised in the Mariners Handbook not to anchor or fish (trawl) within 0.25NM of cables.	Maritime and Coastguard Agency and Mariners Handbook
BP6	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	If cables are buoyed off whilst the vessel departs the area, buoy positions will be notified to the NTM distribution list including Kingfisher and 0.25NM clearance will be requested.	Maritime and Coastguard Agency
BP7	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Coordination with local ferry Service and Coastguard Operations to provide 24-hour radio and radar coastal vessel traffic information which helps vessels navigate safely to help prevent collisions at sea.	Maritime and Coastguard Agency
BP8	Physical, Biological, Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Rock , bags/contingency protection measures will only be deployed where adequate burial cannot be achieved or as required by crossing agreements. The footprint of the deposits will be the minimum required to ensure cable safety stability.	Crossing Agreements; Existing Asset Owner (BT
BP9	Human Environment: Archaeology	The geophysical survey data will be reviewed by an appropriately qualified archaeologist. Appropriate archaeological exclusion zones (AEZs) will be assigned to anomalies identified with archaeological potential. These will be avoided. If it is not possible to avoid the AEZ completely, alternative mitigation will be proposed.	The Crown Estate 2021
BP10	Biological Environment Marine Birds; Marine mammals; Fish and shellfish; Protected sites	The installation vessels will be moving at a speeds less than 6 knots during installation activities. Typical installation speeds are likely to be 1knot for surface lay and 0.3 knots for plough installation.	Global Marine installation requirement
BP11	Human Environment: Commercial Fishing	Disruption claims will be handled in accordance with ESCA standard operating practices.	ESCA Guidance (No13, issue 11)

ID	Aspect	Design Measure	Source
BP12	Biological Environment: Benthic and Intertidal Ecology	Route development and micro-routing has been used where possible to avoid or minimise the footprint of the application corridor routes through potentially sensitive habitats.	Global Marine installation requirement
BP13	Biological Environment: Benthic & Intertidal Ecology	Construction vehicle movement will be minimised as far as practical to minimise effects to compacting the beach; beach profile will be restored following cable installation.	Global Marine installation requirement
BP14	Biological Environment	The 'Guide to Best Practice for Watching Marine Wildlife' guidance will be followed where practicable.	Global marine installation requirement

3. APPROACH TO ASSESSMENT

3.1 Introduction

This section of the MEA sets out the overall approach to the environmental assessment process for the Project.

3.2 Assessment Methodology

The environmental assessment presented in this document reports on the impacts associated with the licensable activities of the cable installation described in Section 2 – Project Description. To assess the significance of the effect of the marine licensable activities of the cable installation process on the environment the appraisal follows a stepped process:

- Characterisation of the baseline environment and sensitive receptors
- Establish the potential pressures from the Project and their respective zones of influence
- Evaluate the significance of the effect
- Establish mitigation (where required)

3.2.1 Characterisation of baseline environment

Data was gathered to inform the R100 application corridors through a review of relevant publicly available literature and where applicable supplemented by survey data. In addition to this, consultation with relevant stakeholders and consultees was undertaken. This information has been used to establish the baseline conditions within the 4 Inner Hebrides geographical area application corridors.

A number of supporting studies have been undertaken to support the MEA as required by other regulatory processes. For conciseness, the study findings are referenced in the MEA and signposted to the relevant supporting information, but have not been provided as a separate assessment within MEA topic chapters. The supporting documents are listed in the Appendix.

3.2.2 Pressure identification and zone of influence

3.2.2.1 Pressures

Pressures are the mechanism through which an activity has an effect on any part of the ecosystem. The nature of the pressure is determined by the activity type, intensity and distribution. A list of marine physical / chemical and biological pressures and their definitions has been formally agreed by the OSPAR Intercessional Correspondence Group on Cumulative Effects (ICG-C) (OSPAR 2011) and has been used in the assessment. The ICG pressure list does not include human pressures, and therefore, categories have been developed based on industry experience. In order to identify the appropriate pressures on biological features the following guidance has been considered:

- JNCC Pressures-Activities Database (PAD) (JNCC 2020); and
- Feature Activity Sensitivity Tool (FEAST) for identifying the sensitivity of marine habitats and features to the effects of cable installation (MS 2020).

3.2.2.2 Zone of influence

The zone of influence (ZOI) refers to the spatial extent over which the activities of the Project are predicted to have an effect on sensitive receptors. The ZOI which have been identified for each receptor topic, are set out the relevant chapters. The ZOI identifies the extent of the area to be considered in the assessment. Where receptors are mobile e.g. mobile species or mobile users of the sea, the assessment considers whether there is potential for the receptor to enter the ZOI.

3.2.3 Evaluation of Significance

This MEA follows best practice guidance outlined in the following documents:

- Environmental Protection Agency (EPA) Guidelines on the information to be contained in environmental impact assessment reports; and
- NatureScot's Environmental Impact Assessment Handbook V5.

3.2.4 Significance of the Effect

To assess the significance of effects on the environment from the Project it is necessary to identify the pressures and impacts the Project may have.

In assessing the significance of the effect, the magnitude (the spatial extent of the impact, the duration and frequency) and sensitivity, recoverability and importance of the receptor are considered. The following definitions[1] of significance have been used in the assessment, derived from EPA guidance[2] as outlined in Table 3-1 below.

Table 3-1 Definition of Significance

Negligible	An effect capable of measurement but without significant consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences
Minor	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends
Significant	An effect which, by its character, magnitude, duration, or intensity alters a sensitive aspect of the environment
Very Significant	An effect which, by its character, magnitude, duration, or intensity alters most of a sensitive aspect of the environment
Profound	An effect which obliterates sensitive characteristics

Effects which are Minor and below typically do not require mitigation measures other than compliance with environmental statute and best practice. Effects which are classified as Moderate or above would typically be unacceptable without the implementation of project specific mitigation designed to avoid, abate or reduce the significance of the effect.

3.3 Cumulative Effects

The proposed method for the assessment of potential cumulative effects is based on 'A Strategic Framework for Scoping Cumulative Effects' (Marine Management Organisation 2014). The guidance sets out a two-stage approach to identifying cumulative effects as summarised below:

- Task 1: Identification of activities, receptors, and pressures

[1] Adapted from EPA (2017)
[2] EPA. (2017). Guidelines on the information to be contained in environmental impact assessment reports.

- Task 2: Defining interactions within a specific scale

3.3.1 Task 1 - Identification of activities, receptors, and pressures

To first identify which projects and plans are likely to interact with the proposed Inner Hebrides geographical area application corridors, common pressure-receptor pathways need to be identified with the proposed installation and other types of projects and plans. For there to be potential cumulative effects, R100 and another project or plan must share a common pressure-receptor pathway which overlaps spatially and temporally.

3.3.2 Task 2 - Defining interactions within a specific scale

The nature of a linear telecoms cable project means that many potential pressures result in temporary or short-term and localised effects restricted to the footprint of the R100 Inner Hebrides geographical area application corridors. The search area for other projects has been defined as the extent of the application corridors, herein referred to as the assessment search area. Although it is recognised that certain pressures may exceed this spatial extent these have been scoped out of the MEA as they will have a negligible effect.

3.4 Mitigation and Monitoring

3.4.1 Design Requirements

Design requirements include measures that have been incorporated into the design of the Project and are inherent to the Project for which consent is sought. The consultation and environmental appraisal process has fed into the optioneering and design process to streamline and optimise the Project where possible.

Design measures are inherent in the Project design as part of the marine licence application (for example, the selection of the cable landfall or marine cable route to avoid aquaculture sites or ecologically sensitive areas) and measures related to installation that are industry best practice (for example, a burial of the cable within the seabed).

The assessment within the technical sections of this MEA accounts for design requirements already being implemented.

3.4.2 Project Specific Mitigation

If required, Project specific mitigation measures are those incorporated to prevent, avoid, and reduce any remaining environmental effects that remain despite the implementation of design requirements. Where required, the project specific mitigation measures have been identified and outlined within each topic specific section and all design measures and project specific mitigation is summarised in Section 8: Schedule of Mitigation.

4. PHYSICAL ENVIRONMENT

4.1 Introduction – Physical processes

This Section describes the baseline physical environment along the Inner Hebrides Application Corridors. The section identifies potential impacts associated with the cable installation and presents the findings of the environmental appraisal. To avoid repetition, the baseline for the Inner Hebrides geographical area and cable corridors has been discussed as a whole and referred to as the Project Area. Any aspects specific to the individual cable corridors have been discussed separately.

The physical environment has been described as follows:

- Metocean conditions;
- Climate change implications;
- Coastal processes;
- Bathymetry, geology and seabed sediments;
- Water and sediment quality;
- Seabed quality; and
- Suspended sediments.

4.2 Baseline Conditions

This Section describes the physical conditions within the Inner Hebrides geographical area. Where specific baseline information or survey data exists, this has been used to inform the baseline and is separated by each proposed cable corridor.

4.2.1 Overview

The purpose of the baseline description is to characterise the physical environment baseline of the Inner Hebrides geographical area and to enable the identification of areas that may be sensitive to pressures from cable installation. The baseline includes an overview of the metocean conditions, sediments and seabed features within the proposed cable corridors. The assessment considers the effects of sea level rise on the proposed installation in addition to the effects of cable installation on water quality.

4.2.2 Metocean Conditions

4.2.2.1 Water Levels and Currents

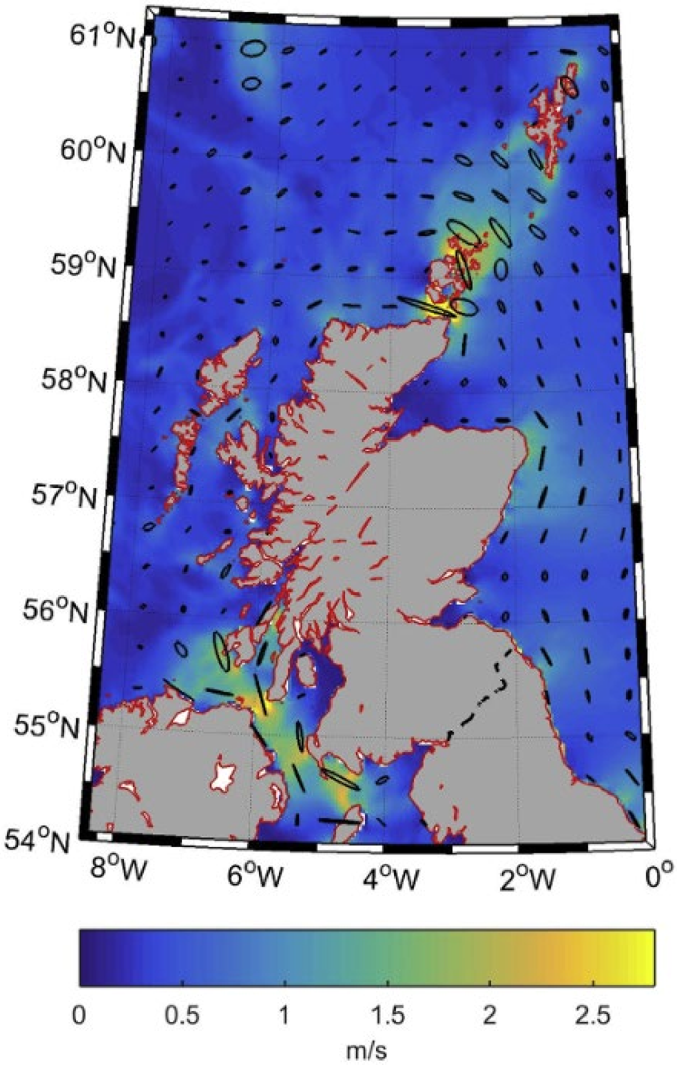
The Inner Hebrides and the archipelago of the Outer Hebrides create a network of channels, sounds and headlands, giving rise to enhances currents and turbulence, eddy generation, and flow separation (Ellett and Edwards, 1983).

The tides around Scotland are strongly semi-diurnal and can be described by the principal semi-diurnal lunar (M2) and semi-diurnal solar (S2) constituents (Neill et al., 2017) with the diurnal species, namely the K1 and O1, generally an order of magnitude smaller (Inall and Sherwin, 2006). The tidal wave propagates northwards up the western edge of the continental shelf, then turns eastwards across the northern extent of Scotland, before travelling into the North Sea (Neill et al., 2017).

The tidal range around the western seaboard varies from near-zero close to the island of Islay where an amphidrome is located to approx. 5m during spring ties to the north of Skye (Proctor, 1996). Although tidal ranges are higher to the north, the areas of strongest tidal current are found predominantly in the south, particularly around the North Channel (Neill et al., 2017). From the amphidromic point near Islay, the tide propagates northwards with tidal currents being diverted through the multiple channels and straits between the islands, sometimes converging either end of the strait leading to differences in tidal phase and sea surface elevation at either end, which causes strong tidal currents, i.e. Sound of Islay (Neill et al., 2017).

Figure 4-1 shows the simulated spring tidal current amplitude around Scotland taken from Hashemi et al. (2015). Tidal currents within the Inner Hebrides are generally < 1.0ms-1 with the exception of flow around headlands and within straits where spring tidal currents can exceed 2.5ms^{-1}.

Figure 4-1 Simulated peak spring tidal current amplitude around Scotland, and M2 tidal current ellipses (black lines) (Neill et al., 2017)



Cable Corridor 2.13 – Eigg-Mainland

Bay of Laig in the vicinity of the Eigg landfall has a spring and neap tidal range of 4.2m and 1.9m, respectively, while Mallaig on the Mainland has a spring and neap tidal range of 4.2m and 1.5m, respectively (TotalTide, 2021).

Around Eigg, currents are generally weaker with the exception of the south-east where they reach 0.74ms-1 (Global Marine, 2021). Current speeds along the proposed cable corridor peak at approximately 1.0ms-1 and 0.50ms-1 during a spring and neap, respectively, with the highest current speeds offshore of the Eigg landfall (ABPmer, 2017).

Cable Corridor 2.14 – Mainland-Lismore

Port Appin on the Mainland has a spring and neap tidal range of 3.4m and 1.2m (TotalTide, 2021).

Around Lismore, currents reach up to 1.0ms^{-1} at the northern extent of the island, reducing to the south due to the shallow water and narrow gap between the island and mainland Scotland constricting the flow of water as the tidal wave propagates through the channels in the region (Global Marine, 2021).

Cable Corridor 2.15 – Iona-Mull

Iona has a spring and neap tidal range of 3.5m and 1.5m, respectively (TotalTide, 2021).

Between Mull and Iona, currents reach up to approximately 0.5ms-1 however, this could be an underestimation due to the channel being too narrow to be accurately represented (Global Marine, 2021).

Cable Corridor 2.16 – Colonsay-Mull

Carsaig Bay (Mull) to the east of the Mull landfall in the vicinity of the Eigg landfall has a spring and neap tidal range of 3.5m and 1.3m, respectively, while Scalasaig, Colonsay has a spring and neap tidal range of 4.2m and 1.5m, respectively (TotalTide, 2021).

Between Ardalanish and Colonsay, current speeds are generally between 0.26ms-1 and 0.5ms^{-1} though off the northern tip of Colonsay they reach up to 0.75ms-1 (Global Marine, 2021). Current speeds along the proposed cable corridor peak at approximately 0.5ms-1 and 0.25ms-1 during a spring and neap, respectively (ABPmer, 2017).

Table 4.1 provides a summary of the tidal levels and ranges in the vicinity of the proposed cable landfall locations.

Table 4-1 Tidal levels and ranges (TotalTide, 2021)

Location	MHWS (m CD)	MLWS (m CD)	Spring range (m)	MHWN (m CD)	MLWN (m CD)	Neap range (m)
Bay of Laig, Eigg	4.7	0.5	4.2	3.5	1.6	1.9
Mallaig, Mainland	5.0	0.8	4.2	3.6	2.1	1.5
Port Appin, Mainland	4.2	0.8	3.4	3.1	1.9	1.2
Iona	4.0	0.5	3.5	3.0	1.5	1.5
Carsaig Bay (Mull)	4.1	0.6	3.5	3.1	1.8	1.3
Scalasaig, Colonsay	3.7	0.7	3.0	2.7	1.5	1.2

4.2.2.2 Waves

Waves are directly driven by winds, modified by currents and shallow sea-floor topography. In UK waters, wave climate is strongly seasonal; mean wave heights peak around January, with a high risk of high monthly-mean wave heights and extreme wave heights from October to March (UKMMAS, 2010).

The wave resource in Scotland is generally influenced by conditions in the North Atlantic due to the predominantly south-westerly prevailing winds, with a fetch sufficient to generate swell (Neill and Hashemi, 2013). The dominant wave direction for both swell and total sea is from the westerly sector. Although the influence of waves from this sector will reduce significantly to the north, swell conditions generated in the North Atlantic will diffract into the Sea of the Hebrides (Ramsay and Brampton, 2000).

More than half of the wave conditions experienced to the west of Islay occur from a narrow wave window to the west, although waves in excess of 8m can be experienced from the majority of the western sector (Ramsay and Brampton, 2000). Dominant swell wave conditions can also be experienced from a very narrow wave window to the west, with Atlantic swell being a significant component of the total offshore wave energy

Table 4-2 below shows the total sea and swell extreme significant wave heights west of Islay.

Table 4-2 Offshore total sea and swell extreme significant wave heights west of Islay (Ramsay and Brampton, 2000)

Return Period (Years)	Total sea extreme significant wave height (m)	Total swell extreme significant wave height (m)
1	11.80	5.07
10	14.12	6.09
100	16.29	7.04

4.2.2.3 Wind

Northern Scotland is subject to strong winds, with prevailing winds from the south-west and annual average wind speeds in the vicinity of the proposed cable corridors of approximately 10ms-1 (ABPmer, 2017). For 75% of the time, wind speeds exceed 4.0 ms-1, while for 0.1% of the time, wind speeds exceed 20ms-1 (Barne et al., 1997 a).

At Tiree, the wind is variable in both direction and speed. The most frequent directions are from the south and southeast, with peaks coming from the west and north (Global Marine, 2021). Speeds are within the Inner Hebrides geographical area are most often within the 6-18ms-1 range, with winds of gale force or greater occurring on around 23% of occasions, and calms around 13% of occasions (Global Marine, 2021).

4.2.2.4 Salinity and Temperature

The North Atlantic Drift current carries oceanic water along the north coast of Scotland through the Faroe – Shetland Channel to the Norwegian coast. The has a cooling effect on temperatures in the summer and a warming affect in the winter with average temperatures along the north coast of 12.5°C – 13°C in the summer and 6.5°C – 7.0°C in winter (Xodus Group, 2019). There appears to be little variability between the surface and bottom temperature of the water column within the Inner Hebrides, with the greatest difference occurring in the summer months when the surface is warmed most (Global Marine, 2021). Sea temperatures within the Hebrides is approximately 8°C in winter months increasing to 12-13°C in summer months (Berx and Hughes, 2017).

Salinity in this region appears to be variable with greatest differences between surface and bottom salinity occurring in Spring and Autumn, potentially due to variations in freshwater input from Scotland (Global Marine, 2021). In general, salinity is approximately 34.4ppt (Berx and Hughes, 2017), which is marginally lower than the salinity of normal sea water (35ppt).

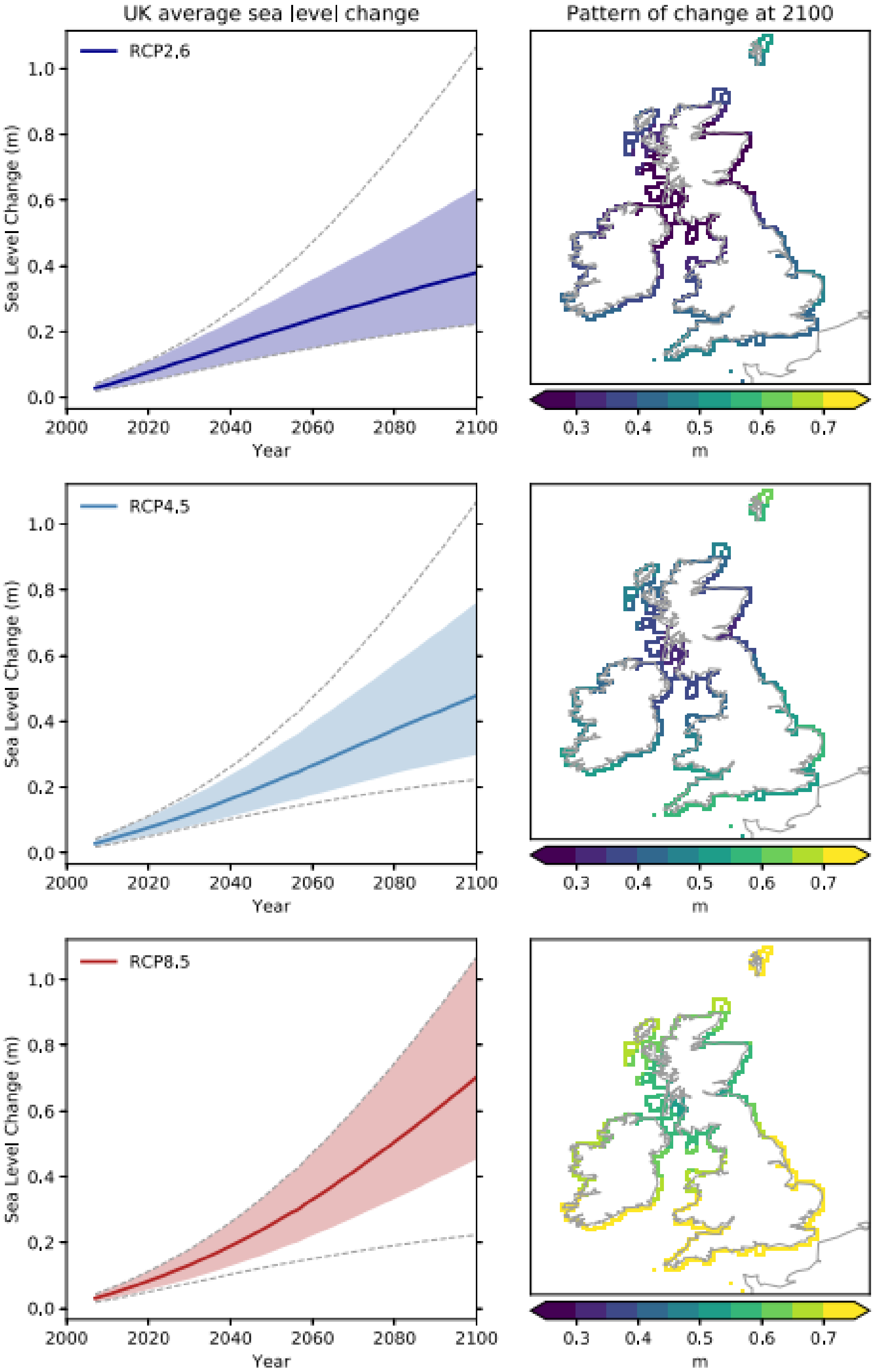
4.2.3 Climate Change Implications

With the anticipated onset of climate change, sea levels are predicted to change around the UK, which is likely to result in coastal flooding/erosion. The UK Climate Projections (UKCP18) project presents a new set of sea level projections, rooted in the climate models and methods from the Intergovernmental Panel on Climate Change AR5, which includes projections for a range of climate phenomena (temperature, rainfall, sea levels, etc.) under different emission scenarios (Palmer et al, 2018). The study found that sea level rise will occur for all emission scenarios and at all locations around the UK, with possible changes in tidal characteristics and waves.

Due to the uncertainty in future sea levels, a number of different scenarios exist (Palmer et al., 2018). The UKCP18 sea level projections are consistently larger than in the previous set of UK climate projections, UKCP09, for similar emissions scenarios. However, UKCP18 also includes a lower emissions scenario that assumes more mitigation. The amount of sea level rise depends on the location around the UK and increases with higher emissions scenarios. Based on exploratory results to 2300, sea levels continue to increase beyond 2100 even with large reductions in greenhouse gas emissions. Sea level rise over the coming centuries may affect tidal characteristics substantially (including tidal range). However, the atmospheric contribution to storm surges is unlikely to change. Extreme sea levels will increase due to the rise in mean sea level. However, the estimates presented suggest no additional change due to the atmospheric contribution to extreme sea level.

When combined with local information on sea defences and coastline structure, the sea level and storm surge projections enable vulnerability assessments along the UK coastline to be made. The UKCP18 sea level projections of future changes in sea water level around the UK coastline are calculated on a 12km grid around the coastline (Palmer et al, 2018). These are provided in Figure 4-2 below.

Figure 4-2 Three emissions scenarios against the relative sea level rise in the UK and Ireland, with further detailed (Palmer et al, 2018)



The implications of future sea level rise on the Inner Hebrides landfalls have been projected as follows. It should be noted that this does not take account of storm surge or waves under different return periods.

4.2.3.2 Cable Corridor 2.13 – Eigg-Mainland

For a low emissions scenario (Representative Concentration Pathway (RCP) 2.6), a medium emission scenario (RCP 4.5) and a high emissions scenario (RCP 8.5), sea levels in the vicinity of the proposed Mainland landfall are predicted to rise by up to 0.13m, 0.14m and 0.17m, respectively (UKCP, 2018), in 2046 for the central estimate (50th %ile). The Mean High-Water Spring (MHWS) level at Mallaig is

5.0m above Chart Datum (CD) (UKHO, 2021). In this respect, the MHWS level in the vicinity of the proposed Mainland landfall could increase to 5.13m CD, 5.14m CD and 5.17m CD under the low, medium, and high scenarios respectively in 2046 for the central estimate (50th %ile).

4.2.3.3 Cable Corridor 2.14 – Mainland-Lismore

For a low emissions scenario (RCP 2.6), a medium emission scenario (RCP 4.5) and a high emissions scenario (RCP 8.5), sea levels in the vicinity of the proposed landfalls are predicted to rise by up to 0.12m, 0.12m and 0.16m, respectively (UKCP, 2018), in 2046 for the central estimate (50th %ile). The Mean High-Water Spring (MHWS) level at Port Appin is 4.2m above Chart Datum (CD) (UKHO, 2021). In this respect, the MHWS level in the vicinity of the proposed Mainland landfall could increase to 4.32m CD, 4.32m CD and 4.36m CD under the low, medium, and high scenarios respectively in 2046 for the central estimate (50th %ile).

4.2.3.4 Cable Corridor 2.15 – Iona-Mull; Route 2.16 – Colonsay-Mull

For a low emissions scenario (RCP 2.6), a medium emission scenario (RCP 4.5) and a high emissions scenario (RCP 8.5), sea levels in the vicinity of the proposed landfalls are predicted to rise by up to 0.13m, 0.13m and 0.17m, respectively (UKCP, 2018), in 2046 for the central estimate (50th %ile). The Mean High-Water Spring (MHWS) level at Carsaig Bay (Mull) is 4.1m above Chart Datum (CD) (UKHO, 2021) and 3.7m at Scalasaig, Colonsay. In this respect, the MHWS level in the vicinity of the proposed Mainland landfall could increase to 4.23m CD, 4.23m CD and 4.27m CD under the low, medium, and high scenarios respectively, while in the vicinity of the Colonsay landfall, the MHWS level could increase to 43.83m CD, 3.83m CD and 4.00m CD under the low, medium, and high scenarios respectively, in 2046 for the central estimate (50th %ile).

4.2.4 Coastal Processes

The Isle of Eigg is relatively sheltered from the Atlantic swell by the Western Isles with generally small and independent beaches. In the vicinity of Mull, wind and wave erosion is occurring at many locations with littoral drift, which is low, strongly influenced by the orientation of the coastline (Barne et al., 1997 b).

There are very few beaches along this stretch of coastline other than dynamically stable shingle and cobble fringe beaches (Ramsay and Brampton, 2000). In the vicinity of the Eigg-Mainland landfall, the coastline is characterised by small sand beaches interrupted by rock outcrops, reefs and skerries, which provide a certain degree of shelter to the beach units from severe wave action. These beaches have a much greater shell content than others to the north and are all relatively stable (Ramsay and Brampton, 2000).

4.2.5 Bathymetry, Geology and Seabed Sediments

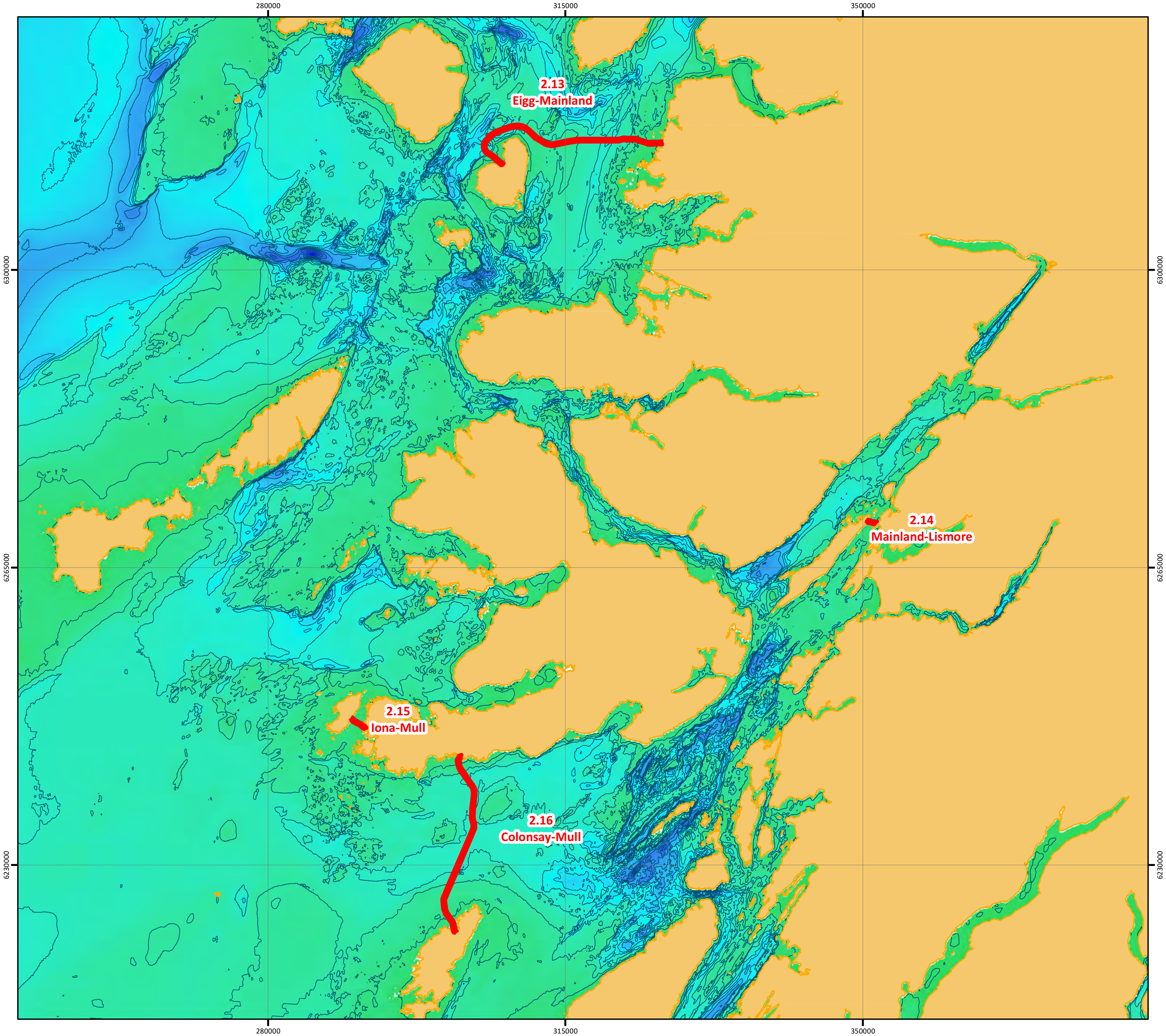
4.2.5.1 Bathymetry

The bathymetry within the Inner Hebrides is characterised by deep lochs and sounds representing former river valleys over deepened by glaciers flowing off major ice sheets with shallow sills at the entrances to many of these lochs (Barnes at al., 1997a). The maximum water depths are given in Table 4-3 and an overview of bathymetry within the cable corridors is presented in Figure 4-3 (Drawing Reference: P2308-BATH-001_IH).

Table 4-3 Cable corridor depths

Cable corridor	2.13 Eigg – Mainland	2.14 Mainland – Lismore	2.15 Iona – Mull	2.16 Colonsay – Mull
Maximum depth (m below MSL)	-120m	-13m	-10m	-85m

Source: EMODnet 2021 and UKHO 2021



SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

BATHYMETRY
EMODnet Bathymetry

Drawing No: P2308-BATH-001_IH	B

Legend

- Cable Route Application Corridor
- Contour (25 m Interval)

Bathymetry (-m MSL)

Value

High : 75.859

Low : -318.73

N E S W

NOTE: Not to be used for Navigation

Date	18 October 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ESRI; EMODnet, ONS
File Reference	J:\P2308\Mxd\12_BATH\ P2308-BATH-001_IH.mxd
Created By	Emma Langley
Reviewed By	Chris Dawe
Approved By	Paul Evans

BT Global Marine intertek

0 5 10 15 20 km

4.2.5.2 Underlying Geology

Scotland's geology is extremely complicated with the existing geology largely stemming from the Caledonian orogeny (mountain-building episode). At present this area is very stable, falling well within the boundaries of the Eurasian continental plate (Global Marine, 2021).

The Mainland-Lismore and Colonsay-Mull cable corridors are associated with the Great Glen Fault with Lismore and Colonsay composed of the Dalradian (late Proterozoic to Cambrian) metamorphic rocks, while Mull is more complex being almost entirely comprised of Palaeogene (Palaeocene, Eocene and Oligocene) basalts intruded by later granitic rocks with a small section of late Proterozoic metamorphosed sandstones on the southwest peninsula (Global Marine, 2021). Mull and Colonsay are separated by the Colonsay Basin, a graben bounded by the Great Glen Fault to the north and the Colonsay Fault to the south (Global Marine, 2021).

Iona is composed Lewisian gneisses in the west and metamorphosed sandstones and siltstones in the east, separated by the Moine Thrust fault (Global Marine, 2021).

Eigg is primarily composed of the same Palaeogene basalts as Mull, surrounded on the northern coast by Jurassic sedimentary strata. The coastline around Morar is made of late Proterozoic rocks (Global Marine, 2021).

4.2.5.3 Seabed Sediments

Seabed sediments are defined as the unconsolidated sediments at the seabed that have been deposited since the early Holocene (Barne et al. 1997).

Cable Corridor 2.13 – Eigg – Mainland

British Geological Society (BGS) data shows that the majority of the proposed cable corridor lies on sandy mud, while at the Bay of Laig, the sediment coarsens to gravelly sand closer inshore with rock outcrops to the north (Global Marine, 2021).

Cable Corridor 2.14 – Mainland – Lismore

The Mainland-Lismore Cable Corridor is not covered by BGS seabed sediment maps, however, UKHO charts suggest that the seabed in the northern part of the Lynn of Lorn is primarily sand mixed with shells with gravel, larger stones and boulders at the shoreline (Global Marine, 2021).

Cable Corridor 2.15 – Iona – Mull

The Iona-Mull Cable Corridor is not covered by BGS seabed sediment maps, however, UKHO charts suggest that the seabed is a mix of sand and shells – satellite imagery indicates that extensive rock exists in the eastern half of the channel (Global Marine, 2021).

Cable Corridor 2.16 – Colonsay – Mull

British Geological Society (BGS) data shows that the seabed is dominated by sands, progressively becoming gravellier close to shore and within the centre of the channel (Global Marine, 2021). EMODnet bathymetry data indicates a rocky seabed off Mull with scattered rock outcrops with potential subcropping rock to the centre of the channel with a 3km band of rock to the north of Colonsay (Global Marine, 2021).

4.2.6 Water and Sediment Quality

Water and sediment quality at any particular location on the UK continental shelf is the result of a combination of source, transport and removal mechanisms for the individual chemical species under consideration. There are many routes by which substances with the potential to affect water quality enter the Inner Hebrides, both through natural processes and as a result of anthropogenic inputs over the past few decades (UKMMAS, 2010).

4.2.6.1 Potential Sources of Pollution

Munitions

According to the OSPAR dumping at sea data, there is one marine dumpsite approximately 14km to the south-west of Cable Corridor 2.14 at the south-western end of the Sound of Mull. No further details have been provided, however, its distance is unlikely to pose any risks to the proposed cable installation.

Organic Contaminants

The majority of organic compounds present in the environment are either readily biodegradable or of low water solubility and hence of limited significance in terms of water contamination. However, some organic compounds are the subjects of concern. Prominent among the compounds that can reach toxic concentrations in the dissolved phase, and/or bioaccumulate from the dissolved phase to toxic levels are the organo-metallic compounds of lead, tin, and mercury. Use of organo-tin compounds (as marine anti-foulants) and tetraethyl lead (as a petrol additive) has been subject to stringent controls and concentrations in the marine environment are consequently decreasing.

Heavy Metals

In general, dissolved metal concentrations are normally higher in coastal waters than in the open ocean (Chester, 2009), with a generally inverse relationship to salinity.

Artificial Radionuclides

Artificial radionuclides form a very small component of seawater radioactivity. The natural background radioactivity of seawater, largely due to dissolved Potassium-40, is around 12 becquerels (Bq). The Scottish Environment Protection Agency (SEPA) regulates the disposal of radioactive waste from licenced nuclear sites to ensure that the amount of radiation than an individual is exposed to from the authorised disposal of radioactive waste does not exceed 1.0 millisievert per year (mSv/y) (Marine Scotland, 2020). The closest nuclear power station to the Inner Hebrides is Dounreay, which is located on the north coast of Scotland approximately 13km to the west of Thurso. Data collected between 2013 and 2017 suggest that doses from the Dounreay power station are significantly less than the legal dose limit of 1.000 mSv/y. Furthermore, non-soluble nuclides, such as plutonium and americium, are quickly removed from the water column by precipitation or scavenging by suspended particulate matter. The distance of the proposed cable corridors in the Inner Hebrides from Dounreay power station means that the risk posed by this source is insignificant.

4.2.6.2 Water Quality

The European Union (EU) Marine Strategy Framework Directive (MSFD) adopted in 2008 requires that the UK takes “the necessary measures to achieve or maintain “Good Environmental Status” in the marine environment by the year 2020 at the latest” (Department for Environment, Food and Rural Affairs (Defra), 2015). The report concludes that good progress has been made towards this with significant contamination restricted to industrial estuaries and coastal areas.

Water Framework Directive (WFD)

The requirement for monitoring UK rivers and near-shore waters has increased as a result of the implementation of the EU Water Framework Directive (WFD), with more stringent criteria for water quality in rivers applied. River Basin Management Plans (RBMP) are being developed as a requirement of the WFD and report on the ‘ecological status’ of surface and ground water in coastal waters (out to 1 nm from the baseline) and ‘chemical status’ of surface and ground waters in territorial waters (out to 12 nm from the baseline). The Scottish Environment Protection Agency (SEPA) is responsible for producing RBMPs for the Scotland and the Solway Tweed River Basin Districts. The MSFD assessments are carried out at subregion level, i.e. the Greater North Sea and the Celtic Seas. The MSFD and WFD overlap in coastal waters as the WFD extends to three nm seaward from the Scottish territorial baseline. Any proposed development within these waters must have regards to the WFD and ensure that all surface water bodies achieve 'Good Ecological Status (GES)' and that there is no deterioration in the status. Table 4-4 summarises the WFD status along each proposed cable corridor.

Table 4-4 WFD status along proposed cable corridors

Cable Corridor	Waterbody the corridors pass through
Cable Corridor 2.13 – Eigg – Mainland	Ardnamurchan to Southern Skye waterbody (ID: 200355) with an overall waterbody status of High in 2016 (Atkins Geospatial, 2019).
Cable Corridor 2.14 – Mainland – Lismore	Firth of Lorn (North) waterbody (ID: 200066) with an overall waterbody status of Good in 2016 (Atkins Geospatial, 2019).
Cable Corridor 2.15 – Iona – Mull	Sound of Iona waterbody (ID: 200063) with an overall waterbody status of High in 2016 (Atkins Geospatial, 2019).
Cable Corridor 2.16 – Colonsay – Mull	The northern part of the cable corridor passes through the South Mull waterbody (ID: 200059) with and overall waterbody status of High in 2016; the central part of the cable corridor passes through the Atlantic Ocean – SW Mull waterbody (ID: 200505) with an overall waterbody status of High in 2016; while the southern part of the cable corridor passes through the Colonsay waterbody (ID: 200053) with an overall waterbody status of Good in 2016 (Atkins Geospatial, 2019).

Bathing Waters

The closest bathing water to any of the proposed cable corridors is Ganavan, which is located approximately 12.8km to the south-west of Cable Corridor 2.14 Mainland-Lismore. This bathing water has had an Excellent classification since 2015.

Shellfish Waters

Shellfish waters rely on good water quality to ensure safety for human consumption. Within Scotland, shellfish waters are designated for protection under the Water Environment (Shellfish Water Protected Areas: Designation) (Scotland) Order 2013.

There are no classified Shellfish Harvesting Areas in the Inner Hebrides, however, there is currently one Shellfish Water Protected Area in the vicinity of Cable Corridor 2.13 Eigg-Mainland: Arisaig, located in Loch nan Ceall (approximately 3.5km to the south-west of Cable Corridor 2.13); two Shellfish Water Protected Areas in the vicinity of Cable Corridor 2.14 Mainland-Lismore: Lismore located at the northern end of Lismore island and Loch Creran to the immediate south of the Mainland landfall; and one Shellfish Water Protected Area to the south of Cable Corridor 2.15 Colonsay-Mull: Colonsay.

4.2.7 Seabed Quality

Sediment contamination can result from natural and anthropogenic inputs and can be harmful to biota. Sediment in the near-shore sections of the proposed cable corridor corridors is likely to be affected by recent human activity. The level of both organic and inorganic contaminants in sediments is largely related to the proportion of fine material present, as a result of deposition processes. In a predominantly coarse sediment area, such as that observed along much of the proposed cable corridors in the Inner Hebrides, contamination levels are expected to be low. Operations at Dounreay Nuclear Power Development Establishment resulted in the discharge of radioactive (predominantly, sand sized) particles. Survey data and modelling (PRAGD, 2012) suggests that significant (i.e. potentially hazardous and persistent) contaminated particles are unlikely to be found beyond 2km from the Dounreay outfall. As a result, and given that the proposed cable corridors are a significant distance from this power station, they are not expected to be present at the installation corridors.

4.2.8 Suspended Sediments

Particulate matter in the water column is composed of organic and inorganic fractions. Organic fractions are predominantly the result of biological activity in the water column and is primarily composed of planktonic material, including bacteria. This will not be influenced by any activities associated with the cable laying and will, therefore, not be discussed further. Inorganic suspended particulate material (iSPM) is derived from fluvial inputs (derived from both erosion in the river catchments and from chemical reactions in the estuarine zone), fallout from the atmosphere and coastal erosion combined with re-suspension of existing sediments and chemical reactions in the water column. As a result, iSPM loads vary widely, generally increasing with proximity to the coastline (UKMAAS, 2010). These are also highly dependent on energy inputs (i.e. storms).

Available measurements of iSPM, whether from vessels or by satellite imagery, are largely restricted to near-surface data obtained under non-storm / cloud free conditions and are limited for the Inner Hebrides R100 cable system. Average measured iSPM for the period 1998-2015 within the Inner Hebrides is low (approximately 0-1mg/l) (CEFAS Report, 2016). However, iSPM concentrations vary widely with season, wave action, tidal conditions and freshwater discharges. As a result, water clarity and seabed and water column light intensity are also highly variable.

4.2.9 Assessment of Effects

Table 4-5 Potential pressures identified for proposed cable corridors in Inner Hebrides region

Potential Pressure	Screened In/Out?
Abrasion/disturbance at the surface of the substratum	Yes
Penetration and disturbance below the substratum including abrasion	Yes
Siltation rate changes including smothering (depth of vertical sediment overburden)	Yes
Changes in bathymetry	No
Changes in suspended solids (water clarity)	No
Physical change to another seabed type	Yes
Local water flow (tidal current) changes	Yes

A review of the pressures to be included in the Marine Environmental Appraisal has excluded the following pressures from further consideration in this topic Chapter:

- Changes in bathymetry given that each cable will be trenched and backfilled along the majority of their lengths coupled with the small footprint of each cable where trenching is not possible, i.e. where rock bags are utilised, the effect of the proposed cables on changes to bathymetry is negligible.
- Changes in suspended solids (water clarity): specifically, in relation to discharges from project vessels.
- The following sub-sections provide the assessment of the effects on the physical environment for each pressure.

4.2.10 Compliance and best practice measures

The R100 Project within the Inner Hebrides geographical area includes a range of primary mitigation measures that have been 'designed' into the development proposals to demonstrate that the applicant will comply with national and international statute and best practice guidance as determined by the cable industry as a basic standard for how to proceed on a project. These design measures will help to reduce the effects of cable installation. These have been outlined in the MEA Project Description (MEA Chapter 2: Project Description) and those which are relevant to the physical environment are provided in Table 4-6, below. When undertaking the assessment, it has been assumed that these measures will be complied with.

Table 4-6 Compliance and best practice measures – physical environment

ID	Aspect	Design Measure	Source
COMP 5	Physical environment; Biological Section: Benthic and Intertidal Ecology	Ballast water discharges from Project vessels will be managed under the International Convention for the Control and Management of Ships' Ballast Water and Sediments standard.	International Maritime Organisation
COMP 6	Physical environment; Biological Section: Benthic and Intertidal Ecology	Project vessels will be equipped with waste disposal facilities (sewage treatment or waste storage) to IMO MARPOL Annex IV Prevention of Pollution from Ships standards.	International Maritime Organisation
COMP 7	Physical environment; Biological Section: Benthic and Intertidal Ecology	Control measures and shipboard oil pollution emergency plans (SOPEPs) will be in place and adhered to under MARPOL Annex I requirements for all project vessels.	International Maritime Organisation
BP8	Physical environment; Biological, Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Rock bags/contingency protection measures will only be deployed where adequate burial cannot be achieved or as required by crossing agreements. The footprint of the deposits will be the minimum required to ensure cable safety and stability.	Crossing Agreements
BP13	Physical environment; Biological Environment: Benthic and Intertidal Ecology	Construction vehicle movement will be minimised as far as practical to minimise effects to compacting the beach; beach profile will be restored following cable installation.	Global Marine installation requirement

4.2.11 Abrasion/disturbance at the surface of the substratum

During installation, a plough will be towed within the proposed Inner Hebrides route, which will simultaneously lay and bury the cable. The plough is towed across the seabed on skids and the plough share separates the sediment to bury the cable to the required burial depth. This action is in contact with the surface of the seabed and will cause a localised area of abrasion during the installation process. The footprint of the plough (skid and share) in contact with the seabed is less than 0.015km2 along the length of each cable (worst case).

As the skids pass over the seabed, the sediment below may be compacted, and the topography changed. However, the area affected will be highly localised and these changes will be transient with pre-installation conditions quickly returning following natural sediment transport processes. Therefore, effects of abrasion and/or disturbance of the substrate on the surface of the seabed has been assessed as negligible.

In sections of hard seabed where burial cannot be achieved, the cable may be surface laid and as such, only the seabed within the direct footprint of the cable will be disturbed. The extent of the disturbance will be confined to a small and linear area. Therefore, the effects of abrasion/disturbance to the substrate on the surface of the seabed will be negligible.

Sections of surface laid cable will be assessed to determine the level of on-bottom stability as well as risk from anthropogenic hazards such as fishing activity. If considered unstable, the cable will be secured to the seabed to ensure stability and to minimise abrasion to the seabed and the cable.

Contingency external cable protection measures may be used in such areas such as concrete mattressing and/or rock bags to provide additional stability (if required). The footprint of any contingency external cable protection will be limited to that required to ensure cable stability on the seabed and/or protection at crossings. This will minimise the movement of the cable on the seabed minimising the potential abrasion due to currents and wave action moving the cable. Therefore, the effects of abrasion and/or disturbance to the substrate on the surface of the seabed from the surface laid cable will be negligible.

If re-location of a small number of targeted boulders is required during pre-installation works, there is the potential for seabed sediments to be subjected to abrasion and/or disturbance of the surface of the seabed. Boulder re-location will induce this pressure in a one-off event when the boulders are picked and re-positioned in a new area of seabed close to the installation route. Despite the potential for abrasion and/or disturbance, should a small number of boulders be repositioned, this will not change the character and nature of the seabed with boulders only being moved a short distance from one location to another.

4.2.12 Penetration and disturbance below the substratum including abrasion

Prior to installation, PLGR will be undertaken along the proposed application corridors. Typical PLGR can penetrate and/or disturb up to 40cm depth of the seabed (depending on seabed type). As the grapnels are dragged through the surface sediments of the seabed it will pick up obstructions such as wires and derelict fishing gear and disturb the sediments. While grapnels can penetrate up to 40cm of the seabed, the sediment along the cable corridors are primarily sands and gravels, which will be moved and naturally backfill with some areas of rock particularly in the intertidal areas. During installation the plough share will also disturb sediments within the same footprint of the PLGR. The depth of penetration of the plough share will be to 1m. Disturbance will be minor and similar to that of some penetrative with fishing methods and there will be no net loss of sediment. The effects of penetration and/or disturbance to the substratum below the surface of the seabed to the physical environment from PLGR are, therefore, considered negligible.

4.2.13 Siltation rate changes including smothering (depth of vertical sediment overburden)

The marine cable installation will cause resuspension of sediments from the seabed into the water column. Jet trenching will cause a greater level of sediment suspension compared to the use of ploughing equipment. However, this is not proposed other than for small sections of the cables in the near shore area or sections of the cable that cannot be plough buried at the time of installation. The impact is a small localised and temporary increase in turbidity.

The findings of a separate study on the Environmental Impact of Subsea Trenching Operations (Gooding et al., 2012) suggested that the impacts of subsea trenching operations on sediment disturbance vary depending on the sediment size. For coarser sediments, these are likely to settle back in the very near-field (~ 100m) with finer particles deposited further afield (1-2km). Suspended solid concentrations, although elevated immediately after trenching, have been shown to fall to ambient levels within 66 m of trenching activity in hard ground areas and 70 m in sandy areas with fine deposition occurring out to a maximum of 2 km from the trench (Gooding et al., 2012). Fine material will, however, be rapidly diluted and dispersed in the water. Far-field deposition is predicted to be less than 1 mm for both trenching by jetting and ploughing. No significant impacts on fish populations or migratory species from sediment disturbance are expected to occur.

The effects of siltation rate changes including smothering to the physical environment from the PLGR are, therefore, considered negligible.

4.2.14 Physical change to another seabed type

The use of integral and external cable protection could introduce a different type of artificial material onto the seabed, which may differ in consistency to the surrounding sediments.

4.2.14.1 Integral Cable Protection

Integral cable protection measures include High-Density Polyethylene (HDPE) such as Uraduct® and Articulated Pipe (AP) which are fitted to the cables prior to cable lay.

HDPE protection may be used where the cable crosses an existing in-service fibre optic cable. There is one telecommunication cable crossings required within Cable Corridor 2.14 Mainland – Lismore. HDPE may be used approximately 50m either side of the crossing location and post lay buried where possible. The HDPE diameter is small (94mm), therefore the overall footprint of the seabed to be affected within Cable Corridor 2.14 Mainland – Lismore is 2.82m2. However, the area to be affected by the physical change to substratum type is small in the context of the wider sedimentary seabed surrounding the cable crossings. Effects to the physical environment are generally associated with a larger footprint of change, higher magnitude of change to seabed morphology and local tidal flow changes. Furthermore, as the HDPE at crossings is to be post lay buried where possible, therefore there will be no effects to seabed sediments and morphology.

AP protection is planned to be fitted from the end of the BMH duct to the 10m water depth contour subject to burial conditions. The maximum diameter of the articulated pipe is 150 mm and will be applied to the cable and buried at all landfalls. As the articulated pipe will be buried, this will not have any effect on coastal processes at each landfall or change the morphology of the intertidal zone. Articulated pipe may also be applied to any sections of surface laid cable. The footprint of articulated pipe is small and will be in areas of gravel content or hard ground and is unlikely to constitute a significant change to the seabed in such areas.

The effects of a physical change to another seabed type from the installation of integral cable protection for R100 within the Inner Hebrides geographical area on seabed sediments is negligible.

4.2.14.2 Contingency External Cable Protection

Contingency external cable protection includes rock bags and concrete mattresses. These measures may be used at power cable crossings or areas where further cable stability is required. There are no crossings requiring external cable protection within the Inner Hebrides Geographical Area.

Concrete mattresses have been included in the marine licence application as a contingency measure within the Inner Hebrides geographical area (3 mattresses per cable corridor have been included as a contingency). Each mattress covers an area of 18m2. The location of any potential deposit of concrete mattresses is unknown until the cable has been installed and burial depths are known. A deposit of mattresses in a soft sedimentary environment is unlikely as good burial is expected to be achieved in such areas. A deposit of mattresses in a soft sedimentary environment would result in a physical change to another seabed type, however effects to the physical environment are generally associated with a larger footprint of change, higher magnitude of change to seabed morphology and local tidal flow changes. Effects from potential contingency external cable protection is of low magnitude and unlikely to cause changes to tidal flow or sediment transport and therefore are Not Significant.

Similar to concrete mattresses, the requirement, and locations for any deposit of rock bags is not currently known and will only be available following post cable route surveys. For the purposes of assessment, this MEA has considered the number of rock bags to be used per cable as a worstcase scenario (see Table 2-4 within the Project Description). Rock bags are only likely to be used in sections of the route where cable burial is not possible due to hard ground, glacial till or sub cropping rock and current speeds are high. The addition of rock bags to such areas will not cause a significant change to the seabed physical environment. The area affected is small and based on this, the addition of rock bags is considered negligible.

4.2.15 Local water flow (tidal current) changes

There are no planned rock berms within the Inner Hebrides geographical area.

Contingency cable protection is only likely to be used where adequate burial cannot be achieved or where surface lay is required. Such areas are likely to be areas of hard ground or exposed rock and the effects of scour in such areas is unlikely to be significant.

Therefore, the magnitude of the effect on water flow has been assessed as low as although the structures will be permanent features, the spatial extents of effects will be very localised. The overall significance of the effect has been assessed Not Significant.

4.3 Project Specific Mitigation

No project specific mitigation is required to reduce the effects of cable installation on the physical environment.

4.4 Conclusion

Four pressures on the physical environment have been assessed in this MEA. These are Abrasion/disturbance at the surface of the substratum, Penetration and disturbance below the substratum including abrasion, physical change to another seabed type and local water flow (tidal current) changes. No significant effects to the physical environment have been identified from cable installation activities within the Inner Hebrides geographical area.

5. BIOLOGICAL ENVIRONMENT

5.1 Introduction

This Section provides a full description of the baseline environment for benthic and intertidal ecology for the cable corridors within the Inner Hebrides geographical area; identifies potential effects associated with the cable installation; presents the findings of the environmental appraisal; and where necessary proposes appropriate mitigation and management measures that will be implemented to remove or reduce effects.

Sandeel have also been considered in this section, as they are an important marine prey species across Scotland for bird, fish and cetacean species.

A full assessment of the potential effects of the Project on protected sites, European Protected Species (EPS) and basking shark is provided in the Protected Sites Assessment (Appendix C) and EPS Risk Assessment (Appendix D). The findings of these assessments have been summarised in this Section for completeness, along with any mitigation proposed in the Appendices.

5.2 Benthic and Intertidal Ecology – Data Sources

Baseline conditions have been established by undertaking a desktop review of published information, consultation with relevant bodies and selected site-specific surveys.

An initial desk-top study used predictive seabed habitat maps from the European Marine Observation Data Network (EMODnet) and GIS spatial information showing the known locations of Priority Marine Features (PMF) and Annex I habitats (as described in Table 5-1), to identify the likely presence of sensitive habitats within the cable corridors. Where it was likely that a sensitive habitat would occur or where the cable corridor was within a protected site for benthic habitats, a benthic survey was carried out. This approach was discussed with NatureScot on 22nd March 2021 who confirmed that the proposed approach to informing the benthic baseline is pragmatic and therefore acceptable.

Within the Inner Hebrides geographical area, benthic habitat surveys were undertaken during June 2021 for Cable Corridor 2.14 Mainland to Lismore.

The survey reports are provided as Appendix A. Drop down video (DDV) and still images were used to verify the physical (e.g. substrate) and biological features (e.g. biota) of the seabed and identify PMFs. Sample stations were selected based upon the existing knowledge of the distribution of PMFs and samples were targeted around these areas to verify the presence or absence of these features.

In addition, Phase 1 habitat surveys and intertidal surveys, as described in Table 5-1, have been used to identify protected features and inform the baseline description at the cable connection points.

Table 5-1 Data Sources

Data Source	Description
European Marine Observation Data Network (EMODnet)	Predictive seabed habitat map ‘EU Sea Map’ (EUSM) updated every 2-3 years based on survey, ground-truthing points and results from habitat suitability models. Habitats are classified according to the European Nature Information System (EUNIS) (version 2007-11) habitat classification, which provides a hierarchical structure and includes substrate type, dominant lifeform, humidity, typical depth zone, human usage, and impact. Surveys undertaken by EMODnet and EMODnet partners which informed the EUSM within or adjacent to (<1km) the cable corridor have also been used to inform finer-scale habitats at the corridors.

Data Source	Description
GEMs Priority Marine Features (PMF)	The Scottish PMF list contains 81 habitats and species considered to be of conservation importance in Scottish waters, of which 11 are vulnerable and are currently seen as a conservation priority (NatureScot, 2021b). The Geodatabase of Marine Features adjacent to Scotland (GeMs) PMF datasets have been used to establish the presence of PMFs within the cable corridors.
Phase 1 Habitat Surveys	Phase 1 habitat surveys were undertaken at the landing points for all cable corridors from June to September 2021 by Aquatera in accordance with JNCC methodology (JNCC, 2015). This included walkover surveys by trained surveyors, vegetation mapping and use of aerial photography to identify distinct vegetation types. The survey areas were at least a 250m radius around the proposed cable connection points at the beach manhole (BMH), plus a corridor to 250m in length along the coast in each direction (500m total) from the proposed cable connection points between High Water Springs (HWS) and the BMH. No limitations were identified to the surveys.
Intertidal surveys	Phase 1 Intertidal Biotope Mapping surveys were undertaken at the landing points for all cable corridors from June to September 2021 by Aquatera using standard survey techniques outlined by the Countryside Council for Wales (CCW) (Wyn *et al*., 2006) and JNCC (Hiscock, 1996). Prior to surveys, aerial imagery was used to identify obvious features or habitat variations. The proposed survey areas comprised a 500 m corridor centred on the proposed cable landing point locations and extended from the splash zone down to the Lowest Astronomical Tide (LAT). Areas of sediment where then sampled at various intervals at the upper mid shore, mid shore and lower shore, which were then filtered to 5mm and 0.5mm to identify habitat type. Biotopes were assigned and described with reference to The Marine Habitat Classification for Britain and Ireland (v04.05) (Connor et al., 2004) and the Joint Nature Conservation Committee (JNCC) website's online search facility, and species names were taken from the Marine Life Information Network (MarLIN) (MarLIN, 2021). No limitations were identified to the surveys.

5.3 Benthic and Intertidal Ecology - Baseline Conditions

The baseline conditions for the benthic and intertidal ecology within the cable corridors are outlined in this subsection, and summarised in Table 5-2, below. Protected sites which are designated for benthic features, potential Annex I habitats, PMFs and cable corridors which have suitable habitat to support sandeel, have also been identified in this subsection, and are summarised in Table 5-2.

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Table 5-2 Summary of the predominant habitats and protected benthic features for cable corridors within Inner Hebrides geographical area

Cable Corridor	Predominant Intertidal habitat	Predominant subtidal habitat	Within Protected Site for Habitat Features	Presence of Annex I habitat / PMF / UKBAP habitat	Suitable Sandeel habitat
2.13	**Eigg Landing Point**: Sandy beach with boulders and shingle. Low sandbank running the length of the beach and small burn 120m north of the BMH marked by cobbles and small boulders. **Mainland Landing Point:** Sandy beach with clean fine to medium sand. South of the beach bound by a line of large rocky outcrops extending out to sea. North of the beach backed by grass, dunes and rocky outcrops.	Circalittoral sandy mud (EUNIS habitat A5.35) and deep circalittoral mud (EUNIS habitat A5.37).	No	No	Yes
2.14	**Mainland Landing Point:** Stony beach, mostly cobbles and pebbles with some boulders and occasional bedrock outcrops. Beach backed by a road, woodland and bushes. **Lismore Landing Point:** Beach composed of gravelly fine to medium sand overlain by cobbles and pebbles with occasional small boulders. One bedrock outcrop along the upper shore, north of the proposed BMH.	Low energy infralittoral seabed type. *Laminaria hyperborea* park and foliose red seaweeds on tide-swept lower infralittoral mixed substrata (EUNIS habitat A3.2132).	No	No	Yes
2.15	**Iona Landing Point:** Sandy bays interspersed with extensive intertidal rocky platforms cut through with narrow channels. Gravelly fine to medium sand embayment near the proposed BMH. **Mull Landing Point:** Sandy bay with wide rugged rocky platforms between rocky headlands to the north and south.	High energy infralittoral seabed dominant. No EUNIS habitats identified.	No	No	Yes
2.16	**Colonsay Landing Point:** Sandy beach within an inlet, flanked by rocky headlands. Several small bedrock outcrops and a small burn at the western end. It is backed by sand dunes with marram grass, with rough pasture behind. **Mull Landing Point:** to the east and west. Sandy beach backed by rocky, rough pasture between rocky headlands.	Moderate energy deep circalittoral seabed dominant. Circalittoral fine sand (EUNIS habitat A5.25) or Circalittoral muddy sand (EUNIS habitat A5.26) most dominant habitat type identified.	No	No	Yes

5.3.2 Subtidal habitats

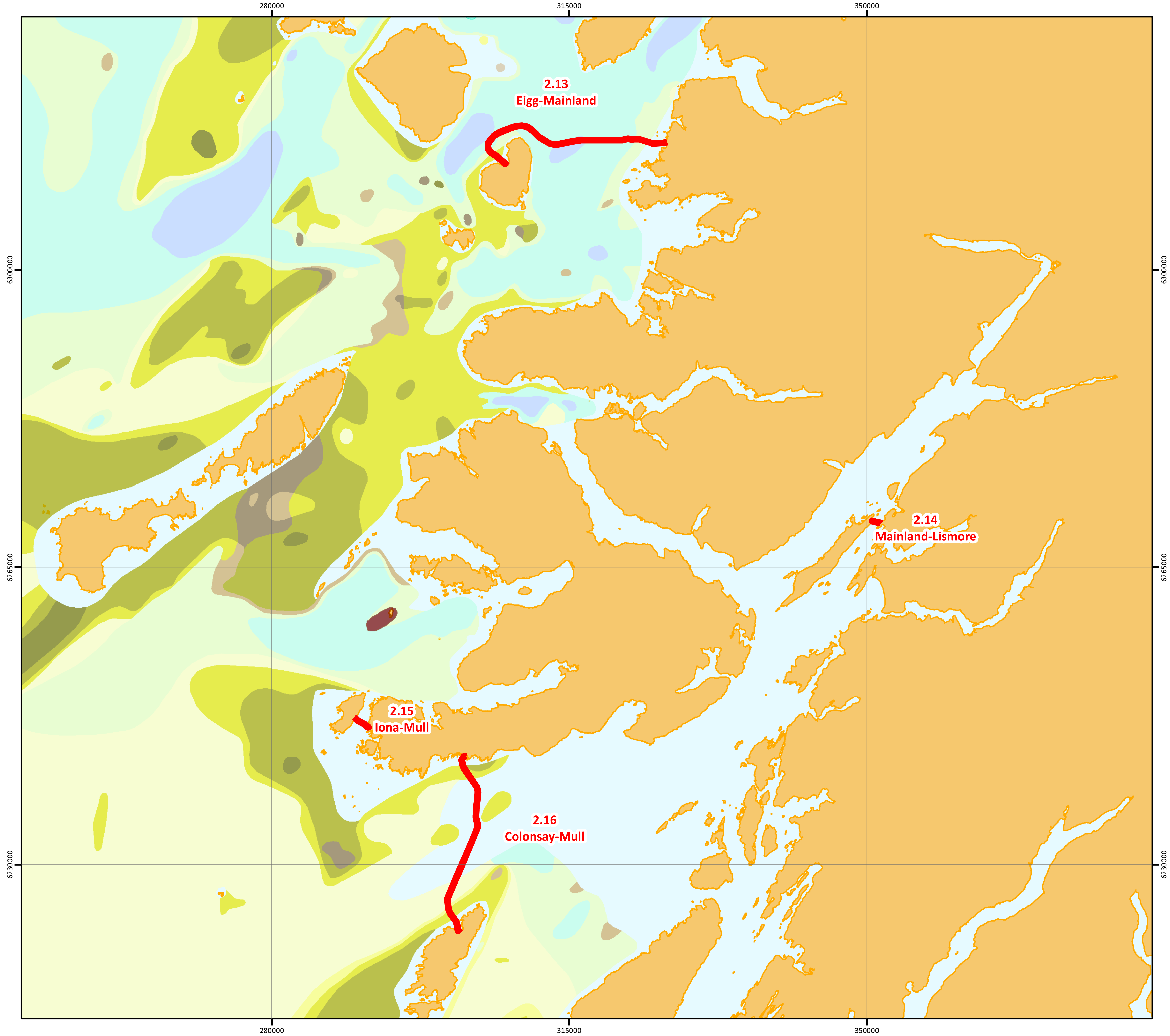
The Inner Hebrides geographical area displays a contrast of seabed types, from higher energy open shelf sands, which are strongly influenced by storm waves, to lower energy muddy sands in depositional sink (Murray, 2003). The sediments are predominantly comprised of sand and coarse-grained sediments, with finer sediments such as muddy sand and mud in the north of the area, at Cable Corridor 2.13 Eigg to Mainland (Figure 5-1; Drawing Reference: P2308-SEDS-001_IH-B).

Twelve broad scale EUNIS habitats were identified within the cable corridors from the EMODnet broad-scale seabed habitat map (Figure 5-2, Drawing Ref: P2308-HAB-001-IH-B) listed within Table 5-3, below. However, the broad-scale habitat map does not cover all of Inner Hebrides, and some so broad habitat types could not be determined for the full extent of all cable corridors. Where EUNIS habitats could not be classified, the EMODnet broad-scale seabed habitat map has classified the broad seabed type of some areas, which are given listed under 'non-EUNIS classified habitat types' in Table 5-3.

Table 5-3 Percentage Cover of broad scale EUNIS habitats within the cable corridors

Habitat Type	2.13	2.14	2.15	2.16
	Percentage of corridor where the habitat is present (%)			
Broad Scale EUNIS Habitat Types				
A3.1: Atlantic and Mediterranean high energy infralittoral rock				0.06
A4.1: Atlantic and Mediterranean high energy circalittoral rock				1.08
A4.2: Atlantic and Mediterranean moderate energy circalittoral rock				0.07
A5.13: Infralittoral coarse sediment	0.02			
A5.14: Circalittoral coarse sediment	3.86			9.07
A5.15: Deep circalittoral coarse sediment	0.40			3.28
A5.25 or A5.26: Circalittoral fine sand or Circalittoral muddy sand				16.25
A5.27: Deep circalittoral sand				0.04
A5.33: Infralittoral sandy mud	0.53			
A5.35: Circalittoral sandy mud	31.06			
A5.36: Circalittoral fine mud	12.16			
A5.37: Deep circalittoral mud	39.63			
Non-EUNIS classified Habitat Types				
Circalittoral seabed				0.05
High energy circalittoral seabed	0.12		70.39	3.20
High energy infralittoral seabed	6.00			6.40
Infralittoral seabed	0.001	0.47	1.07	0.11
Low energy circalittoral seabed		1.85		1.31
Low energy deep circalittoral seabed				3.79
Low energy infralittoral seabed	0.13	86.06	14.60	0.32

Habitat Type	**2.13**	**2.14**	**2.15**	**2.16**
	Percentage of corridor where the habitat is present (%)			
Moderate energy circalittoral seabed	0.31			0.15
Moderate energy deep circalittoral seabed				52.64
Moderate energy infralittoral seabed	4.63			
Data Deficient	1.13	11.62	13.94	2.19



SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

SEABED SEDIMENTS
EMODnet Seabed Substrate

Drawing No: P2308-SEDS-001_IH	B

Legend

- Cable Route Application Corridor

Seabed Substrate - Folk 16 Level

- 1.1.1 Mud
- 1.2.1 sandy Mud
- 1.2.2 (gravelly) sandy Mud
- 1.3.1 muddy Sand
- 2.1.1 Sand
- 2.1.2 (gravelly) Sand
- 3.1.1 gravelly Sand
- 3.2.1 sandy Gravel
- 3.3.1 Gravel
- 4.1.1 gravelly Mud
- 4.3.1 gravelly muddy Sand
- 4.4.1 muddy sandy Gravel
- 5. Rock & boulders

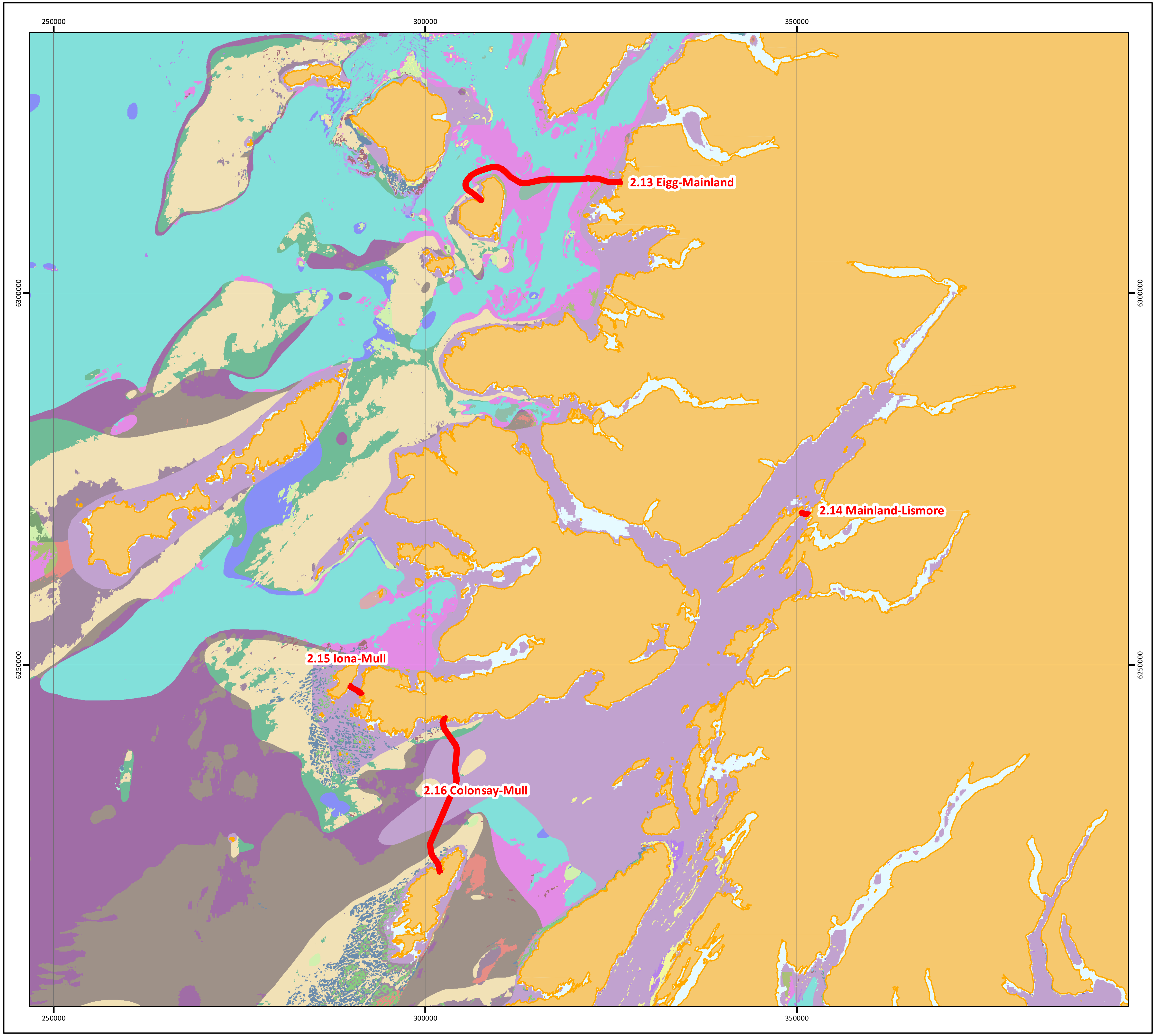
N S W E

NOTE: Not to be used for Navigation

Date	18 October 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ESRI; EMODnet, ONS
File Reference	J:\P2308\Mxd\10_SEDS\ P2308-SEDS-001_IH.mxd
Created By	Emma Langley
Reviewed By	Chris Dawe
Approved By	Paul Evans

BT Global Marine intertek

0 5 10 15 20 km



SCOTTISH ISLES
FIBRE OPTIC CABLE PROJECT

SEABED HABITATS
EMODnet EUSeaMap Predicted Habitats
Inner Hebrides

Drawing No: P2308-HAB-001_IH	B

Legend

Cable Route Application Corridor

EU Sea Map

EUNIS classification

- A3
- A3.1
- A3.2
- A3.3
- A4
- A4.1
- A4.12
- A4.12 or A4.27 or A4.33
- A4.2
- A4.27
- A4.3
- A4.33
- A5
- A5.13
- A5.14
- A5.15
- A5.23 or A5.24
- A5.25 or A5.26
- A5.27
- A5.33
- A5.34
- A5.35
- A5.36
- A5.37
- A5.43
- A5.44
- A5.45
- Na

NOTE: Not to be used for Navigation

Date	18 October 2021
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Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ONS; EMODnet; ESRI;
File Reference	J:\P2308\Mxd\06_HAB\ P2308-HAB-001_IH.mxd
Created By	Chris Dawe
Reviewed By	Abigale Nelson
Approved By	Paula Daglish

BT Global Marine intertek

0 5 10 15 20 km

Source: Office for National Statistics licensed under the Open Government Licence v.3.0, Contains OS data © Crown copyright and database right (2018); Information contained here has been derived from data that is made available under the European Marine Observation Data Network (EMODnet) Seabed Habitats project (www.emodnet-seabedhabitats.eu), funded by the European Commission's Directorate-General for Maritime Affairs and Fisheries (DG MARE).; ©Esri

5.3.3 Protected features

5.3.3.1 Introduction

Several potential Annex I habitats and PMFs were identified as occurring within the Inner Hebrides geographical area. These are outlined in Table 5-4. Table 5-2 above summarises which habitat occurs within each cable corridor. Only habitats which occur within 100m of the cable corridors have been described below and are highlighted in bold in the table.

Table 5-4 Benthic habitats of conservation interest in R100 Project area

Conservation interest	Habitat
Within designated site	
Special Area of Conservation (SAC) Annex I habitat (Treshnish Isles SAC)	Reef - Bedrock and / or stony reef
Nature Conservation Marine Protected Area (NCMPA) protected features (Small Isles NCMPA)	Burrowed mud
	Circalittoral sand and mud communities
	Fan mussel aggregations (*Atrina fragilis*)
	Horse mussel beds
	Northern feather star aggregations (*Leptometra celtica*) on mixed substrata
	Northern sea fan and sponge communities
	White cluster anemones (*Parazoanthus anguicomus*)
Outside designated site	
Potential Annex I habitat (PAIH)	**Reef - Bedrock and / or stony reef**
	Sandbanks slightly covered by seawater all of the time
Priority marine features	**Burrowed mud**
	Kelp and seaweed communities on sublittoral sediment
	Kelp beds
	Tide-swept algal communities
	Sandeel

Due to the distance from the closest cable corridor to the Treshnish Isles SAC (16.1km from Cable Corridor 2.15 Iona to Mull) and Small Isles NCMPA (2.3km from Cable Corridor 2.13 Eigg to Mainland) no pressure pathway to these habitats was identified, and so these habitats have not been assessed further.

5.3.3.1 Reef - Bedrock and / or stony reef

Annex I reef habitats are predicted to be the most common seabed feature across Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) in Scottish territorial waters (Connor et al., 2004). These may be 'stony' or 'bedrock' reef types, which provide hard substrate for plant and animal communities to develop. Biogenic reefs also exist, which are where structure is created by the animals themselves, including coral, mussel and Sabellaria reefs (JNCC, 2021a).

Rocky reefs are rocky marine habitats that rise from the seabed. They are generally subtidal but may also extend as an unbroken transition into the intertidal zone, where they are exposed to the air at low tide. Intertidal areas are only included within this Annex I type where they are connected to subtidal reefs.

Reefs are characterised by communities of attached algae (where there is sufficient light). In Northern UK waters these habitats tend to support a community of cold-water species such as anemone (*Bolocera tuediae*), kelp (*Laminaria hyperborean, Laminaria digitata*), red seaweed (*Ptilota plumosa*) and filamentous seaweeds (JNCC, 2021a). They are also usually associated with a range of mobile animals, including invertebrates and fish. The communities are variable and dependant on rock type, aspect and metocean conditions. The presence of strong tidal streams and exposure to wave action often significantly increases species diversity, although some communities require very still conditions. Reefs are important supporting habitats and are often associated with other Annex I habitats and PMFs. The recoverability of rocky reef habitats from a one-off event of disturbance and abrasion are variable (up to 10 years) and are dependent on the algal regeneration and community species present (MarLIN, 2021).

5.3.3.2 Kelp beds and Kelp and seaweed communities on sublittoral sediment

Shallow sublittoral sediments which support seaweed communities typically include the sugar kelp (*Saccharina latissimi*), the bootlace weed (*Chorda filum*) and various red and brown seaweeds, particularly filamentous types. With increasing shelter from wave action, some algae (e.g., *Phyllophora crispa*) may develop as loose-lying mats on the sediment surface. A diverse array of animals is associated with these kelp and seaweed dominated habitats e.g., burrowing polychaete worms and bivalves, scavenging hermit crabs, crabs, starfish, fish and grazing top shells (JNCC, 2015).

Kelp and seaweed communities are found in shallow water (max. 20m depth), on a wide variety of substrates (muddy sands and gravels through to cobbles and boulders) and in various environmental conditions. The habitat is particularly widespread along the west coast of Scotland and in sheltered areas of Orkney and Shetland, with occasional records on the east coast (MarLIN, 2021).

The habitat which most closely resembles the PMF Kelp and seaweed communities on sublittoral sediment in MarLIN is “red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles”. This habitat is characterised by tide-swept infralittoral cobbles and pebbles which are highly mobile, and create an environment that is difficult for many algae to survive in. Foliose and filamentous seaweeds with an encrusting phase in their life history, or those that are able to withstand rolling of the substratum and scouring can form dense turfs of seaweed. This habitat can also support dense bryozoan/hydroid turf and dense brittlestar and horse mussel beds in mixed sediment below the kelp zone. Sponges and ascidians occur on the vertical rock faces, and crabs and brittlestars are common within crevices in the rock (JNCC, 2021a).

The mobility of the sediment and rock fractions of this habitat allow *Saccharina latissima*, *Chorda filum* and other red and brown seaweeds to grow on small stones and shells. *Saccharina latissima* and *Chorda filum* are important canopy forming species within these biotopes. The MarLIN sensitivity assessment of this habitat is based on these two primary species.

Saccharina latissima and *Chorda filum* are opportunistic seaweeds which have relatively fast growth rates. *Saccharina lattisima* is a perennial kelp which can reach maturity in 15-20 months and has a life expectancy of 2-4 years (MarLIN 2021). *Chorda filum* is an annual seaweed, completing its life cycle in a single season.

Saccharina latissimi and *Chorda filum* have the potential to rapidly recover following disturbance. *Saccharina latissima* has been shown to be an early colonizer within algal succession, appearing within 2 weeks of clearance, and can reach sexual maturity within 15-20 months. *Chorda filum* has rapid growth rates, capable of reaching sexual maturity within a year. Resilience has therefore been assessed as 'High'. Recoverability is likely to be high following penetration or disturbance of the substratum subsurface through cable burial activities.

The habitat has been assessed as having medium recoverability to abrasion/disturbance of the substratum or seabed and therefore is likely to be sensitive to repeated abrasion if this was to occur from movement of a surface laid cable. Recoverability to physical change (to another seabed type) is very low therefore this habitat will be very sensitive to habitat loss through external cable protection measures. Recoverability from changes in suspended solids (water clarity) is high (MarLIN, 2021).

5.3.3.3 Tide-swept algal communities

The tide-swept algal communities PMF encompasses a range of communities, which can all be categorised as fucoids in tide-swept conditions. The tide-swept algal communities PMF biotope '*Laminaria hyperborea* park and foliose red seaweeds on tide-swept lower infralittoral mixed substrata' was identified in the vicinity of the installation activities and has been described here.

Laminaria hyperborea park and foliose red seaweeds on tide-swept lower infralittoral mixed substrata occurs in moderately wave-exposed, tide-swept, infralittoral mixed substrata with Laminaria hyperborea park (JNCC, 2021c). The understory is characterised by foliose seaweeds (e.g. *Phycodrys rubens, Plocamium cartilagineum and Hypoglossum hypoglossoides*), and sometimes brown seaweeds (e.g. *Dictyota dichotoma*) and brozoants (e.g. *Alcyonium diaphanum*). It typically occurs between 10 and 30m depth, with tidal streams of greater than 1 knot (JNCC, 2021c).

Laminaria hyperborea park and foliose red seaweeds on tide-swept lower infralittoral mixed substrata is considered to have medium sensitivity to abrasion, based on a study of *Laminaria hyperborea* recovery following trawling disturbance (Christie et al., 1998; MarLIN, 2021). As disturbance related to the installation activities will affect a significantly smaller area than trawling, sensitivity to this pressure is anticipated to be lower. As the habitat occurs in tide-swept areas, it is considered to not be sensitive to sediment rate changes, as any fine sediments deposited at the site will be quickly dispersed (MarLIN, 2021).

In favourable conditions, recovery of *Laminaria hyperborea* beds can be seen within 2-6 years of a discrete kelp harvesting event, as a proxy for disturbance (Christie et al., 1998). Recovery of associated communities can take longer, from 7-10 years (MarLIN, 2021). Recurrent disturbance would be likely to lengthen recovery time (Burrows et al., 2014). The habitat is therefore considered to overall have medium resilience to disturbance.

5.3.3.4 Burrowed mud

Burrowed muds are characterised by dense aggregations of seapens (*Kophobelemnon* spp) in mud sediments (MarLIN, 2021). They are also inhabited by species such as Norway lobster (*Nephrops norvegicus*), mud shrimps (*Callianassa subterranean* and *Calocaris macandreae*) and burrowing brittlestars (*Amphiura spp*.), which help to aerate the mud and prevent anoxia. This habitat only occurs in deeper water (less than 50m depth) in sheltered basins and sea lochs (NatureScot, 2021a).

Kophobelemnon stelliferum, a filter-feeding species which is often characteristic of burrowed mud, is likely to take 5-8 years to reach sexual maturity, with recruitment occurring irregularly and some years having limited to no recruitment (MarLIN, 2021, Murillo et al., 2018). Loss of this species may result in loss or degradation of these biotopes; therefore, the sensitivity of these biotopes are dependent on the sensitivity of *Kophobelemnon* (MarLIN, 2021).

As this is a sediment habitat, this habitat has very low recoverability from habitat loss through physical change (to another seabed type) by placement of hard substrates such as rock bags and concrete mattressing associated with the installation activities (MarLIN, 2021). Abrasion and penetration can cause local mortality to seapens, however the positioning of *Kophobelemnon stelliferum* colonies within the sediment and their ability to retract increases their resistance to abrasion pressure (Kenchington et al., 2011). They are overall assessed to have medium sensitivity to these pressures

(MarLIN, 2021). Sensitivity to light siltation rate changes is low, as seapens have some behavioural adaptations to tolerate sedimentation (Torre et al., 2012). However, they have high sensitivity to heavy siltation rate changes by smothering and blocking their filtering apparatus used in respiration and feeding (Torre et al., 2012), with no recovery within three years (Gates & Jones, 2012; MarLIN, 2021)

A review of studies on similar habitats by MarLIN (2021) suggests that recovery from physical impacts has been shown to take from four years (Lindholm et al., 2008) to 13-22 years (Wilson et al., 2002), based on the deep-sea proxy *Halipteris* sp. growth rates. Burrowing mud are therefore assessed to have overall low resilience to one-off or temporary disturbance (MarLIN, 2021).

5.3.4 Sandeel

Sandeel have been included in this section as they are an important keystone species with an important role as a prey species for marine mammals, certain seabirds and larger fish (Frederiksen et al, 2006). Of particular note are the associations with black legged kittiwake (Furness, 2002), auks (Daunt et al, 2008), and seal species (Furness, 2002) in the North Sea. Sandeel are identified within certain habitat types, which can be used to predict if they will be present.

Five species of sandeel are currently found in UK waters, namely Greater sandeel (*Hyperoplus lanceolatus*); Corbin's sandeel (*Hyperoplus immaculatus*); lesser sandeel (*Ammodytes tobianus*); smooth sandeel (*Gymnammodytes semisquamatus*); and Raitt's sandeel (*Ammodytes marinus*). Raitt's sandeel is by far the most abundant, comprising over 90% of commercial sandeel fishery catches (Scottish Government, 2017). In Scotland, the species Raitt's and lesser sandeel are protected as PMF's. For the purposes of this assessment, the umbrella term 'sandeel' encompasses both of these protected species.

Sandeel are small (<30cm length) eel-like fish usually found in sandy substrates, in which they bury to protect themselves from predators. Sandeel display seasonal and diurnal patterns in that they remain buried in sediments over the winter period and overnight (Holland et al, 2005; JNCC, 2014), emerging to feed on their primary food sources, phytoplankton and zooplankton. Sandbanks and sandy substrates are important habitats for this species (Ellis et al, 2012).

The distribution of sandeel within Scotland's seas is patchy and is generally concentrated on or nearby banks and areas of suitable sediment (NatureScot, 2021c). There are no protected sites for sandeel within the Inner Hebrides geographical area, but they are an important prey item for many protected species, such as seals and Minke whale.

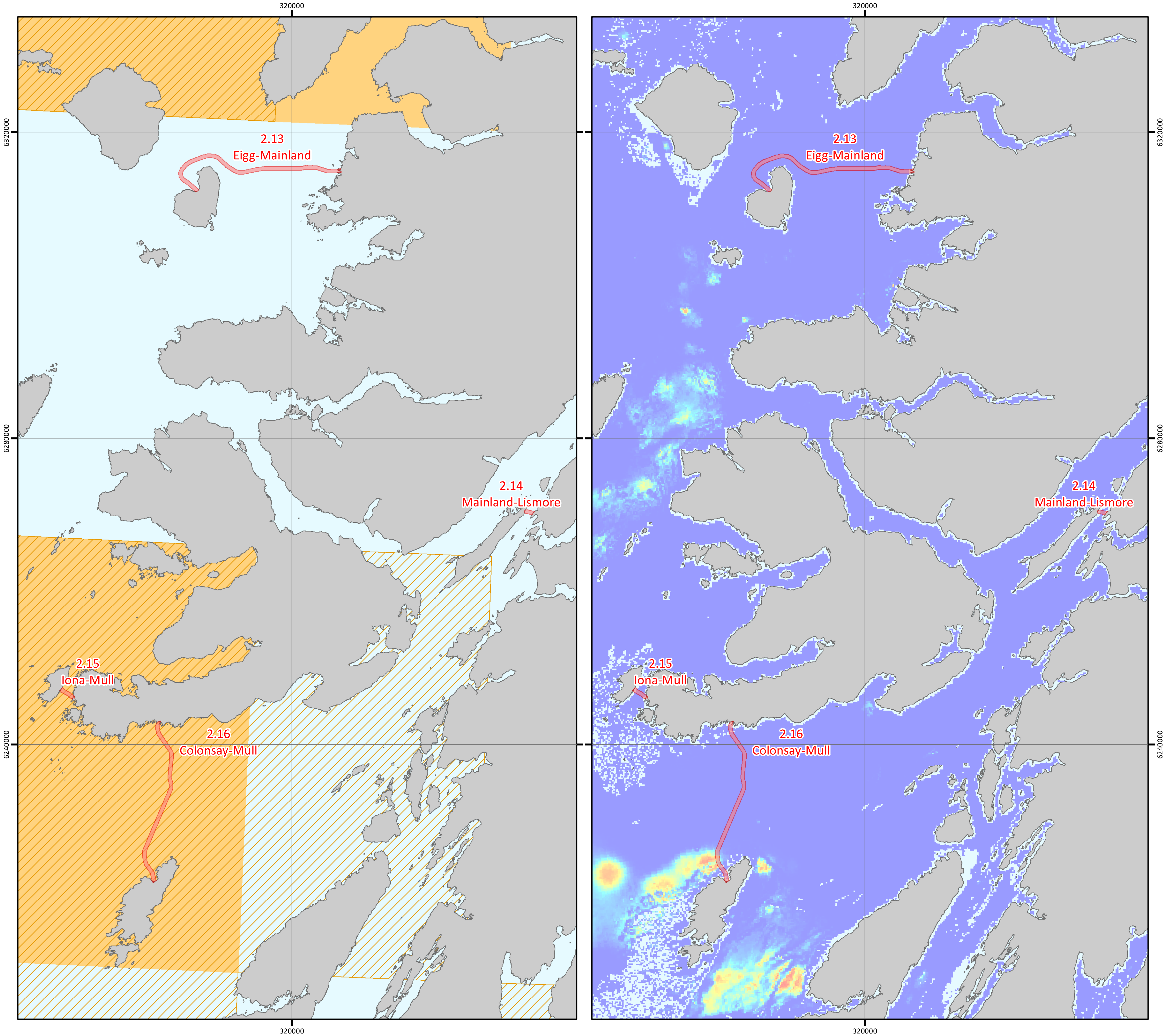
A review of broad-scale seabed habitat (EMODnet, 2020a), sediment (BGS, 2020), benthic survey data, potential nursery and spawning grounds (Ellis et al., 2012) and sandeel probability data (Langton, Boulcott and Wright, 2021) have identified the likelihood for presence of sandeel across the Inner Hebrides geographical area. Cables Corridors 2.15 Iona to Mull and 2.16 Colonsay to Mull are both within an area which has been identified as having potential for low intensity sandeel nursery and spawning grounds following review of larval data from icthyoplankton surveys (Figure 5-3: Drawing Reference: P2308-FISH-008_IH-B). All corridors are also in areas of low lesser sandeel probability, except Cable Corridor 2.16 Colonsay to Mull which overlaps a small area of medium probability offshore of Colonsay (Figure 5-3: Drawing Reference: P2308-FISH-008_IH-B).

Research undertaken to date (Pinto et al, 1984; Wright et al, 2000; Holland et al, 2005) has demonstrated that the preferred sediments for sandeel are coarse to medium sands. Small fractions of fine gravels and silts of all grades are tolerated by sandeel up to approximately 10% of the total sediment. It is considered that this relates to the ability of individuals to bury themselves in the sediment. Sandeel species also typically dwell at water depths of between 30m – 70m (Wright et al, 2000; McDonald et al, 2019).

SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

FISH AND FISHING
Sandeel Distribution in Inner Hebrides

Drawing No: P2308-FISH-008_IH	B



Legend

Cable Route Application Corridor

Sandeel Nursery and Spawning Grounds (Ellis et al., 2012)

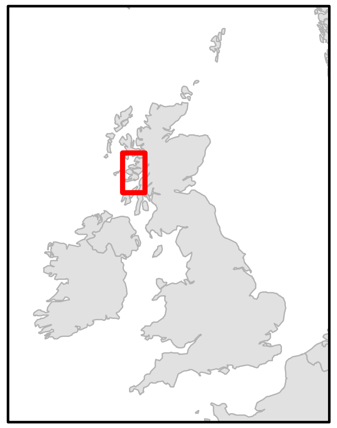
Nursery

Spawning

Lesser Sandeel Probability Presence (Celtic Sea)

High : 0.983799

Low : 0



NOTE: Not to be used for Navigation

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Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ESRI; OSOD; CEFAS; MS
File Reference	J:\P2308\Mxd\03_FISH\ P2308-FISH-008_IH.mxd
Created By	Jessica Harvey
Reviewed By	Chris Dawe
Approved By	Jill Hobbs

0 5 10 15 20 km

Contains data from UKOGD.; ©Esri; Contains public sector information licensed under Open Government Licence v3.0. Data from Ellis, J.R. et al. (2012) Spawning and Nursery Grounds of Selected Fish Species in UK Waters. CEFAS Lowestoft Science Series Technical Report, 147: 55pp.; Contains information from the Scottish Government (Marine Scotland) licensed under the Open Government Licence v3.0.

5.3.5 Cable Corridor 2.13 Eigg to Mainland

Cable Corridor 2.13 Eigg to Mainland is located just outside the Sound of Sleat. The cable corridor routes around the north of Eigg into the Sound of Rum, and lands on Eigg at the Bay of Laig. Around Eigg, currents are generally weaker with the exception of the south-east where they reach $0.74ms^{-1}$ (Global Marine, 2021).

5.3.5.1 Intertidal area

Table 5-5 summarises the intertidal information for the cable landing points. A detailed description of the biotopes and features observed are provided in the intertidal survey reports (Appendix A).

Table 5-5 Characteristics of Cable Corridor 2.13 Eigg to Mainland landing points

Cable Corridor 2.13	Eigg	Mainland
Location	The landing point is within the Bay of Laig, located on the northwest coast of Eigg.	The landing point is at Silver Sands Morar, approximately 3km North of Arisaig on mainland Scotland.
Description	Sandy beach with boulders and shingle at the southern end. At mid-tide level the beach profile is raised into a low sandbank running the length of the beach. Small burn 120m north of the BMH marked by cobbles and small boulders.	Sandy beach with clean fine to medium sand. South of the beach bound by a line of large rocky outcrops extending out to sea. North of the beach backed by grass, dunes and rocky outcrops.
No. of biotopes recorded by Phase 1 intertidal survey	9	11
Presence of Annex I habitat or PMF	No	No
Presence of OSPAR Listed Threated and/or Declining Species	Dog whelk - common across UK and not locally protected	Dog whelk - common across UK and not locally protected
BAP priority marine species or habitats	No	No

5.3.5.2 Subtidal area

A total of seven broad EUNIS habitat types were identified within the cable corridor from the broad-scale seabed habitat map (Table 5-6). The entire cable corridor is dominated by circalittoral sandy mud (EUNIS habitat A5.35) and deep circalittoral mud (EUNIS habitat A5.37). There was also an area of circalittoral fine mud (EUNIS habitat A5.36) in the centre of the cable corridor (Table 5-6; Figure 5-4, Drawing Reference: P2308-HAB-002-B_2.13 Eigg-Mainland). Previous EMODnet seabed habitat partner surveys also identified a range of predominantly sandy habitats just offshore of the Eigg landing point (Table 5-6).

The cable corridor does not intersect any areas of potential Annex I reef, or Annex I sandbank habitat features (Figure 5-4, Drawing Reference: P2308-HAB-002-B_2.13 Eigg-Mainland). The PMFs burrowed mud, kelp and seaweed communities on sublittoral sediment and northern sea fan and sponge communities were identified north of Eigg, between 800 and 900m away from the cable corridor. Burrowed mud was also identified approximately 95m west of the cable corridor, northwest of Eigg.

The cable corridor is not in the vicinity of any protected sites which are designated for benthic species or features.

Table 5-6 EUNIS habitats within the Cable Corridor 2.13 Eigg to Mainland

Habitat	EUNIS code	Species/ benthic features identified from previous surveys	Source
Littoral sand and muddy sand	A2.2	Offshore of the Eigg landing point ▪ Rippled medium and fine sands ▪ No living organisms observed	2
Barren littoral coarse sand	A2.221	Offshore of the Eigg landing point ▪ Mid-shore sand bar of firm medium and fine sand ▪ No living organisms observed	2
Polychaetes in littoral fine sand	A2.231	Offshore of the Eigg landing point ▪ Irregularly rippled sand ▪ Medium sand with few shell fragments ▪ Four polychaetes observed	2
Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock	A3.125	Offshore of the Eigg landing point ▪ Small and large boulders ▪ Coarse, shell, cobbles and pebbles	2
Sublittoral coarse sediment	A5.1	Offshore of the Eigg landing point ▪ Level seabed of fine and coarse sand ▪ Few species found except for frequent *Liocarcinus depurator* and *Aporrhais pespelecani*	2
Infralittoral coarse sediment	A5.13	Offshore of the Eigg landing point ▪ Coarse sand with shell gravel plain ▪ Several echinoderm species observed including *Corymorpha nutans*	1, 2
Circalittoral coarse sediment	A5.14	NA – Broad-scale seabed habitat map only available.	1
Deep circalittoral coarse sediment	A5.15	NA – Broad-scale seabed habitat map only available.	1
Echinocardium cordatum and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand	A5.241	Offshore of the Eigg landing point ▪ Medium rippled sand ▪ Occasional Zostera plants and Ectocarpoid algae ▪ Small Decapoids common ▪ Burrowing infauna included *Ensis* sp. and *Echinocardium* sp	2
Infralittoral sandy mud	A5.33	NA – Broad-scale seabed habitat map only available.	1
Circalittoral sandy mud	A5.35	NA – Broad-scale seabed habitat map only available.	1
Circalittoral fine mud	A5.36	NA – Broad-scale seabed habitat map only available.	1
Deep circalittoral mud	A5.37	NA – Broad-scale seabed habitat map only available.	1
Cerianthus lloydii with *Nemertesia* spp. and other	A5.4411	Offshore of the Eigg landing point ▪ Level seabed of fine and coarse sand	2

Habitat	EUNIS code	Species/ benthic features identified from previous surveys	Source
hydroids in circalittoral muddy mixed sediment		▪ Few species found except for frequent *Liocarcinus depurator* and *Aporrhais pespelecani*	
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	A5.444	Offshore of the Eigg landing point ▪ Coarse/medium sand with the occasional boulder ▪ Pink encrusting algae and *Cliona celata* on boulders ▪ A variety of red algae	2

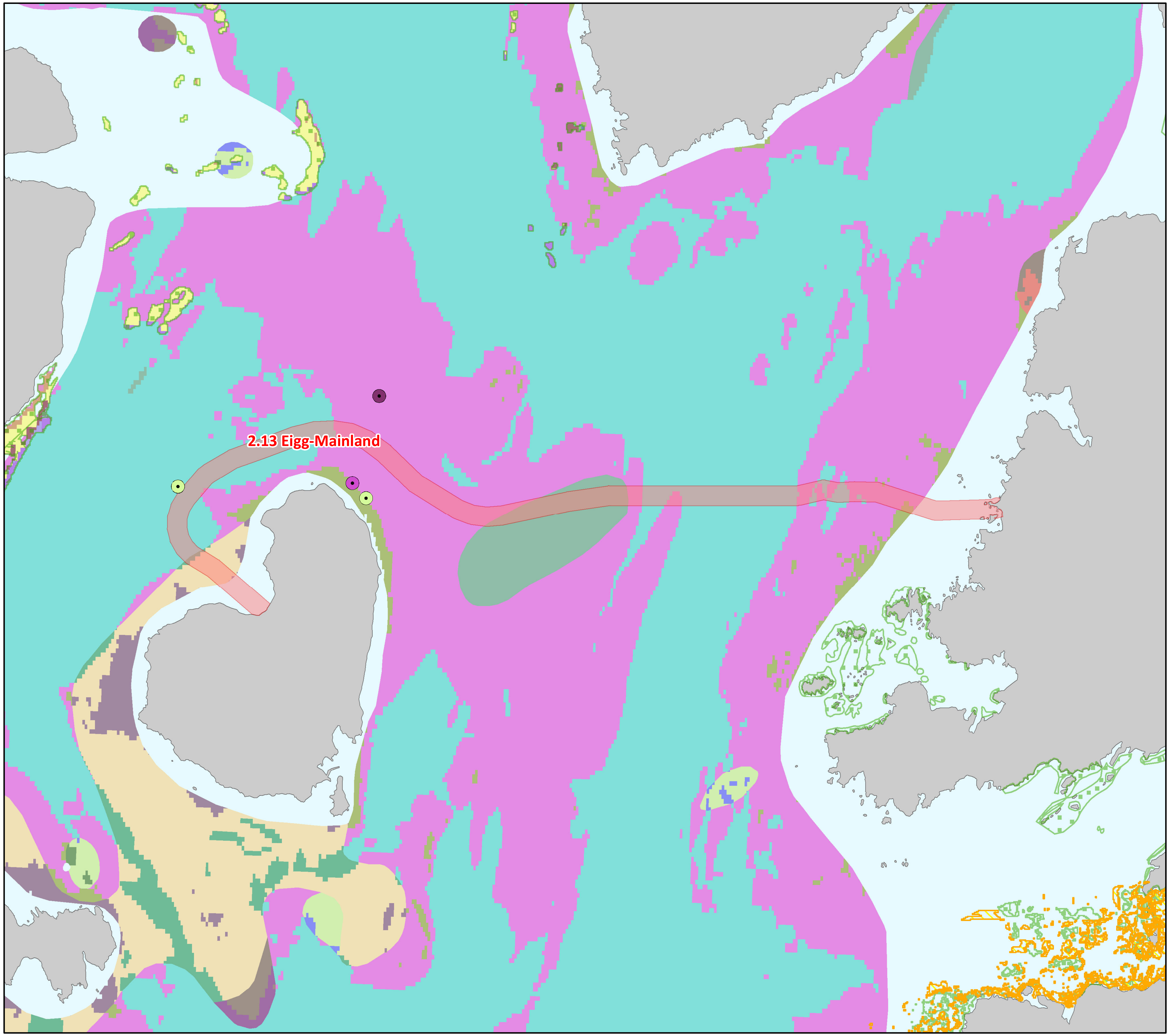
Sources:

[1] Habitats are obtained from the EMODnet broad-scale seabed (EUNIS) habitat map (EMODnet, 2019)

[2] Habitats and species/benthic information are obtained from previous surveys within or adjacent to the Cable corridor by EMODnet Seabed Habitat partners (EMODnet, 2020)

5.3.5.3 Sediment characterisation and sandeel potential

According to BGS sediment data, Cable Corridor 2.13 Eigg to Mainland predominantly crosses areas of sandy mud, with small areas of muddy sand and gravelly sand (BGS, 2020). This is consistent with the EUSM broad habitat map which shows that the area is dominated by circalittoral sandy mud and deep circalittoral mud (Figure 5-4, Drawing Reference P2308-HAB-002-B_2.13 Eigg-Mainland). Sandeel are only able to tolerate up to 10% of fine sediments and silt (Wright et al, 2000). Therefore, the majority of the cable corridor is unsuitable for sandeel. However, there may be potential sandeel habitat in the small areas of the more coarse gravely sand.



SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

SEABED HABITATS

EUSeaMap and Priority Marine Features

2.13 Eigg-Mainland

Drawing No: P2308-HAB-002	B

Legend

- Cable Route Application Corridor

Priority Marine Feature

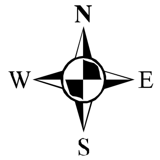
- Burrowed
- Kelp and seaweed communities on sublittoral sediment
- Kelp beds
- Northern sea fan and sponge communities
- Sandbank Area (High Confidence)

Annex I Reef Habitat

- Stony
- Bedrock and/or

EUNIS Classification

- A3
- A3.1
- A3.2
- A3.3
- A4.1
- A4.2
- A4.27
- A4.3
- A4.33
- A5.13
- A5.14
- A5.15
- A5.23 or A5.24
- A5.25 or A5.26
- A5.27
- A5.33
- A5.35
- A5.36
- A5.37
- A5.43
- A5.44
- A5.45



NOTE:
Only Priority Marine Features which are within 1km of the Application Corridors are shown.

Map Centre
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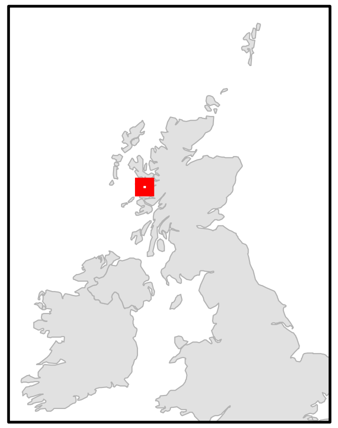
Longitude: -6.0276°W

Scale @A3 1:100,000



NOTE: Not to be used for Navigation

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File Reference	J:\P2308\Mxd\06_HAB\ P2308-HAB-002.mxd
Created By	Jessica Harvey
Reviewed By	Chris Dawe
Approved By	Paula Daglish

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5.3.6 Cable Corridor 2.14 Mainland to Lismore

Cable Corridor 2.14 Eigg to Mainland is located at the north of Lynn of Lorn. The cable corridor routes from the north of Lismore island to the Mainland, south of Port Appin. Current speeds are up to 1.0ms^{-1} around the cable corridor, where the narrow gap between Lismore and the mainland constricts the flow of water (Global Marine, 2021).

5.3.6.1 Intertidal area

Table 5-7 summarises the intertidal information for the cable landing points. A detailed description of the biotopes and features observed are provided in the intertidal survey reports (Appendix A).

Table 5-7 Characteristics of Cable Corridor 2.14 Mainland to Lismore landing points

Cable Corridor 2.14	Mainland	Lismore
Location	Located at Port Appin, in the Lynn of Lorn on the east mainland coast of Loch Linnhe.	Northeastern end of Lismore at an unnamed beach, 0.5km south of the ferry landing point.
Description	Stony beach approximately 75m south of the main stone jetty at Port Appin. Mostly cobbles and pebbles with some boulders and occasional bedrock outcrops. Beach backed by a road, woodland and bushes and is used to launch small boats.	Beach composed of gravelly fine to medium sand overlain by cobbles and pebbles with occasional small boulders. Beach bounded at each end by a small headland. One bedrock outcrop along the upper shore, north of the proposed BMH.
No. of biotopes recorded by Phase 1 intertidal survey	9	7
Presence of Annex I habitat or PMF	No	No
Presence of OSPAR Listed Threatened and/or Declining Species	Dog whelk - common across UK and not locally protected	Dog whelk - common across UK and not locally protected
BAP priority marine species or habitats	No	No

5.3.6.2 Subtidal area

Cable corridor 2.14 Mainland to Lismore was outside of the extent of the broad-scale seabed habitat map. However, three broad seabed types were identified by EMODnet, with low energy infralittoral seabed dominating the cable corridor (Table 5-3).

The centre of the cable corridor intersects an area which has been previously identified as biogenic Annex I reef habitat, supporting flame shell bed, horse mussel bed, kelp and seaweed communities on sublittoral sediment and tide-swept algal communities and kelp bed PMFs (Table, 5-8; Figure 5-5, Drawing Reference: P2308-HAB-002-B_2.14 Mainland-Lismore). However, DDV and still image surveys undertaken across the cable corridor did not identify any Annex 1 features, flame shell bed or horse mussel bed habitats (Table 5-9, Appendix A). The PMFs tide-swept algal communities; kelp bed and kelp and seaweed communities on sublittoral sediment were observed across the centre of the cable corridor during the DDV and still image surveys (Table 5-9, Appendix A). Full details of the DDV benthic survey and supporting figures are provided in Appendix A.

The cable corridor is not in the vicinity of any protected sites which are designated for benthic species or features.

Table 5-8 EUNIS habitats within the Cable Corridor 2.14 Mainland to Lismore (EMODnet, 2020)

Habitat	EUNIS code
Infralittoral seabed	N/A
Low energy circalittoral seabed	N/A
Low energy infralittoral seabed	N/A

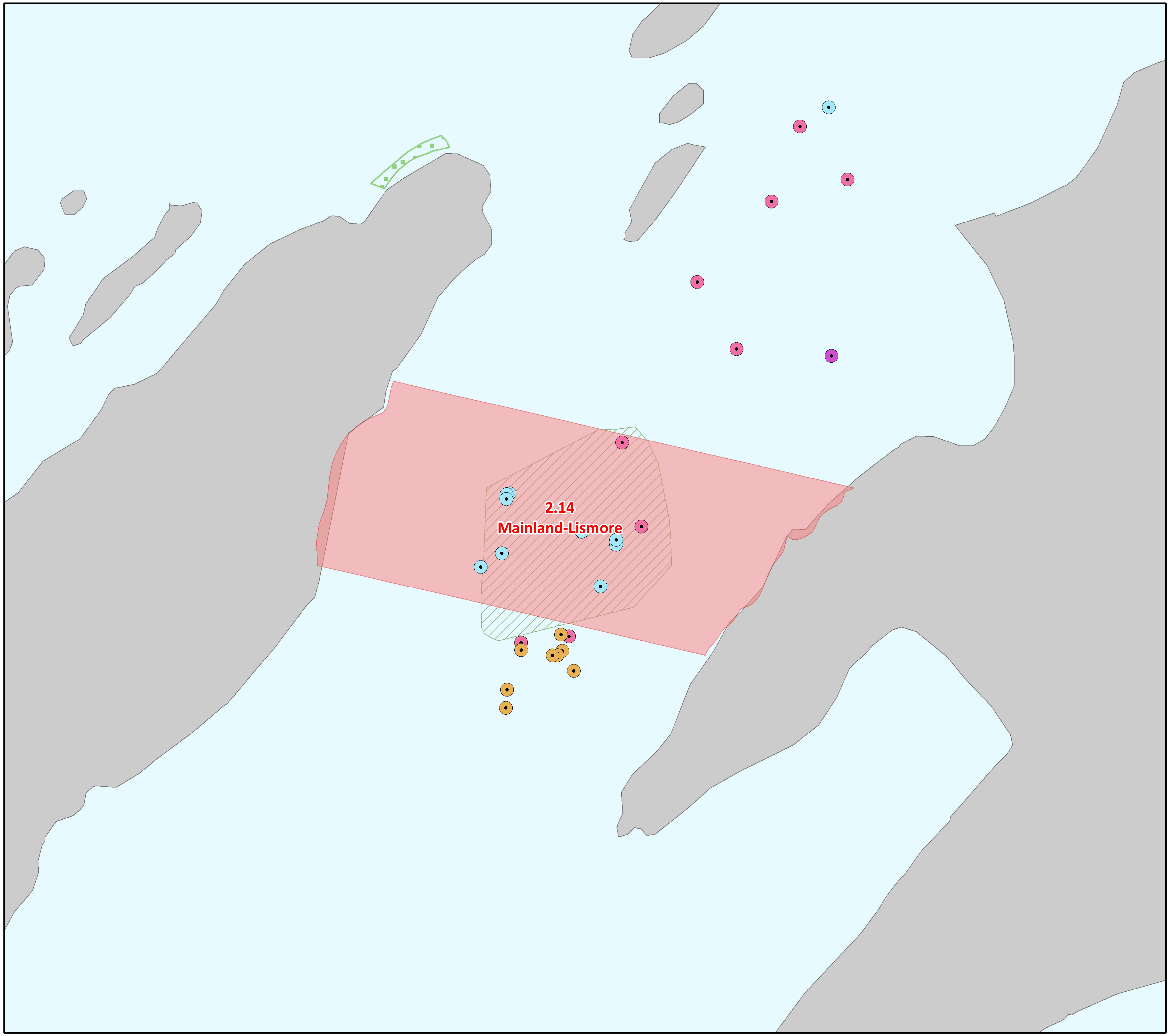
Table 5-9 Habitat types identified from the video and still imagery analysis for the Cable Corridor 2.14 Mainland to Lismore (Appendix A).

EUNIS Code	Habitat	PMF	Annex I	Location
A3.2132	*Laminaria hyperborea* park and foliose red seaweeds on tide-swept lower infralittoral mixed substrata	Tide-swept algal communities; Kelp beds	None	Ten stations Central section of the cable corridor
A5.441	*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment	None	None	Three stations Central section of the cable corridor
A5.4411	*Cerianthus lloydii* with *Nemertesia* spp. and other hydroids in circalittoral muddy mixed sediment	None	None	Two station Central section of the cable corridor
A5.5	Sublittoral macrophyte-dominated communities on sediments	None	None	One station at the east of the cable corridor
A5.52	Kelp and seaweed communities on sublittoral sediment	Kelp and seaweed communities on sublittoral sediment	None	Three stations at the east and west of the cable corridor

5.3.6.3 Sediment characterisation and sandeel potential

Cable Corridor 2.14 Mainland to Lismore is outside of the extent of the BGS seabed sediment data. UKHO charts indicate that the seabed is likely to be sand mixed with shells along the majority of the cable corridor, with more gravel, large stones and boulders at the shorelines (Global Marine 2021). During DDV and still image surveys of the cable corridor, sandeel were observed on both the east and west sides of the cable corridor.

As sandeel require coarse sediment substrates, and sandeel PMF have been previously identified along the cable corridor, there is likely to be suitable sandeel habitat within this cable corridor.



SCOTTISH ISLES
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SEABED HABITATS
EUSeaMap and Priority Marine Features
2.14 Mainland-Lismore

Drawing No: P2308-HAB-002	B

Legend

- Cable Route Application Corridor

Priority Marine Feature

- Flame shell beds
- Horse mussel beds
- Kelp and seaweed communities on sublittoral sediment
- Tide-swept algal communities and Kelp beds

Annex I Reef Habitat

- Biogenic
- Bedrock and/or

N
W E
S

NOTE:
Only Priority Marine Features which are within 1km of the Application Corridors are shown.

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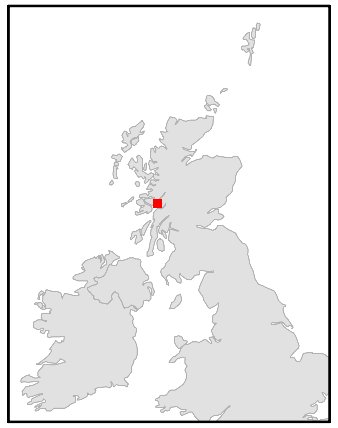

NOTE: Not to be used for Navigation

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File Reference	J:\P2308\Mxd\06_HAB\ P2308-HAB-002.mxd
Created By	Jessica Harvey
Reviewed By	Chris Dawe
Approved By	Paula Daglish

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0 0.25 0.5 km

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5.3.7 Cable Corridor 2.15 Iona to Mull

Cable Corridor 2.15 Iona to Mull passes across the Sound of Iona, between the bay of Port Mòr, south of Fionnphort and the eastern side of Iona. The currents here are estimated to be approximately 0.5ms^{-1} (Global Marine, 2021).

5.3.7.1 Intertidal area

Table 5-10 summarises the intertidal information for the cable landing points. A detailed description of the biotopes and features observed are provided in the intertidal survey reports (Appendix A).

Table 5-10 Characteristics of Cable Corridor 2.15 Iona to Mull landing points

Cable Corridor 2.15	Iona	Mull
Location	The landing point is at Sligneach, on the east coast of Iona.	The landing point is in the bay of Port Mòr, approximately 1.5km south of Fionnphort on the southwest tip of Mull.
Description	Sandy bays interspersed with extensive intertidal rocky platforms cut through with narrow channels. Gravelly fine to medium sand embayment near the proposed BMH, with seaweed-covered rocky platforms below the sand. Survey area backed by grass.	Sandy bay with wide rugged rocky platforms between rocky headlands to the north and south. The land around the bay and backing the beach consists of rough pasture.
No. of biotopes recorded by Phase 1 intertidal survey	11	11
Presence of Annex I habitat or PMF	No	No
Presence of OSPAR Listed Threated and/or Declining Species	Dog whelk - common across UK and not locally protected	Dog whelk - common across UK and not locally protected
BAP priority marine species or habitats	No	No

5.3.7.2 Subtidal area

Cable Corridor 2.15 Iona to Mull was outside of the extent of the broad-scale seabed habitat map. However, three broad seabed types were identified by EMODnet, with high energy infralittoral seabed dominating the cable corridor (Table 5-3; Table 5-11).

The cable corridor does not intersect any areas of potential Annex I reef, or Annex I sandbank habitat features (Figure 5-6, Drawing Reference: P2308-HAB-002-B_2.15 Iona-Mull). No PMFs were identified within 1km of the cable corridor. The cable corridor is not in the vicinity of any protected sites which are designated for benthic species or features.

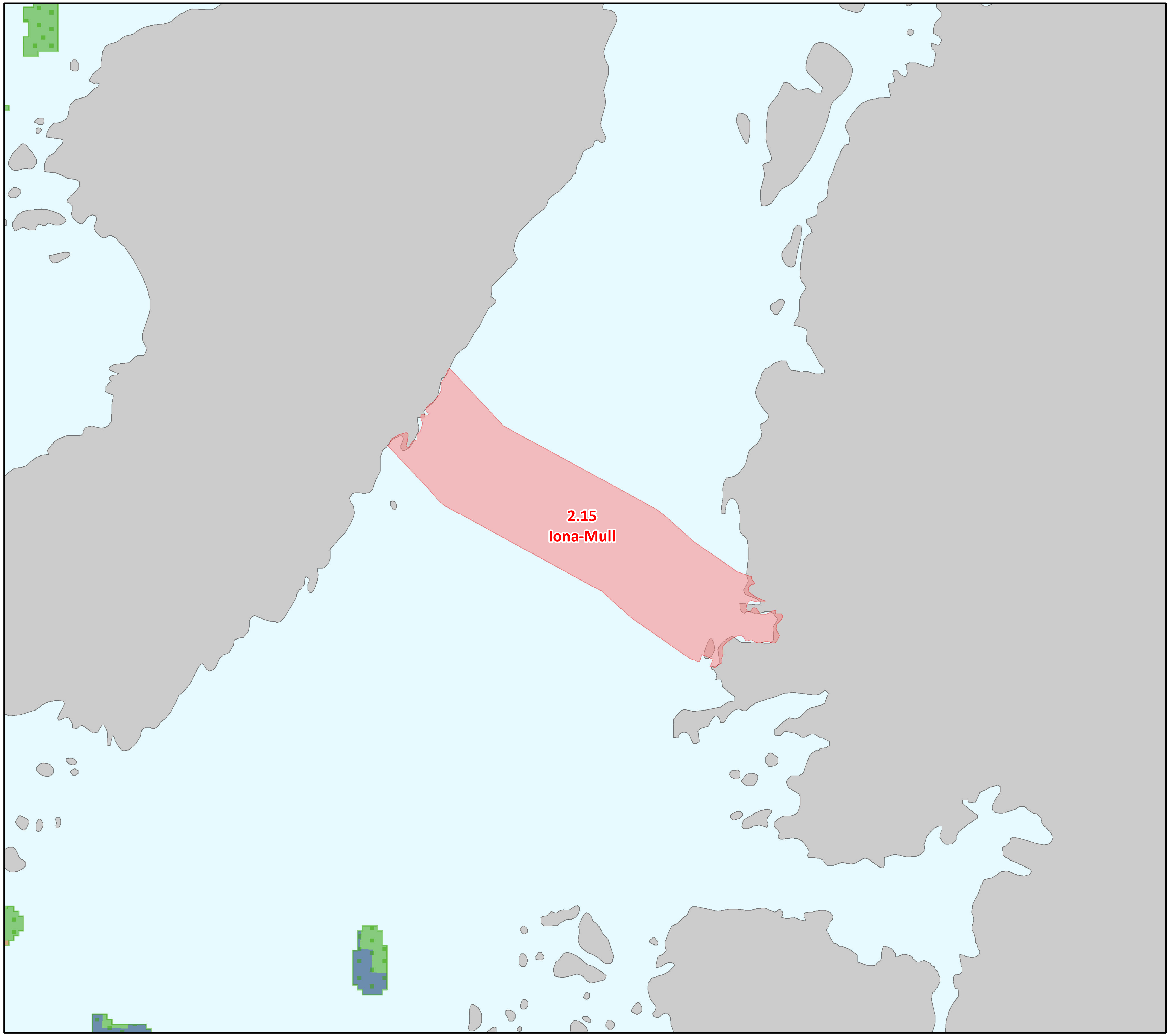
Table 5-11 EUNIS habitats within the Cable Corridor 2.15 Iona to Mull (EMODnet, 2020)

Habitat	EUNIS code
High energy infralittoral seabed	N/A
Infralittoral seabed	N/A
Low energy infralittoral seabed	N/A

5.3.7.3 Sediment characterisation and sandeel potential

Cable Corridor 2.15 Iona to Mull is outside of the extent of the BGS seabed sediment data. UKHO charts indicate that the seabed is likely to be a mix of sand and shells. A review of satellite imagery undertaken by Global Marine confirmed that sediment was present across the western part of the channel, but an extensive area of rock covered by seaweed was observed in the eastern half (Global Marine 2021).

As sandeel require coarse sediment substrates, there is likely to be suitable sandeel habitat within the western part of the cable corridor.



SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

SEABED HABITATS
EUSeaMap and Priority Marine Features
2.15 Iona-Mull

Drawing No: P2308-HAB-002	B

Legend

Cable Route Application Corridor

Annex I Reef Habitat

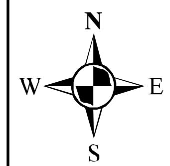
Bedrock and/or

EUNIS Classification

A3.1

A3.3

A4.1



NOTE:
Only Priority Marine Features which are within 1km of the Application Corridors are shown.

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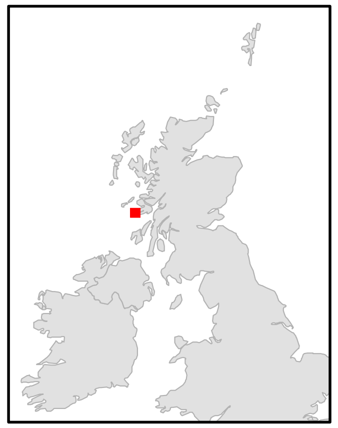

NOTE: Not to be used for Navigation

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File Reference	J:\P2308\Mxd\06_HAB\ P2308-HAB-002.mxd
Created By	Jessica Harvey
Reviewed By	Chris Dawe
Approved By	Paula Daglish

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0 0.25 0.5 0.75 1 km

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5.3.8 Cable Corridor 2.16 Colonsay to Mull

Cable Corridor 2.16 Colonsay to Mull passes from the south coast of Mull to the north-west coast of Colonsay at Kiloran Bay.

5.3.8.1 Intertidal area

Table 5-12 summarises the intertidal information for the cable landing points. A detailed description of the biotopes and features observed are provided in the intertidal survey reports (Appendix A).

Table 5-12 Characteristics of Cable Corridor 2.16 Colonsay to Mull landing points

Cable Corridor 2.16	Colonsay	Mull
Location	Kiloran Bat on the west coast of Colonsay.	South of mull at Kilvickeon Bay, approximately 1.5km from Loch Assapol.
Description	Northwest facing inlet flanked by rocky headlands. Landing point at the sandy beach with several small bedrock outcrops and a small burn at the western end. It is backed by sand dunes with marram grass, with rough pasture behind.	Exposed to prevailing southwesterly winds and sea conditions, despite being set deep between rocky headlands to the east and west. Sandy each backed by rocky, rough pasture with a rough track leading to the beach.
No. of biotopes recorded by Phase 1 intertidal survey	10	8
Presence of Annex I habitat or PMF	No	No
Presence of OSPAR Listed Threated and/or Declining Species	Dog whelk - common across UK and not locally protected	Dog whelk - common across UK and not locally protected
BAP priority marine species or habitats	No	No

5.3.8.2 Subtidal area

A total of seven broad EUNIS habitat types were identified within the cable corridor from the broad-scale seabed habitat map (Table 5-13). However, the majority of the cable corridor was outside of the extent of the broad scale seabed habitat. Nine broad seabed types were also identified by EMODnet, with the majority of the cable corridor dominated by moderate energy deep circalittoral seabed (Table 5-3; Table 5-13).

The cable corridor intersects with an area of potential Annex I reef habitat at the northern end and southern ends of the cable corridor. The cable corridor does not intersect any areas of potential Annex I sandbank habitat features (Figure 5-7, Drawing Reference: P2308-HAB-002-B_2.16 Colonsay-Mull). No PMFs were identified within 1km of the cable corridor. The cable corridor is not in the vicinity of any protected sites which are designated for benthic species or features.

Table 5-13 EUNIS habitats within the Cable Corridor 2.16 Colonsay to Mull (EMODnet, 2020)

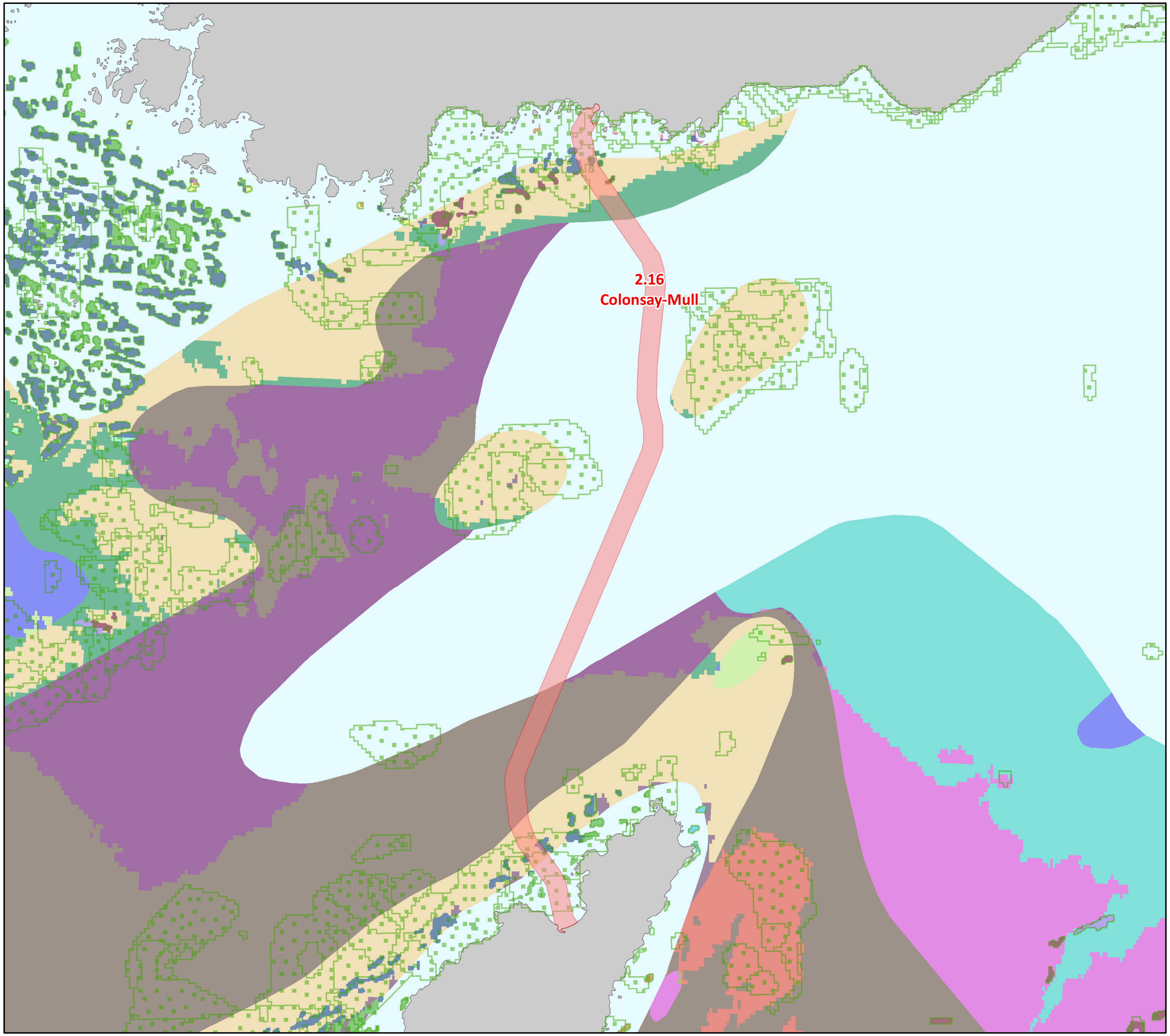
Habitat	EUNIS code
Atlantic and mediterranean high energy infralittoral rock	A3.1:
Atlantic and mediterranean high energy circalittoral rock	A4.1:

Habitat	EUNIS code
Atlantic and Mediterranean moderate energy circalittoral rock	A4.2
Circalittoral coarse sediment	A5.14
Deep circalittoral coarse sediment	A5.15
Circalittoral fine sand or Circalittoral muddy sand	A5.25 or A5.26
Deep circalittoral sand	A5.27
Circalittoral seabed	N/A
High energy circalittoral seabed	N/A
High energy infralittoral seabed	N/A
Infralittoral seabed	N/A
Low energy circalittoral seabed	N/A
Low energy deep circalittoral seabed	N/A
Low energy infralittoral seabed	N/A
Moderate energy circalittoral seabed	N/A
Moderate energy deep circalittoral seabed	N/A

5.3.8.3 Sediment characterisation and sandeel potential

Cable Corridor 2.16 Colonsay to Mull is partially within the extent of the BGS seabed sediment data, which indicates that the seabed is predominantly sand and gravelly sands (BGS, 2020). UKHO charts indicate that the area not mapped by the BGS data is comprised of mud sediments (Global Marine, 2021).

As sandeel require coarse sediment substrates, such as gravelly sands, there is likely to be suitable sandeel habitat within the cable corridor.



SCOTTISH ISLES
FIBRE OPTIC CABLE PROJECT

SEABED HABITATS
EUSeaMap and Priority Marine Features
2.16 Colonsay-Mull

Drawing No: P2308-HAB-002	B

Legend

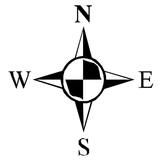
Cable Route Application Corridor

Annex I Reef Habitat

Bedrock and/or

EUNIS Classification

- A3
- A3.1
- A3.2
- A3.3
- A4
- A4.1
- A4.12
- A4.2
- A4.27
- A4.3
- A5.13
- A5.14
- A5.15
- A5.23 or A5.24
- A5.25 or A5.26
- A5.27
- A5.33
- A5.35
- A5.37
- A5.44
- A5.45



NOTE:
Only Priority Marine Features which are within 1km of the Application Corridors are shown.

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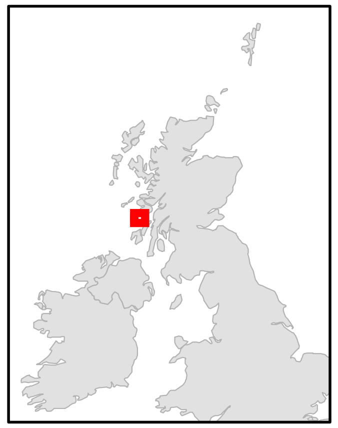

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Created By	Jessica Harvey
Reviewed By	Chris Dawe
Approved By	Paula Daglish

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0 1 2 3 4 5 km

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5.4 Assessment of Effects – benthic and intertidal

5.4.1 Potential pressures and zones of influence

An assessment of the effects of the installation activities on protected marine habitats and sandeel has been undertaken. Table 5-14 summarises the pressures which have been assessed.

A review of the pressures has excluded the following from further consideration in this topic Chapter:

- Changes in bathymetry - the effect of the proposed cables on changes to bathymetry is negligible. This is due to each cable being trenched and backfilled along the majority of their lengths coupled with the small footprint of each cable where trenching is not possible, i.e. where cables are surface laid, at crossings of third-party infrastructure, or where rock bags are utilised for additional stabilisation or protection.
- Changes in suspended solids (water clarity) - specifically, in relation to discharges from project vessels will be in line with national statute which prevents significant effects on the environment.
- Local water flow (tidal current) changes - The footprint of any placed cable protection will be limited to that required to ensure cable stability on the seabed or in alignment with crossing designs. The cable protection can cause localised scour in sedimentary environments; however, it will be limited in extent. No change sufficient to cause effects on the biological environment to water flow (tidal current) is expected.

Table 5-14 Pressures considered for cable corridors in Inner Hebrides geographical area

Potential Pressure	Screened In?
Abrasion/disturbance at the surface of the substratum	Yes
Penetration and disturbance below the substratum including abrasion	Yes
Siltation rate changes including smothering (depth of vertical sediment overburden)	Yes
Changes in bathymetry	No
Changes in suspended solids (water clarity)	No
Physical change to another seabed type	Yes
Local water flow (tidal current) changes	No

Table 5-15, below, lists the identified pressures, the associated cable installation activities, the footprint of these pressures and the habitats within the cable corridors which have been identified as sensitive to these pressures.

There is one telecommunications cable crossing within Cable Corridor 2.14 Mainland to Lismore, but this is not within a protected site. There are no power cable crossings within the Inner Hebrides geographical area.

Table 5-15 Potential pressures, installation activities and key sensitive receptors

Potential pressure	Activities resulting in pressure	Footprint of Installation		Key sensitive receptor
		Cable Corridor	Approximate Footprint (m^2)	
Abrasion / disturbance at the surface of the substratum	Plough (skids and share) and Jetting Plough Pre-Lay Grapnel Run (PLGR) and surface cable lay*. Footprint: 2.6m wide x length of cable corridor with cable burial (worst case)	2.13 2.14 2.15 2.16	69300 3800 7000 61500	▪ Reef habitat ▪ Kelp bed PMF ▪ Burrowed mud PMF ▪ Kelp and seaweed communities on sublittoral sediment PMF ▪ Tide-swept algal communities ▪ Sandeel
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Plough (skids and share) and Jetting Plough and PLGR Footprint: 2.6m wide x length of cable corridor with cable burial (worst case) Up to 1m deep (penetration)	2.13 2.14 2.15 2.16	69300 3800 7000 61500	▪ Burrowed mud PMF ▪ Sandeel
Physical change to another seabed type	External cable protection (concrete mattresses, rock bags) Footprint (worse case deposits): 7m² per rock bag 18m² per mattress	2.13 2.14 2.15 2.16	10 rock bags + 3 mattresses = 124m² 10 rock bags + 3 mattresses = 124m² 20 rock bags + 3 mattresses = 124m² 10 rock bags + 3 mattresses = 194m²	▪ Reef habitat ▪ Kelp bed PMF ▪ Burrowed mud PMF ▪ Kelp and seaweed communities on sublittoral sediment PMF ▪ Tide-swept algal communities ▪ Sandeel
Siltation rate changes including smothering (depth of vertical sediment overburden)	Siltation from the Plough and Jetting Plough Footprint (worst case): 200m x length of the cable corridor with cable burial	2.13 2.14 2.15 2.16	2660000 140000 260000 1360000	▪ Reef habitat ▪ Kelp bed PMF ▪ Kelp and seaweed communities on sublittoral sediment PMF ▪ Burrowed Mud PMF ▪ Sandeel

* Although the base case is for no surface lay in the Inner Hebrides geographical area, should cable burial not be achievable in any sections of the cable routes, surface lay may be required.

For each of the pressures which have been screened in Table 5-115, the cable corridors where the pressure applies, and the relevant protected receptors present within each cable corridor has been summarised in Table 5-16.

Table 5-16 Summary of pressures and relevant protected receptors identified for cable corridors in Inner Hebrides geographical area

Potential Pressure	Cable Corridor			
	2.13	2.14	2.15	2.16
Abrasion/disturbance at the surface of the substratum	Burrowed mud PMF	Tide-swept algal communities PMF Kelp bed PMF Kelp and seaweed communities on sublittoral sediment PMF Sandeel		Reef habitat
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Burrowed mud PMF	Tide-swept algal communities PMF Kelp bed PMF Kelp and seaweed communities on sublittoral sediment PMF Sandeel		
Physical change to another seabed type	Burrowed mud PMF	Tide-swept algal communities PMF Kelp bed PMF Kelp and seaweed communities on sublittoral sediment PMF Sandeel		Reef habitat
Siltation rate changes including smothering (depth of vertical sediment overburden)	Burrowed mud PMF	Kelp bed PMF Kelp and seaweed communities on sublittoral sediment PMF Sandeel		Reef habitat

5.4.2 Compliance and best practice measures – biological environment

The R100 Project within the Inner Hebrides geographical area includes a range of primary mitigation measures that have been 'designed' into the development proposals to demonstrate that the applicant will comply with national and international statute and best practice guidance as determined by the cable industry as a basic standard for how to proceed on a project. These design measures will help to reduce the effects of cable installation. These have been outlined in the MEA Project Description (MEA Chapter 2: Project Description) and those which are relevant to the biological environment are provided in Table 5-17, below. When undertaking the assessment, it has been assumed that these measures will be complied with.

Table 5-17 Project design measures to minimise effects to the biological environment

ID*	Design Measure	Source
COMP 5	Ballast water discharges from Project vessels will be managed under the International Convention for the Control and Management of Ships' Ballast Water and Sediments standard.	International Maritime Organisation
COMP 6	Project vessels will be equipped with waste disposal facilities (sewage treatment or waste storage) to IMO MARPOL Annex IV Prevention of Pollution from Ships standards.	International Maritime Organisation
COMP 7	Control measures and shipboard oil pollution emergency plans (SOPEPs) will be in place and adhered to under MARPOL Annex I requirements for all project vessels.	International Maritime Organisation
BP8	Rock bags/contingency protection measures will only be deployed where adequate burial cannot be achieved or as required by crossing agreements. The footprint of the deposits will be the minimum required to ensure cable safety and stability.	Existing Asset Owner (BT)

ID*	Design Measure	Source
BP10	The survey and installation vessels will be moving at a speeds less than 6 knots during installation activities. Typical installation speeds are likely to be 1knot for surface lay and 0.3 knots for plough installation.	Global Marine installation requirement
BP12	Route development and micro-routing has been used where possible to avoid or minimise the footprint of the cable corridor through potentially sensitive habitats.	Global Marine installation requirement
BP13	Construction vehicle movement will be minimised as far as practical to minimise effects to compacting the beach; beach profile will be restored following cable installation.	Global Marine installation requirement
BP14	The latest guidance from the GB non-native species secretariat (2015) will be followed and a Biosecurity Plan produced pre-installation. All vessels and equipment will be clean and free from debris and fouling.	GB non-native species secretariat (2015)

*COMP = Compliance measures which are undertaken to meet environmental, health and safety legislation; BP = Best practice measures as a matter of good operating procedures or to comply with statute.

5.4.3 Abrasion/disturbance at the surface of the substratum

5.4.3.1 Assessment

Activities considered by the assessment that cause the pressure 'abrasion/disturbance at the surface of the substratum' include activities such as the pre-lay grapnel run, cable laying and cable burial. Although the base case is for no surface lay in the Inner Hebrides geographical area, should cable burial not be achievable in any sections of the cable routes, surface lay may be required. These activities lead to limited or no loss of substrate from the system. The magnitude of the effect has been assessed as low for the following reasons:

- Disturbance will be short-term
- The zone of influence is small in comparison to the wider extent of habitat present within the cable corridors and surrounding area.
- Sediment will not be removed or altered leaving the underlying character of the habitat similar to that pre-cable installation

Prior to installation a PLGR will remove any debris along the cable route. The PLGR will be used within the footprint of the plough. During installation, a plough will be towed along the proposed Inner Hebrides cable corridors, which will simultaneously lay and bury the cable. The plough is towed across the seabed on skids and the plough share separates the sediment to bury the cable to the required burial depth. This action is in contact with the surface of the seabed and will cause a localised area of abrasion during the installation process. The footprint of the plough (skid and share) in contact with the seabed is 2.6m along the length of each cable (worst case). In sections of hard seabed, such as reef habitats, where burial cannot be achieved, the cable may be surface laid and as such, only the seabed within the direct footprint of the cable (diameter up to 15cm – worst case) will be disturbed. The extent of the disturbance will be confined to a small and linear area.

The effect of cable installation on benthic habitats is not generally considered to be significant to seabed habitats, because installation is local and temporary (Merck and Wasserthal, 2009; Taormina et al., 2016). However, further assessment has been provided with respect to protected habitat features, due to their ecological significance. Habitats and protected features identified within the cable corridors which have a potential to be impacted by the pressure have been assessed below, and include:

- **Potential Annex I reef and related sub-features:** including potential Annex I bedrock and stony reef and related sub-features, including kelp bed PMFs, tide-swept algal communities PMF and kelp and seaweed communities on sublittoral sediment PMF.

- **Burrowed mud PMF**.
- **Sandeel.**

Potential Annex I reef and related sub-features
Potential Annex 1 reef was identified at both ends of Cable Corridor 2.16 Colonsay to Mull, and the sub-features kelp bed PMFs, tide-swept algal communities PMF and kelp and seaweed communities on sublittoral sediment PMF were identified in DDV and still image surveys across the Cable Corridor 2.14 Mainland to Lismore.

Potential Annex I reef habitats encompass a range of habitat types with varying sensitivity, resilience, and recoverability to abrasion, as determined by the benthic communities they support. Kelp bed PMFs, tide-swept algal communities and kelp and seaweed communities on sublittoral sediment PMF are a sub-feature of Annex I reef habitats. The recoverability of rocky reef habitats from a one-off event of disturbance and abrasion are variable (up to 10 years) and are dependent on the algal regeneration and community species present. Communities may quickly begin to recolonize affected areas, however the equilibrium within the ecosystem may take longer to reach so they have been assessed to have medium resistance to abrasion pressures (MarLIN, 2021). Kelp habitats have been assessed as having medium recoverability to abrasion/disturbance of the substratum or seabed and therefore are likely to be sensitive to repeated abrasion from movement of a surface laid cable, or from PLGR during route preparation (MarLIN, 2021). Ploughing and jetting ROV will only be used in sediment habitats, so there is no pressure-receptor pathway between this activity and the habitat.

As Potential Annex I reef is widespread west of Colonsay and Mull, and the kelp and algal sub-features are present across the Inner Hebrides, relative to the extent of this habitat the area that will be impacted by the installation activities is negligible. Cable protection measures will be used to ensure the cable is stable and prevent persistent abrasion from the movement of the cable.

The effects from abrasion and/or disturbance of the substrate on the surface of the seabed on potential Annex I reef and related sub-features (including Annex I bedrock and stony reef and related sub-features, including Kelp Bed PMFs, Kelp and seaweed communities on sublittoral sediment PMF and tide-swept algal communities) has been assessed as negligible.

Burrowed mud PMF
Abrasion and penetration can cause local mortality to seapens in burrowed mud habitats, however the positioning of *Kophobelemnon stelliferum* colonies within the sediment and their ability to retract increases their resistance to abrasion pressure (Kenchington et al., 2011). They are overall assessed to have medium sensitivity to this pressure with recovery in as little as four years (MarLIN, 2021).

Burrowed Mud PMF was only identified in the vicinity of Cable Corridor 2.13 Eigg to Mainland. The area affected will be highly localised, limited to only 2.6m width (worst case) along the cable corridors, and changes to the substratum will be transient. Cable protection measures will be used to ensure the cable is stable and prevent persistent abrasion from the movement of the cable.

The effects from abrasion and/or disturbance of the substrate on the surface of the seabed on burrowed mud PMF has been assessed as negligible.

Sandeel
As sandeel burrows near the seabed surface, any subsurface abrasion or penetration could cause local mortality to sandeel (Wright et al 2000). They have therefore been assessed to have medium sensitivity to surface abrasion (Marine Scotland, 2021). This may occur from the plough, jetting ROV, or PLGR, which can penetrate up to 40cm depth.

Potential suitable sandeel habitat has been identified at all cable corridors within the Inner Hebrides geographical area, and sandeel PMF were identified in Cable Corridor 2.14 Mainland to Lismore during DDV and still image surveys. Whilst sandeel has been identified within these areas, due to the mobility of the species, their patchy distribution and the patchiness of suitable habitat within some of the cable corridors they may not be found in the same areas year-on-year (NatureScot, 2021c). Additionally, the area affected will be highly localised and changes to the substratum will be transient with pre-installation conditions quickly returning following natural sediment transport processes. The impact to sandeel will be short-term and temporary.

The effect from penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion on sandeel has been assessed as negligible.

5.4.3.2 Project Specific Mitigation

- None specified.

5.4.4 Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion

5.4.4.1 Assessment

Activities considered by the assessment that cause the pressure ‘penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion’ include cable route preparation such as the pre-lay grapnel run, and cable burial. These activities lead to limited or no loss of substrate from the system. The magnitude of the effect has been assessed as low for the following reasons:

- Disturbance will be short-term
- The zone of influence is small in comparison to the wider extent of habitat present within the cable corridors and surrounding area.
- Sediment will not be removed or altered leaving the underlying character of the habitat similar to that pre-cable installation

Prior to installation, a PLGR will be undertaken along the proposed cable corridors. A typical PLGR can penetrate and/or disturb up to 40cm depth of the seabed in sediment habitats (depending on the sediment composition). As grapnels are dragged through the surface sediments of the seabed it will pick up obstructions such as wire, derelict fishing gear and this can cause some disturbance to sediments. Where the cable corridor which although disturbed will be moved by natural sediment transport and naturally backfill any depressions caused by the PLGR. Ploughing and jetting ROV will be undertaken during cable burial in sediment habitats. These will penetrate up to 1m depth and will leave the trench backfilled.

The effect of cable installation on benthic habitats is not generally considered to be significant to seabed habitats, because installation is local and temporary (Merck and Wasserthal, 2009; Taormina et al., 2016). However, further assessment has been provided with respect to protected habitat features, due to their ecological significance. Habitats and protected features identified within the cable corridors which have a potential to be impacted by the pressure have been assessed below and include:

- **Burrowed mud PMF**
- **Sandeel.**

As reef habitats and their sub-features have a hard, rocky substrate, installation activities will not penetrate the surface. Therefore, there is no pressure-receptor pathway between the installation activity and reef habitats.

Burrowed mud PMF
Penetration of the surface can cause local mortality, injury and dislodgement to the species associated with these habitat types. Additionally, when trenching occurs in mud sediments there is potential that the trench may be subject to scour and will not fully naturally backfill. This may leave a depression or

in extreme cases leave the cable exposed. However, with respect to habitat recovery, although during trenching sessile or low mobility species are likely to be damaged or killed through direct contact with the trenching equipment, burial and dislodgement, this will be a one-off event.

Burrowed Mud PMF was only identified in the vicinity of Cable Corridor 2.13 Eigg to Mainland. The area affected will be highly localised, limited to only 2.6m width (worst case) along the cable corridor, and changes to the substratum will be transient.

The effects from penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion on burrowed mud PMF has been assessed as negligible.

Sandeel

As sandeel burrows near the seabed surface, any subsurface abrasion or penetration could cause local mortality to sandeel (Wright et al 2000). They have therefore been assessed to have medium sensitivity to surface abrasion (Marine Scotland, 2021). This may occur from the plough, jetting ROV, or PLGR, which can penetrate up to 40cm depth.

Potential suitable sandeel habitat has been identified at all cable corridors within the Inner Hebrides geographical area, and sandeel PMF were identified in Cable Corridor 2.14 Mainland to Lismore during DDV and still image surveys. Whilst sandeel has been identified within these areas, due to the mobility of the species and their patchy distribution they may not be found in the same areas year-on-year (NatureScot, 2021c). Additionally, the area affected will be highly localised and changes to the substratum will be transient with pre-installation conditions quickly returning following natural sediment transport processes. The impact to sandeel will be short-term and temporary.

The effect from penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion on sandeel has been assessed as negligible.

5.4.4.2 Project Specific Mitigation

- None specified.

5.4.5 Physical change to another seabed type

5.4.5.1 5.4.5.1 Assessment

The pressure ‘physical change (to another seabed type)’ can lead to a permanent change in substrate type which in turn would lead to the habitat or biotope being re-classified (MarLIN 2020). Activities considered by the assessment that cause the pressure include surface laying of the cable (including integral protection) and any form of external cable protection that alters the seabed. For example, cable protection at the third-party asset crossings, and rock bags and concrete mattresses, included as contingency cable protection in this application.

The cable is proposed to be buried to at least 1m. However, for short section where it is not possible to bury the cable, such as in areas of hard ground or rock, the cable will be surface laid using heavier armoured cable as protection. Although the base case is for no surface lay in the Inner Hebrides geographical area, should cable burial not be achievable in any sections of the cable routes, surface lay may be required. Articulated pipe may also be used as additional integral protection to prevent abrasion to the cable. Any sections of the cable surface laid will be pinned or clamped to the seabed to avoid any movement of the cable while minimising the footprint. The addition of discretely placed rock bags may be required at approximately 50m intervals (worst case) for certain sections of the cable to provide stability. Concrete mattresses are only a potential requirement at cable crossings, or if required by a third party.

It should be noted that the use of contingency cable protection considered in the assessment represents a conservative, worst-case quantity of deposit to the seabed and it is likely that no or very little additional protection will be required. The worst-case footprint of cable protection for each cable corridor has been given in Table 5-16.

Habitats and protected features identified within the cable corridors which have a potential to be impacted by the pressure include:

- **Potential Annex I reef and related sub-features:** including Annex I bedrock and stony reef and related sub-features, including kelp bed PMFs, tide-swept algal communities and kelp and seaweed communities on sublittoral sediment.
- **Burrowed mud PMF**.
- **Sandeel.**

Potential Annex I reef and related sub-features
Potential Annex 1 reef was identified at both ends of Cable Corridor 2.16 Colonsay to Mull, and the sub-features kelp bed PMFs, tide-swept algal communities PMF and kelp and seaweed communities on sublittoral sediment PMF were identified in DDV and still image surveys across the Cable Corridor 2.14 Mainland to Lismore.

subtidal areas where there is existing stony seabed or bedrock reef the surrounding epifaunal species may be able to colonise the rock bags. A number of studies have found evidence that cable rock protection has been colonised, for example, Sherwood *et al. (*2016), Lacey and Hayes (2019) and Sheehan *et al. (*2018). Sheehan *et al.* (2018) made observations of the colonisation of rock protection installed for the Wave Hub subsea cable off the north coast of Cornwall, United Kingdom. The cable was installed predominantly over circalittoral rock and biogenic reef habitat. The study found the benthic fauna that colonised the rock protection was comparable to the surrounding rocky reef, and no significant difference in abundance was found in comparison to controls 5 years post-installation. This represents a similar habitat to areas within the Inner Hebrides geographical area, and as such it would be reasonable to assume that any rock protection deposited will see similar results.

This deposit is unlikely to cause a significant change to the receiving environment of the seabed, as it will be used in areas where the cable is surface laid due to hard ground. As the nature of the seabed in such areas is likely to consist of firm and coarse sediments, the change of the addition of small size and localised deposits of rock bags will cause a low magnitude of change in substrate type which can support recolonisation of local epifaunal species, therefore, this effect will be minor.

The effects of physical change to another habitat type on potential Annex I reef and related sub-features (including Annex I bedrock and stony reef and related sub-features, including kelp bed PMFs and kelp, tide-swept algal communities and seaweed communities on sublittoral sediments) has been assessed as minor.

Burrowed mud PMF
In areas of softer sediments, it is likely that the cable will achieve adequate burial depth, so cable protection measures will not be implemented. The only potential for introduction of rock bags or concrete mattresses in soft sediment areas will be for a requirement of a crossing agreement. As there are no power cable crossings in the Inner Hebrides geographical area, there will be no requirement for cable protection within burrowed mud habitat, and so there will be no impact to these features from the pressure physical change to another seabed type.

No effect.

Sandeel
Sandeel have specific sediment requirements which affect presence and density (Wright et al. 2000) and have therefore been assessed as having high sensitivity to physical change to another seabed type

(Marine Scotland, 2021). The external protection, such as rock bags, in softer sediment habitats would result in loss of potential sandeel habitat.

In areas of softer sediments, it is likely that the cable will achieve adequate burial depth, so cable protection measures will not be implemented. The only potential for introduction of rock bags or concrete mattresses in soft sediment areas will be for a requirement of a crossing agreement. As there are no power cable crossings in the Inner Hebrides geographical area, there will be no requirement for cable protection within potential sandeel habitat, and so there will be no impact to sandeel from the pressure physical change to another seabed type.

No effect.

5.4.5.2 Project Specific Mitigation

- None specified.

5.4.6 Siltation rate changes including smothering (depth of vertical sediment overburden)

5.4.6.1 Assessment

This section assesses the pressure of siltation rate changes including smothering (depth of vertical sediment overburden). The marine cable installation will cause resuspension of sediments from the seabed into the water column. Jet trenching will cause a greater level of sediment suspension compared to the use of ploughing equipment. However, this is not proposed other than for small sections of the cables in the near shore area or sections of the cable that cannot be plough buried at the time of installation. The impact is a small localised and temporary increase in turbidity.

The findings of a separate study on the Environmental Impact of Subsea Trenching Operations (Gooding et al., 2012) suggested that the impacts of subsea trenching operations on sediment disturbance are restricted to the immediate vicinity of the trench (less than 10m either side). Suspended solid concentrations, although elevated immediately after trenching, have been shown to fall to ambient levels within 66m of trenching activity in hard ground areas and 70m in sandy areas with fine deposition occurring out to a maximum of 2km from the trench (Gooding et al., 2012). Fine material will, however, be rapidly diluted and dispersed in the water. Far-field deposition is predicted to be less than 1mm for both trenching by jetting and ploughing.

The effect of cable installation is not generally considered to be significant to seabed habitats, because installation is local and temporary (Merck and Wasserthal, 2009; Taormina et al., 2016). However, further assessment has been provided with respect to protected habitat features, due to their ecological significance. Habitats and protected features identified within the cable corridors which have a potential to be impacted by siltation rate changes including smothering (depth of vertical sediment overburden) include:

- **Potential Annex I reef and related sub-features:** including Annex I bedrock and stony reef and related sub-features, including kelp bed PMFs, tide-swept algal communities and kelp and seaweed communities on sublittoral sediment.
- **Burrowed mud PMF**
- **Sandeel**

Potential Annex I reef and related sub-features

Potential Annex 1 reef was identified at both ends of Cable Corridor 2.16 Colonsay to Mull, and the sub-features kelp bed PMFs, tide-swept algal communities PMF and kelp and seaweed communities on sublittoral sediment PMF were identified in DDV and still image surveys across the Cable Corridor 2.14 Mainland to Lismore.

The sensitivity of reef and kelp habitats to sediment change and smothering is dependent on the volume of sediment that is displaced, and the communities which are present (MarLIN, 2021). Sediment rate changes may occur from the plough and jetting ROV during cable installation, where the greatest level of siltation range will occur within 10m of the trench on either side during these activities. However, as these activities will only occur in sediment habitats, and with deposition thicknesses in the far field of less than 1mm, there will be no significant impact to reef or kelp bed habitats.

The effects of siltation rate changes including smothering (depth of vertical sediment overburden) on potential Annex I reef and related sub-features (including Annex I bedrock and stony reef and related sub-features, including kelp bed PMFs, tide-swept algal communities and kelp and seaweed communities on sublittoral sediments) has been assessed as negligible.

Burrowed mud PMF

Sensitivity to light siltation rate changes is low for burrowed mud communities, as seapens have some behavioural adaptations to tolerate sedimentation (Torre et al., 2012). However, they have high sensitivity to heavy siltation rate changes by smothering and blocking their filtering apparatus used in respiration and feeding (Torre et al., 2012). The area affected by significant siltation changes will be localised, to up to 10m, with sediment deposition thicknesses in the far field of less than 1mm. Therefore, heavy smothering will be restricted to the area of overburden in a highly localised area immediately either side of the cable corridor and there will be no significant impact to the mud habitats.

The effects of siltation rate changes including smothering (depth of vertical sediment overburden) on burrowed mud PMF, has been assessed as negligible.

Sandeel

Sandeel eggs are sensitive to the effects of smothering from displaced sediment or settling of suspended sediments. Smothering can impede development of larva and ultimately result in mortality (Griffen *et al*, 2009). Sandeel also have specific sediment requirements which affect presence and density, and an increase in silt content would reduce the carrying capacity of sediment affecting population density (Wright et al. 2000). Additionally, as sandeel dwell in the sediments, they are also susceptible to gill-clogging, although adults are mobile so it is likely that some individuals may avoid the area where cable burial machinery is in use. However, the area affected by significant siltation changes will be localised, to up to 10m, with sediment deposition thicknesses in the far field of less than 1mm.

Potential suitable sandeel habitat has been identified at all cable corridors within the Inner Hebrides geographical area, and sandeel PMF were identified in Cable Corridor 2.14 Mainland to Lismore during DDV and still image surveys. Whilst sandeel has been identified within these areas, due to the mobility of the species and their patchy distribution they may not be found in the same areas year-on-year (NatureScot, 2021c). Additionally, the impact to sandeel habitats will be highly localised, short-term, and temporary.

The effects of siltation rate changes including smothering (depth of vertical sediment overburden) on sandeel has been assessed as negligible.

5.4.6.2 Project Specific Mitigation

- None specified

5.4.7 Conclusion

In conclusion, the installation of the cable corridors will not cause significant impacts to protected benthic features or sensitive habitats within the Inner Hebrides geographical area. No project-specific mitigation is required.

5.5 Biological Environment - Summary of Supporting Information

5.5.1 Introduction

A full assessment of the potential impacts of the proposed installation activities on protected sites has been undertaken and is provided within the Protected Sites Assessment (Appendix C). A full assessment of the potential impacts to European Protected Species (EPS) and basking shark has been undertaken and is provided within the EPS Risk Assessment (Appendix D). This section summarises the findings of the reports.

Table 5-18 highlights the periods when marine mammal, marine turtles, European otter and basking shark are most likely to be present within the Inner Hebrides geographical area.

Table 5-18 Seasonal summary of marine mammal, fish and reptile presence within the Inner Hebrides geographical area

Receptor	Associated protected area* within Inner Hebrides	Winter			Summer						Winter		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Harbour porpoise	Inner Hebrides and the Minches SAC												
White beaked dolphin													
Risso's Dolphin													
Bottlenose Dolphin													
Short-beaked common dolphin													
Minke whale													
Killer whale													
Grey seal	Treshnish Isles SAC												
Harbour seal	Eileanan agus Sgeiran Lios mor SAC												
Leatherback turtle													
Basking shark													
Otter													

Key		
		Breeding
		Present
		Moulting
		Unlikely to be present in significant numbers

5.5.2 Fish

There are two designated sites for fish species within the search area for the cable corridors in the Inner Hebrides geographical area. Sea of Hebrides NCMPA for basking shark, and Loch Sunart to the Sound of Jura NCMPA for flapper skate (Appendix C).

Basking shark are protected under OSPAR Annex V, and in Scotland under the Nature Conservation (Scotland) Act 2004. Following consultation with NatureScot they were included within the EPS Risk Assessment (Appendix D), which concluded that due to their low densities and low sensitivity to sound there will be no significant impacts to basking shark from collision and underwater noise from the installation activities.

Basking shark are also protected under the Sea of Hebrides NCMPA but were not screened through for Stage 1 Assessment (Appendix C). Due to the slow vessel speeds and low sensitivity of fish (including basking shark) to sound, the pressures 'Collision BELOW water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)' and ' Underwater noise changes' were screened out. Due to the small footprint of the installation activities relative to the protected site, there will be no significant adverse effect to the supporting prey and habitats of basking shark.

Flapper skate, protected under the Loch Sunart to the Sound of Jura NCMPA, were also not screened through for Stage 1 Assessment (Appendix C) due to the distance of the protected site to the cable corridors.

Atlantic sturgeon are an EPS and so were considered in the EPS Risk Assessment. Given the short-term, transitory nature of the installation, and the slow speeds of vessels (maximum speed approximately 6 knots), visual disturbance and collision of fish was not considered to be significant. There is potential for injury and disturbance to fish from continuous underwater noise. However, due to the temporary and transient nature of the installation activities, and the ability of marine mammals to move out of the zone of influence it is unlikely for injury or significant disturbance to fish.

5.5.3 Marine Mammals

5.5.3.1 Assessment summary

The EPS assessment considered cetaceans, which have potential to be impacted by underwater noise during cable installation activities. Given the short-term, transitory nature of the installation, and the slow speeds of vessels (maximum speed approximately 6 knots), visual disturbance and collision of cetaceans was not considered to be significant. There is potential for injury and disturbance to cetaceans from continuous underwater noise. However, due to the temporary and transient nature of the installation activities, and the ability of marine mammals to move out of the zone of influence it is unlikely for injury or significant disturbance to cetaceans.

The Protected Sites Assessment (Appendix C) identified three SAC's and one NCMPA the following sites where there was potential for impact to marine mammals:

- One Special Area of Conservation (SAC) for harbour porpoise (Inner Hebrides and the Minches SAC)
- One SAC for harbour seal (Eileanan agus Sgeiran Lios mor SAC)
- One SAC for grey seal (Treshnish Isles SAC)
- One Nature Conservation Marine Protected Areas (NCMPA) for Minke Whale (Sea of Hebrides NCMPA).

No other marine mammals are designated in protected sites within the search area for the cable corridors.

Marine mammals are most sensitive to disturbance during the breeding season, when disturbance can disrupt mating behaviour, nursing and compromise growth and survival of offspring. Seals can be disturbed by visual disturbance from vessels up to 500m from their haul out sites. Underwater noise generate by the installation activities has the potential to disturb all marine mammals up to 1.1km from the cable installation activities, as described in the Protected Sites Assessment (Appendix C) and the European Protected Species Risk Assessment (Appendix D).

The Habitats Regulation Appraisal (HRA), presented in the Protected Sites Assessment, concluded that Appropriate Assessment (AA) should be undertaken for the following sites for underwater noise changes at all the identified SACs. The NCMPA assessment determined that Stage 1 Assessment was also required for the Sea of Hebrides NCMPA. These assessments concluded that as underwater noise from the installation activities is well below the threshold for injury to seal, and the likelihood of injury from noise to cetaceans has been assessed as negligible (Appendix D), there will be no injury to marine mammals from the protected sites. Due to the short-term and transient nature of the installation activities, there will be no long-lasting impacts to the marine mammal qualifying features from underwater noise.

Due to the distance of the installation activities to the protected sites (>500m for all cable corridors to all sites), the HRA concluded that there will be no impact to seals from visual (and above water noise) disturbance), and AA was not required.

Information to inform AA concluded that a likely significant effect can be excluded, and project specific mitigation is not necessary for all SACs. The Stage 1 NCMPA assessment concluded that the project will not hinder the achievement of the management objectives for the NCMPA. There will be no adverse effect on the integrity of the sites either alone or in combination with other plans or projects

Haul-out sites are designated under Section 117 of Marine (Scotland) Act 2010, which makes it an offence to harass a seal (intentionally or recklessly) at a haul-out site. Seal can be impacted by visual disturbance up to 500m from their haul out sites (pers comms – NatureScot 2021). No designated haul out sites were identified within 500m of any cable corridors within the Inner Hebrides geographical area.

5.5.4 Eurasian otter (*Lutra lutra*)

Otter are semi-aquatic mammals which may inhabit rivers, lakes, coastal areas, and marshy areas some distance from open water. Coastal populations utilise shallow, inshore marine areas for feeding but depend on fresh water for bathing and terrestrial areas for resting and breeding holts. They are commonly seen foraging within a narrow zone close to the shore (<100m) and only rarely cover larger distances, moving between islands (DECC, 2016). Otter prefer low peat-covered coastlines with a strong freshwater supply and shallow, seaweed rich waters offshore.

Standard walkover surveys (NatureScot, 2019) were undertaken in Summer 2021 by Aquatera at the cable landing points to search for signs of otters, such as spraint on stones and structures, and potential shelters which may be usable by otters. The survey area was at least a 250m radius around the proposed cable connection point at the beach manhole (BMH), plus a corridor to 250m along the coast in each direction from the proposed cable connection point between High Water Springs (HWS) and the BMH. Summer months are sub-optimal for otter surveys due to dense vegetation. Habitat suitability, including disturbance factors and habitat types, were also used to determine the likelihood of regular use by otters.

Surveys undertaken at all cable landing points identified potential for otters at all landing points within the Inner Hebrides geographical area, as shown in Table 5-19. It should be noted that there are no designated sites which list otter as a primary or qualifying interest feature within 1km of any of the landing points.

Table 5-19 Otter presence in the vicinity of each Inner Hebrides cable

Cable Corridor	Landing point	Accepted NBN records in proximity to cable landing points*	Otters Present? (As determined by otter surveys)	Otter Survey Findings
2.13 Eigg to Mainland	Eigg	4	No	▪ No otters or otter signs identified ▪ Two watercourses which could be used by otter within the survey area.
	Mainland	1	No	▪ No otters or otter signs identified ▪ No areas with high potential for otter identified.
2.14 Mainland to Lismore	Mainland	2	No	▪ No otters or otter signs identified ▪ No areas with high potential for otter identified.
	Lismore	3	No	▪ No otters or otter signs identified ▪ No areas with high potential for otter identified.
2.15 Iona to Mull	Iona	0	No	▪ No otters or otter signs identified ▪ Potential otter resting sites inland of BMH
	Mull	0	Yes	▪ No otters sighted ▪ Potential resting site with nearby fresh and old spraint approximately 350m from the BMH
2.16 Colonsay to Mull	Colonsay	1	No	▪ No otters or otter signs identified ▪ Water courses with potential otter observed in the survey area
	Mull	0	No	▪ No otters or otter signs identified ▪ No areas with high potential for otter identified.

5.5.5 Birds

5.5.5.1 Assessment summary

The Protected Sites Assessment (Appendix C), identified three Special Protection Areas (SPAs), one NCMPA and one SSSI where it could not be excluded that the installation activities will not have a likely significant effect from the pressure visual (and above water noise) disturbance on the Qualifying bird interests. Information to inform AA, NCMPA and SSSI assessment has been provided.

For the Small Isles NCMPA, the assessment concluded that the qualifying feature black guillemot is unlikely to be found within the cable corridors. and as the installation activities are short-term and transient no significant effect will occur to the feature of the NCMPA. Any temporary disturbance will be brief, minimal and localised and will not result in any likely significant effects on black guillemot. The extent and distribution of black guillemot will not be significantly impacted, and the structure, functioning and integrity of the site will be maintained. In addition, no significant in-combination effects will occur.

The HRA concluded that AA is required for three SPAs. Sites which require AA, and the qualifying bird species that have been screened through to AA, are summarised in Table 5-20. The sensitivity to vessel disturbance of these bird species, their foraging ranges, and the periods when they are most likely to be present within or near the cable corridors are outlined in Table 5-21.

As North Colonsay SSSI was within the North Colonsay and Western Cliffs SPA, and both are designated for chough (*Pyrrhocorax pyrrhocorax*), the North Colonsay SSSI was assessed with North Colonsay and Western Cliffs SPA.

The assessment concluded that of the nine SPAs, in the absence of mitigation, LSE could occur to the qualifying interest chough, within North Colonsay and Western Cliffs SPA (and North Colonsay SSSI). As a result, project specific mitigation measures (project specific mitigation M1) have been proposed to prevent LSE from occurring to breeding and wintering chough.

Without prejudice to the conclusion of no LSE on red-throated diver for the Rum SPA as best practice the Applicant has also proposed project specific mitigation (project specific mitigation M2).

The HRA concluded that with the implementation of the mitigation measures prescribed, the proposed installation activities will not have an adverse effect on the integrity of any European site either alone or in-combination with other plans and projects, and their conservation objectives will be maintained

Table 5-20 A summary of screening decisions for birds in protected sites within the Inner Hebrides geographical area

Inner Hebrides	Cnuic agus Cladach Mhuile SPA	North Colonsay and Western Cliffs SPA	Rum SPA and SSSI	Oronsay and South Colonsay SPA and SSSI	Small Isles NCMPA
Birds					
Black guillemot					B
Manx shearwater			B		
Red-throated diver			B		
Guillemot		B	B		
Black-legged kittiwake		B	B		
Chough		B/NB		B/NB	
Corncrake				B	
Golden eagle	B		B		
Key:	Screened In	B = Breeding			
	Screened Out	NB = Non-Breeding			

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Table 5-21 Summary of birds screened in for AA

Receptor	Woodward *et al.*, 2019	Joint SNCB, 2017		Suggested seasonal definitions for birds in the Scottish Marine Environment (NatureScot, 2020)											
	Mean-Max Foraging Range (km)	Disturbance Susceptibility	Habitat Specialisation	Winter			Summer						Winter		
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Auks															
Guillemot (*Uria aalge*)	73.2	3	3												
Divers															
Red-throated diver (*Gavia stellata*)	9.0	5	4												
Gulls and Terns															
Kittiwake (*Rissa tridactyla*)	156.1	2	2												
Shearwater															
Manx shearwater (*Puffinus puffinus*)	1346.8	1	1												
Terrestrial															
Chough (*Pyrrhocorax pyrrhocorax*)	Unknown	Unknown	Unknown												
Golden eagle (*Aquila chrysaetos*)	7 (Tesky, 1994)	Unknown	Unknown												

Key		
	(green)	Bird breeding season / Seal pupping season
	(blue)	Present

5.5.5.2 Project specific mitigation

Project specific mitigation, as proposed in the Protected Site Assessment (Appendix C) to avoid impact on chough in the North Colonsay and Western Cliffs SPA and North Colonsay SSSI is summarised below:

- M1 – Following licence submission and confirmation by NatureScot Ornithology expert on the use of Cable Corridor 2.16 Colonsay to Mull (Colonsay landing point) by breeding chough, appropriate local mitigation will be agreed.

In addition, and without prejudice to the conclusion of no LSE on red-throated diver for the Rum SPA as best practice the Applicant proposes that the following mitigation be implemented:

- M2 - All vessels associated with the cable installation operations within Cable Corridor 2.13 Eigg to Mainland will follow the "Guide to Best Practice for Watching Marine Wildlife' guidance on birds where practicable and reduce their speed on approach to the cable corridor to below 6knots should rafting birds be observed ahead.

5.6 Project Specific Mitigation

Project Specific Mitigation measures are measures which are not part of the project design and have been proposed to reduce or offset potential environmental impacts. Table 5-22 provides details of the project specific mitigation measures proposed for each of the Cable Corridors relating to biological features.

Table 5-22 Project Specific mitigation measures for the Inner Hebrides geographical area

ID	Aspect	Project specific mitigation	2.13	2.14	2.15	2.16
M1	Chough	Following licence submission and confirmation by NatureScot Ornithology expert on the use of Cable Corridor 2.16 Colonsay to Mull (Colonsay landing point) by breeding chough, appropriate local mitigation will be agreed.				
M2	Red-throated diver	All vessels associated with the cable installation operations within Cable Corridor 2.13 Eigg to Mainland will follow the "Guide to Best Practice for Watching Marine Wildlife' guidance on birds where practicable and reduce their speed on approach to the cable corridor to below 6knots should rafting birds be observed ahead.				

A full list of design and mitigation measures for the R100 Project can be found in Chapter 8 of the MEA (MEA Chapter 8: Mitigation).

5.7 Conclusion

The environmental assessment has concluded that the installation activities will have no significant impact to fish (including basking shark). In the absence of mitigation measures, there is potential for installation activities to have significant effects on chough. Where appropriate, project specific mitigation has been proposed to prevent significant effects from occurring. In addition, the applicant has proposed project specific mitigation for red-throated diver as best practice.

6. HUMAN ENVIRONMENT

6.1 Introduction – Human Environment

This section provides details of the human environment for the cable corridors within the Inner Hebrides geographical area. Potential effects on the historic environment, shipping and navigation, commercial fishing and other sea users from the proposed installation activities have been assessed, along with the mitigation and management measures that will be utilised to remove or reduce these impacts.

6.2 Existing Baseline Conditions

6.2.1 Marine Archaeology

The prehistoric archaeological record of the British Isles covers the period from the earliest human occupation more than 780,000 years Before Present (BP) to the Roman invasion of Britain in AD 43.

During this period sea level fluctuations caused by three major phases of glaciations have shaped the prehistoric landscape within Scotland. The changes in sea level have at times exposed the floor of parts of the North Sea, including the location of the cable corridors.

At the beginning of the Upper Palaeolithic period the area remained covered in glacial ice. By around 13,000 BP the area was largely ice free where coastal marsh environments may have developed, and human activity may have occurred.

The Inner Hebrides have extensive archaeological records and the information presented in this section has been sourced from the National Record of the Historic Environment (NRHE) (Marine Scotland, 2021). The known charted historical assets within 500m of the Inner Hebrides cable corridors are outlined within Table 6-1.

Table 6-1 Historic sites within 500m of Inner Hebrides cable corridors

Corridor	Distance form corridor (m)	Description of archaeological asset	Type
2.15 Iona-Mull	267m	Iona Conservation Area	Conservation area
2.16 Colonsay-Mull	420m	Colonsay House	Garden and designates landscape
2.13 Eigg-Mainland	0m	Na Sidheanan, burial mounds 200m N of Laig Farm, Eigg	Scheduled Monument
2.14 Mainland-Lismore	392m	Park, dun 350m N of	Scheduled Monument
2.16 Colonsay-Mull	160m	Dun a' Gheird, dun	Scheduled Monument
2.13 Eigg-Mainland	493M	Dangerous wreck	Wrecks and Obstructions

Marine sediments can be indicative of the potential for archaeology. In addition to the known archaeological interest features outlined in Table 6-1 above, the cable corridors have been surveyed using geophysical survey techniques, both in the intertidal area and subtidal. Surveys were undertaken between May and September 2021 however, analysis of the survey data for archaeological anomalies is not available at the time of writing the MEA.

Therefore, the geophysical survey data will be reviewed by a trained archaeologist and an addendum submitted to further inform the location of potential archaeology identified from survey data analysis. The archaeologist will identify the level of potential importance of each anomaly and will assign an appropriate archaeological exclusion zone to avoid disturbance of seabed sediments surrounding the location of the anomaly, minimising the effects of cable installation to the historic environment. The addendum will be presented to Historic Environment Scotland (HES) and MS-LOT as soon as completed and ahead of licensable activities commencing.

6.2.2 Shipping and Navigation

Information presented in this section has been sourced from Appendix D: Navigation Risk Assessment (NRA) (Document Ref: P2308_R5368 Rev 0) and summarised to provide pertinent information associated with potential shipping and navigation risks in the Inner Hebrides geographical area.

6.2.2.1 Shipping

As detailed in Appendix D - NRA, the study areas for each cable corridor have been defined using a minimum distance of 2km either side of cable corridors (500m width), resulting in a minimum corridor of 4.5km. This corridor takes into consideration the full navigable area extents, to ensure that sufficient baseline shipping information is captured for each cable corridor. The 2km search area has been established for each cable and guidance from Section 4 of the International Maritime Organisation (IMO) Formal Safety Assessment. All Automatic Identification System (AIS) data and navigational features datasets presented in this report are limited to the search area relative to each cable.

As outlined in Appendix D - NRA, 12 months of AIS data between January to December 2019 were analysed within the 4.5km search area from each cable corridor in Inner Hebrides. Average monthly vessel density across the region of Inner Hebrides is shown in Figure 6-1 (P2308-SHIP-014_IH) and the general AIS intensity for each cable corridor is presented in Table 6-2 below. Table 6-2 and Figure 6-1 show that vessel intensity across the Inner Hebrides geographical area ranges from medium to high at 2.14 Mainland – Lismore and low to very low for all other routes. The number of ferry routes which intersect the cable corridors and the number of ports within the vicinity of the cable routes is also provided in Table 6-2. AIS data indicates that areas of higher vessel intensity correlate with the nearby ports and ferry routes.

The identified anchorages and navigational features within the Inner Hebrides geographical area are presented within Appendix D - NRA and are summarised below:

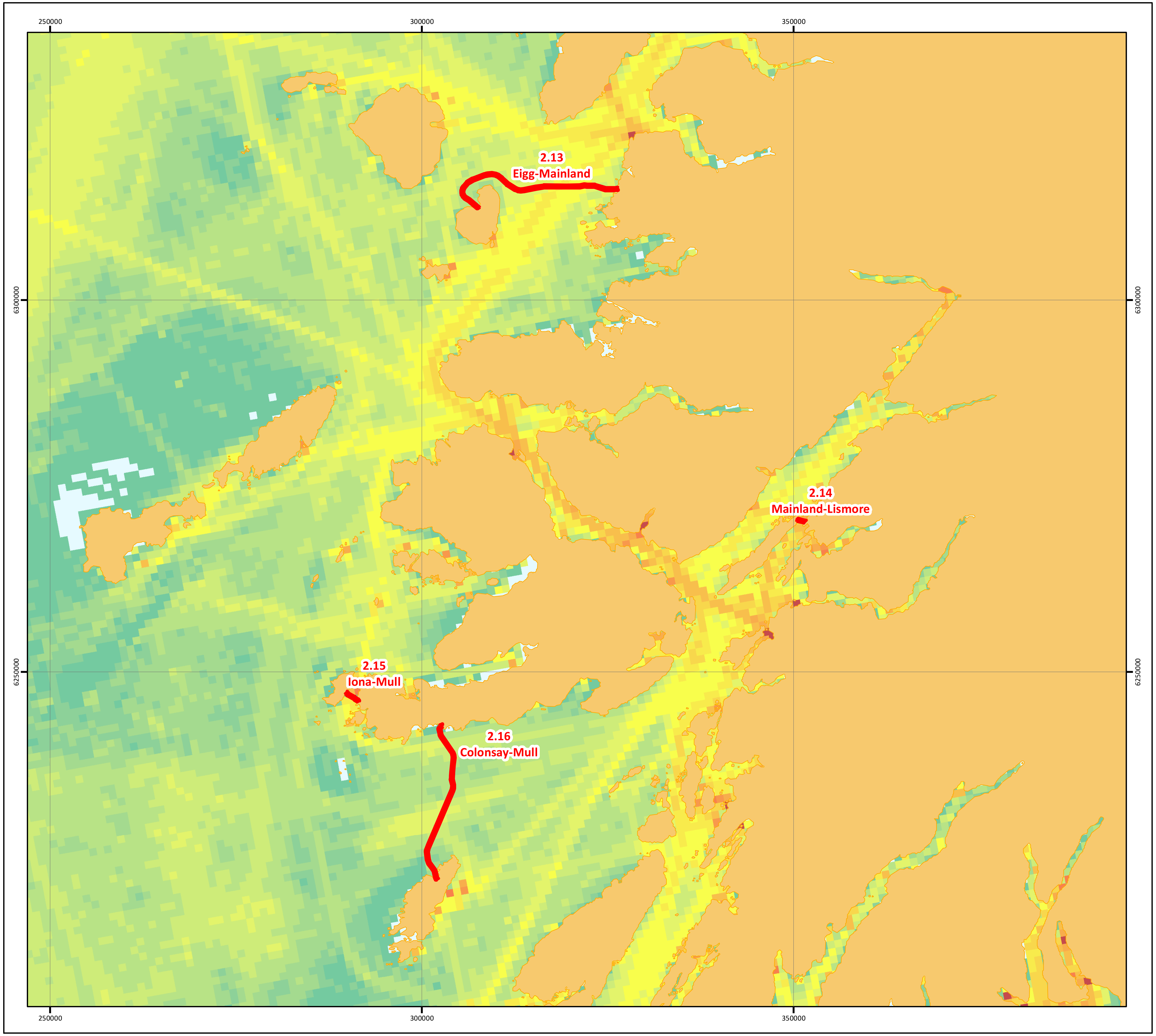
- **Cable Corridor 2.15 Iona - Mull**– An undesignated anchorage exists approximately 500m north of the cable route at Iona. AIS data show that small vessels also anchor in the southern Sound of Iona and may be a risk to the cable
- **Cable Corridor 2.14 Mainland – Lismore -** An undesignated anchorage is present just off the cable corridor at Port Appin, west of the pier. There are numerous further moorings off the Port Appin ferry terminal and the AIS data filtered for stationary vessels confirms that these moorings are also used regularly

Aggregate extraction sites and dumping grounds have been avoided during the route selection process therefore there will be no interaction with other vessels at these sites. No other navigational features have been identified on the admiralty charts within the study area.

Table 6-2 Search radius across the cable corridors in the Inner Hebrides

Cable Corridor	General AIS Intensity (vhpy)	Number and Name of Ferry Routes in Study Area	Number and Name of Ports Within Vicinity of Study Area
2.13 Eigg - Mainland	Low (5-10)	**2 (transect cable corridor)** ▪ *Rum (Kinloch)- Eigg (Glamisdale)* ▪ *Mallaig – Eigg (Galmisdale)*	**2** ▪ *Galimsdale Port*

Cable Corridor	General AIS Intensity (vhpy)	Number and Name of Ferry Routes in Study Area	Number and Name of Ports Within Vicinity of Study Area
			▪ *Mallaig Harbour*
2.14 Mainland – Lismore	Med to High (20-50)	**1 (do not transect cable corridor)** ▪ *Lismore (Point) – Port Appin*	**1** ▪ *Port Appin*
2.15 Iona - Mull	Low (5-10)	**1 (transect cable corridor)** ▪ *Fionnphort – Iona (Baile Mor)*	▪ **No ports but x2 ferry terminals**
2.16 Colonsay - Mull	Very Low (0-5)	**0**	**0**



SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

AIS VESSEL DENSITY
Average Monthly Vessel Density
All Vessels - Inner Hebrides

Drawing No: P2308-SHIP-014_IH	B

Legend

Cable Route Application Corridor

2019 Vessel Density

Vessel Hours (per km²)

- 0
- < 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200
- 200 - 500
- > 500

NOTE: Not to be used for Navigation

Date	18 October 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	EMODnet; GEBCO; ESRI;
File Reference	J:\P2308\Mxd\04_SHIP\ P2308-SHIP-014_IH.mxd
Created By	Chris Dawe
Reviewed By	Abigale Nelson
Approved By	Paula Daglish

0 5 10 15 20 km

Information contained here has been derived from data that is made available under the European Marine Observation Data Network (EMODnet) Human Activites project (https://www.emodnet-humanactivities.eu/about.php), financed by the European Union under Regulation (EU) No 508/2014 of the European Parliament and of the Council of 15 May 2014 on the European Maritime and Fisheries Fund.; © The GEBCO Digital Atlas published by the British Oceanographic Data Centre on behalf of IOC and IHO, 2003; ©Esri;

6.2.2.2 Recreation

Appendix D (Document Ref: P2308_R5368) provides information on recreational boating interests in the study area from the Coastal Atlas of Recreational Boating and the Royal Yachting Association (RYA) dataset. Recreational vessel density across the Inner Hebrides geographical area ranges from low to very high. The following two cable corridors are shown to have a higher level of recreational boating activity than the other Inner Hebrides cable corridors:

- 2.14 Mainland – Lismore – the recreational vessel density across the study area is generally very high, due to a high level of recreational vessels using the channel between mainland Scotland and Lismore (see Figure 3.17, Appendix D Document Ref: Document Ref: P2308_R5368)
- Cable Corridor 2.15 Iona – Mull – recreational vessel density is generally medium to high, due to the high level of recreational vessels using the channel between mainland Iona and Mull (See Figure 3.18, Appendix D Document Ref: Document Ref: P2308_R5368)

There are no other general boating areas, clubs, marinas, or training centres within the cable corridors of the Inner Hebrides geographical area. Smaller recreational vessels that do not transmit AIS are likely to be limited to localised boats and seasonal visitors and relatively low in number.

There are no designated bathing waters or Blue Flag beaches located at the landfalls within or adjacent to the proposed Inner Hebrides cable corridors.

6.2.2.3 Marine Accident Data

The most recent ten-year period available of Royal National Lifeboat Institution (RNLI) data (collected between 2009 and 2020) has been plotted spatially and analysed across the Inner Hebrides cable corridors (Appendix D). During this period, a total of 32 lifeboat launches to unique incidents across the Inner Hebrides cable corridors were recorded by the RNLI (excluding hoaxes and false alarms). This corresponds to an average 5-6 incidents a year. Table 6-3 below summarises the incidents per cable corridor in the Inner Hebrides geographical area.

Table 6-3 RNLI Accidents with 500m of Inner Hebrides cable corridors

Cable Corridor	No of RNLI Accidents within 500m of corridor
2.13 Eigg-Mainland	19
2.14 Mainland-Lismore	11
2.15 Iona-Mull	1
2.16 Colonsay-Mull	1

All UK-flagged commercial vessels are required by law to report accidents to the Marine Accident Investigation Branch (MAIB). One marine incident was reported within the Inner Hebrides region over a period of five years. In terms of yearly variations, this corresponds to less than one incidence per year (Appendix D). It is not expected that the presence of project vessels will increase the risks to the existing baseline of marine safety.

6.2.3 Commercial Fishing

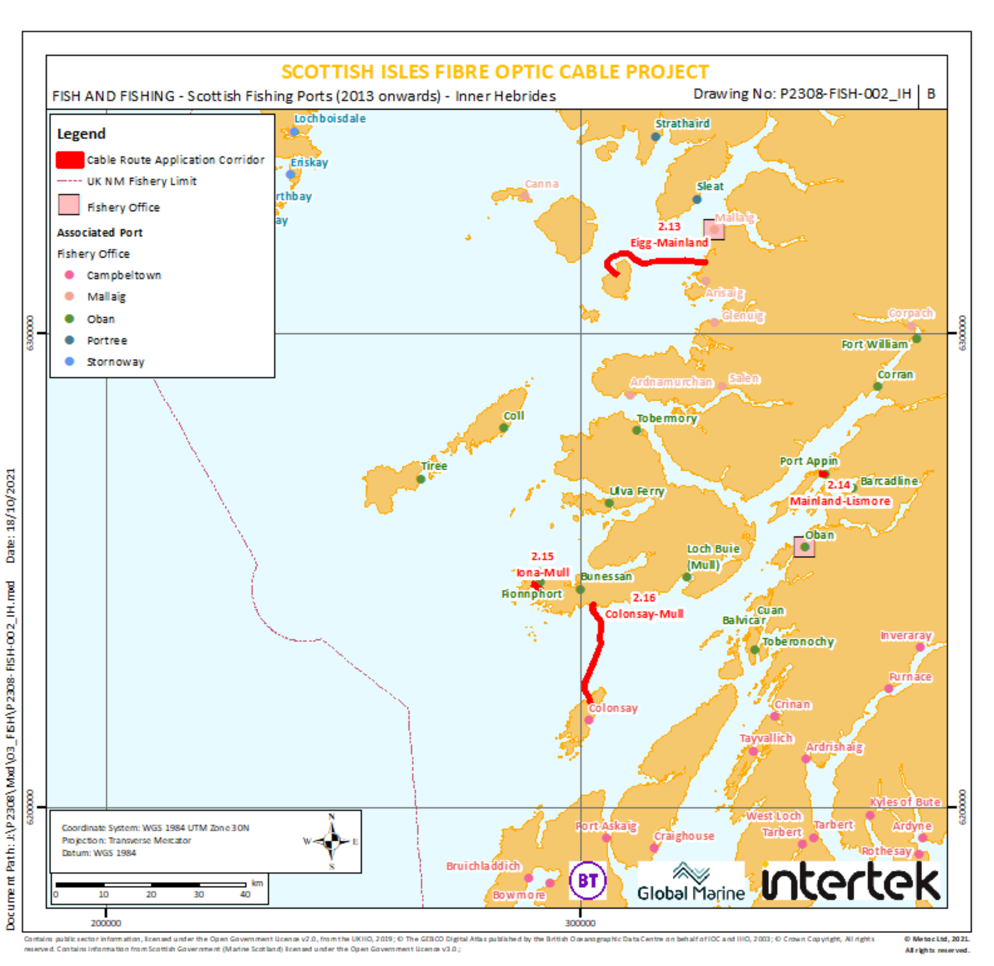
Information provided in this section has been derived from Appendix E – Fishing Activity Study (FAS). The FAS has reviewed publicly available fisheries data and has identified the level fishing activity across the Inner Hebrides geographical area. This includes a review of target species and fishing methods, spatial patterns, landings data and seasonal trends. The pertinent findings from this study have been summarised in the text below and information for each cable corridor within the Inner Hebrides geographical area is presented in Table 6-4.

Table 6-4 Summary of fisheries activity by cable corridor

Cable Route	ICES rectangle	Target Species	Dominant Fishing type			Peak season
			Shellfish	Demersal	Pelagic	
2.13 Eigg-Mainland	42E3	Crab, haddock, lobster, nephrops, scallop, lobster,	✓			June, July and November
	42E4	Nephrops, scallop, crabs, lobster, razor clam	✓			November
2.14 Mainland - Lismore	42E4	Nephrops, scallop, crabs, lobster, razor clam	✓			November
2.15 Iona - Mull	41E3	Crabs, haddock, lobster, nephrops, monks or anglers	✓			November – December
2.16 Colonsay - Mull	41E3	Crabs, haddock, lobster, nephrops, monks or anglers	✓			November – December

There are a number of fishing ports in the Inner Hebrides geographical area (Figure 6-2: Drawing reference: P2308-FISH-002_IH-B), all associated with the Mallaig, Oban, Campbeltown and Portree district Fishery Offices.

Figure 6-2 Scottish fishing ports (2013 onwards) – Inner Hebrides (Drawing No: P2308-FISH-002_IH- B)



From the information available, key fishing activities within the Inner Hebrides geographical area in relation to the proposed cable corridors are shellfish species. Shellfish are the most landed species with crab, European lobster, Norway lobster razor clam and scallop as target species. Static gear is widely used across the area in the nearshore region (within 6NM). The most landed shellfish species in the Inner Hebrides geographical area are Norway lobster, brown crab and scallops

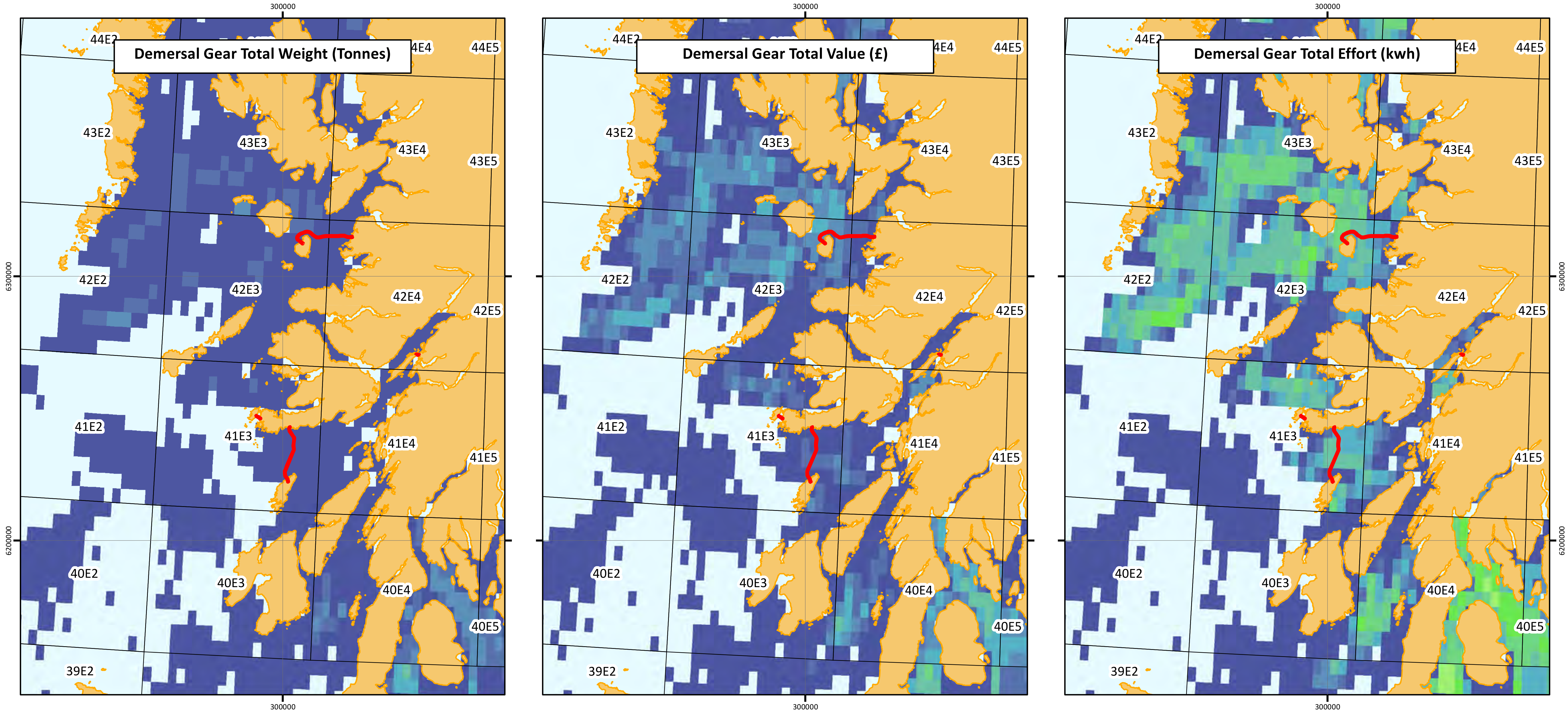
Landing tonnage and their respective value provide a good indication of the importance of commercial fishing in an area. The Inner Hebrides cable corridors are located within ICES rectangles 41E3, 42E3, and 42E4. The waters in the north-west of the Inner Hebrides geographical area is the most important ICES rectangle in terms of value (42E3) (Scottish Government 2020) with average annual landings of over £4.7M. Cable corridor 2.14 has the highest levels of fishing activity within the Inner Hebrides geographical area.

Figure 6-3 (Drawing reference: P2308-FISH-003_IH), Figure 6-4 (Drawing reference: P2308-FISH-004_IH) and Figure 6-5 (Drawing reference: P2308-FISH-005_IH) show the spatial patterns of fishing activities within the Inner Hebrides geographical area per gear type in terms of weight, value, and fishing effort, at a resolution of ICES sub-rectangles (20x10 per ICES rectangle). Based on the figures below, demersal fishing is low across the Inner Hebrides geographical area. The cable corridors where the most demersal fishing occurs are Route 2.16 Colonsay to Mull with between 5,000 and 20,000 kw/h effort; and Route 2.13 Eigg to Mainland where effort is highest with between 2,500 and 80,00 kw/h. Pelagic fishing and passive fishing within the Inner Hebrides geographical area is generally low across all cable routes with up to 2,500kw/h across the period considered.

The seasonality of fishing activity within the vicinity of the proposed cable corridors varies between north of Inner Hebrides and south of Inner Hebrides. The peak seasonality is summarised in Table 6-4 above. This shows that the seasonality of fishing activity is similar across all cable corridors with the peak time for shellfish November to December.

The Project Fishing Liaison Officer (FLO) is in regular communication with fishing stakeholders in Inner Hebrides and has held pre-application meetings and workshops to seek the opinion of the fishing industry. These communications will continue through the Marine Licence determination and into the installation phase of the R100 Project. A Fisheries Liaison Mitigation Action Plan (FLMAP) (Appendix B) has been developed which considers the opinions of the fishing industry stakeholders. The mitigation measures proposed will seek to minimise displacement and disturbance to commercial fishers within the Inner Hebrides geographical area as far as possible. The mitigation measures proposed in the FLMAP, are summarised in Section 8 - Schedule of Mitigation.

There are no active aquaculture sites within 500m of the proposed cable corridors.



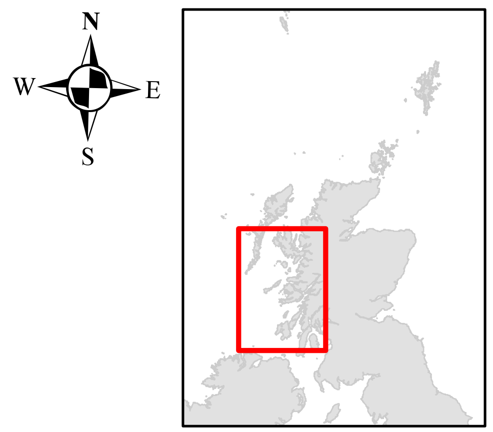
SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT **FISH AND FISHING - Fishing Activity for ≥ 15m UK Vessels 2017 by ICES Sub Rectangle (Demersal Gears) - Inner Hebrides** Drawing No: P2308-FISH-003_IH | B

Legend

Cable Route Application Corridor

ICES Rectangle

Total Weight (Tonnes)	Total Value (£ Sterling)	Total Fishing Effort (kilowatt/hours)
> 0 - 10 (Tonnes)	> £0 - £10,000	> 0 - 2,500 (kilowatt/hours)
> 10 - 20	> £10,000 - £20,000	> 2,500 - 5,000
> 20 - 40	> £20,000 - £40,000	> 5,000 - 10,000
> 40 - 80	> £40,000 - £80,000	> 10,000 - 20,000
> 80 - 160	> £80,000 - £160,000	> 20,000 - 40,000
> 160 - 320	> £160,000 - £320,000	> 40,000 - 80,000
> 320 - 640	> £320,000 - £640,000	> 80,000 - 160,000
> 640 - 1,280	> £640,000 - £1.28 million	> 160,000 - 320,000
> 1,280 - 2,560	> £1.28 - £2.56 million	> 320,000 - 640,000
> 2,560 (Tonnes)	> £2.56 million	> 640,000 (kilowatt/hours)



NOTE: Not to be used for Navigation

Date	18 October 2021
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Projection	Transverse Mercator
Datum	WGS 1984
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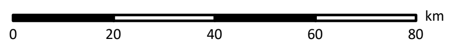
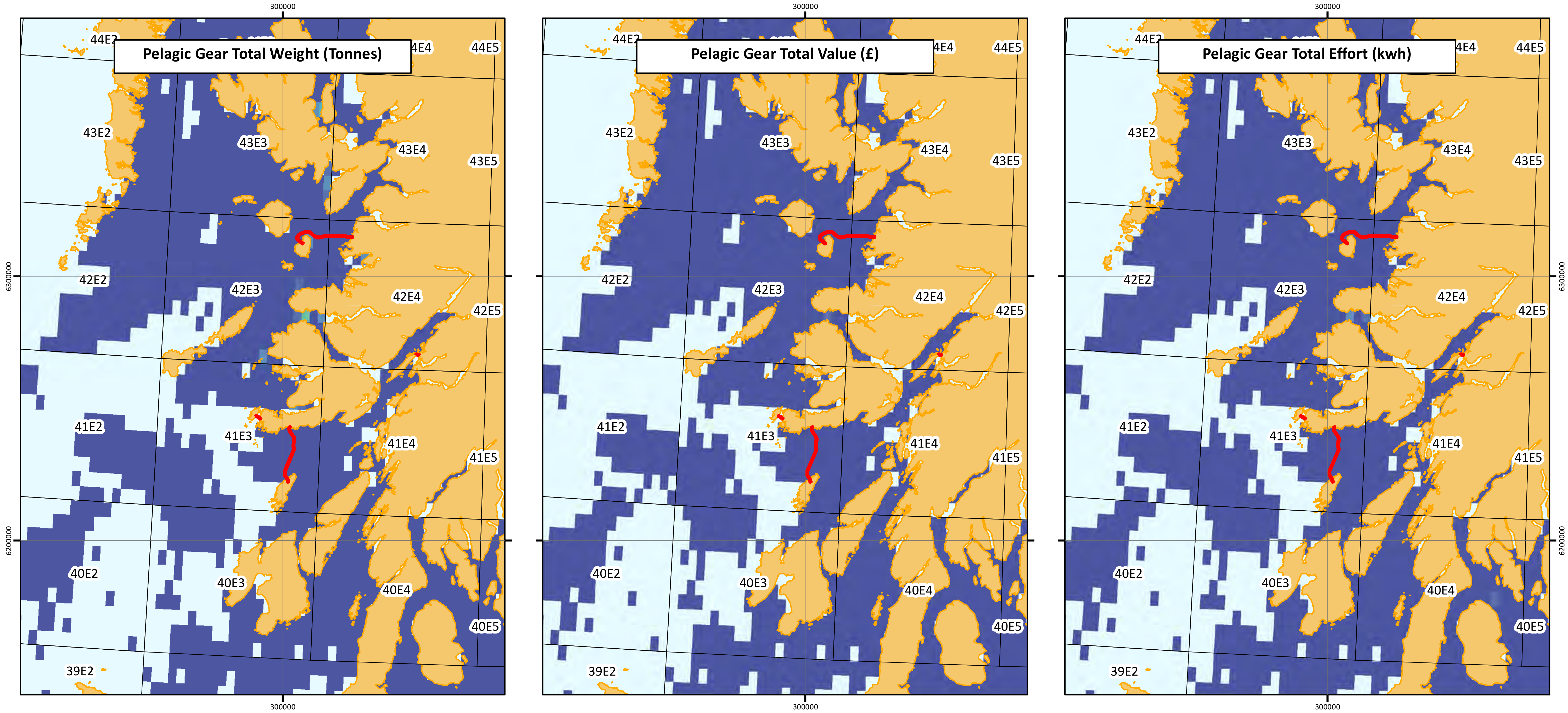
File Reference	J:\P2308\Mxd\03_FISH\ P2308-FISH-003_IH.mxd
Created By	Chris Dawe
Reviewed By	Chris Carroll
Approved By	Nick Archibald

BT Global Marine intertek





SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

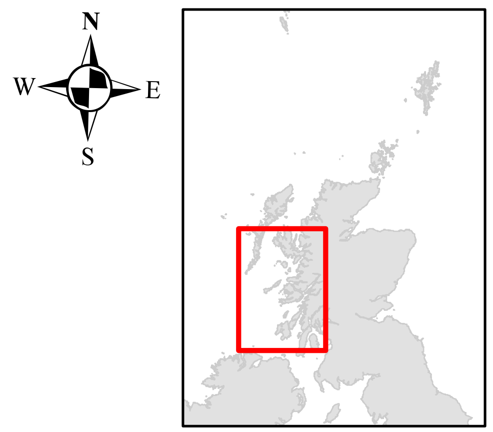
FISH AND FISHING - Fishing Activity for ≥ 15m UK Vessels 2017 by ICES Sub Rectangle (Pelagic Gears) - Inner Hebrides

Drawing No: P2308-FISH-004_IH | B

Legend

- Cable Route Application Corridor
- ICES Rectangle

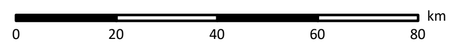
Total Weight (Tonnes)	Total Value (£ Sterling)	Total Fishing Effort (kilowatt/hours)
> 0 - 10 (Tonnes)	> £0 - £10,000	> 0 - 2,500 (kilowatt/hours)
> 10 - 20	> £10,000 - £20,000	> 2,500 - 5,000
> 20 - 40	> £20,000 - £40,000	> 5,000 - 10,000
> 40 - 80	> £40,000 - £80,000	> 10,000 - 20,000
> 80 - 160	> £80,000 - £160,000	> 20,000 - 40,000
> 160 - 320	> £160,000 - £320,000	> 40,000 - 80,000
> 320 - 640	> £320,000 - £640,000	> 80,000 - 160,000
> 640 - 1,280	> £640,000 - £1.28 million	> 160,000 - 320,000
> 1,280 - 2,560	> £1.28 - £2.56 million	> 320,000 - 640,000
> 2,560 (Tonnes)	> £2.56 million	> 640,000 (kilowatt/hours)



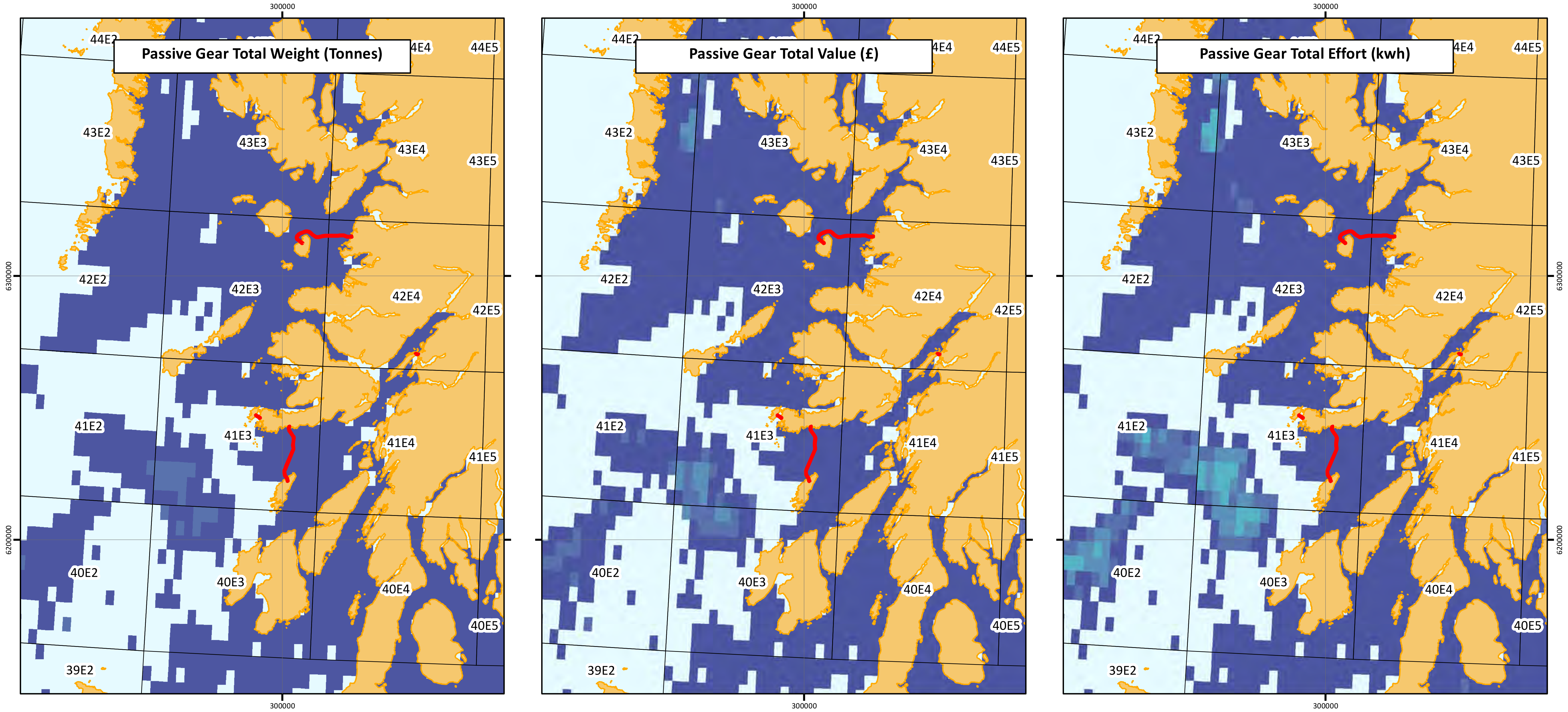
NOTE: Not to be used for Navigation

Date	18 October 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	MarineRegions; UKHO; MMO; OSOD; ICES; ESRI;
File Reference	J:\P2308\Mxd\03_FISH\P2308-FISH-004_IH.mxd
Created By	Chris Dawe
Reviewed By	Chris Carroll
Approved By	Nick Archibald

BT Global Marine intertek



Flanders Marine Institute (2019). Maritime Boundaries Geodatabase: Exclusive Economic Zone (EEZ), version 11. Available online at http://www.marineregions.org/. https://doi.org/10.14284/386; Contains public sector information, licensed under the Open Government Licence v2.0, from the UKHO, 2018.; Open Government Licence reproduced with permission of the Marine Management Organisation.; Contains Ordnance Survey data © Crown copyright and database right 2013; ©ICES; ©Esri



SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT | **FISH AND FISHING - Fishing Activity for ≥ 15m UK Vessels 2017 by ICES Sub Rectangle (Passive Gears) - Inner Hebrides** | Drawing No: P2308-FISH-005_IH | B

Legend

Cable Route Application Corridor

ICES Rectangle

Total Weight (Tonnes)	Total Value (£ Sterling)	Total Fishing Effort (kilowatt/hours)
> 0 - 10 (Tonnes)	> £0 - £10,000	> 0 - 2,500 (kilowatt/hours)
> 10 - 20	> £10,000 - £20,000	> 2,500 - 5,000
> 20 - 40	> £20,000 - £40,000	> 5,000 - 10,000
> 40 - 80	> £40,000 - £80,000	> 10,000 - 20,000
> 80 - 160	> £80,000 - £160,000	> 20,000 - 40,000
> 160 - 320	> £160,000 - £320,000	> 40,000 - 80,000
> 320 - 640	> £320,000 - £640,000	> 80,000 - 160,000
> 640 - 1,280	> £640,000 - £1.28 million	> 160,000 - 320,000
> 1,280 - 2,560	> £1.28 - £2.56 million	> 320,000 - 640,000
> 2,560 (Tonnes)	> £2.56 million	> 640,000 (kilowatt/hours)

N
W
E
S

NOTE: Not to be used for Navigation

Date	18 October 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	MarineRegions; UKHO; MMO; OSOD; ICES; ESRI;
File Reference	J:\P2308\Mxd\03_FISH\P2308-FISH-005_IH.mxd
Created By	Chris Dawe
Reviewed By	Chris Carroll
Approved By	Nick Archibald

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km
0 20 40 60 80

6.2.4 Other Sea Users

6.2.4.1 Military Practice Areas

The following military practice areas are located within 5km of the proposed cable corridors:

- 2.13 Eigg-Mainland cable corridor is located within the Eigg Royal Navy Submarine General (non-firing exercises, practices and trials) area;
- 2.14 Mainland-Lismore cable corridor is located within the Linnhe Royal Navy Submarine General (non-firing exercises, practices and trials) area;
- 2.15 Iona-Mull cable corridor is located within the Staffa Royal Navy Submarine General (non-firing exercises, practices and trials) area and 3.8km from the Mull Royal Navy Submarine General (non-firing exercises, practices and trials);
- 2.16 Colonsay-Mull cable corridor is located within the Colonsay and Mull Royal Navy Submarine General (non-firing exercises, practices and trials) and 4km from the Staffa Royal Navy Submarine General (non-firing exercises, practices and trials) area (Figure 6-6, Drawing reference: P2308-INFR-002_IH).

6.2.4.2 Disposal Sites

The closed Loch Staosna disposal site is located 4.2km from cable corridor 2.16 Colonsay-Mull (Figure 6-6, Drawing reference: P2308-INFR-002_IH). There are no other disposal sites located within 5km of the other Inner Hebrides cable corridors.

6.2.4.3 Renewable Energy

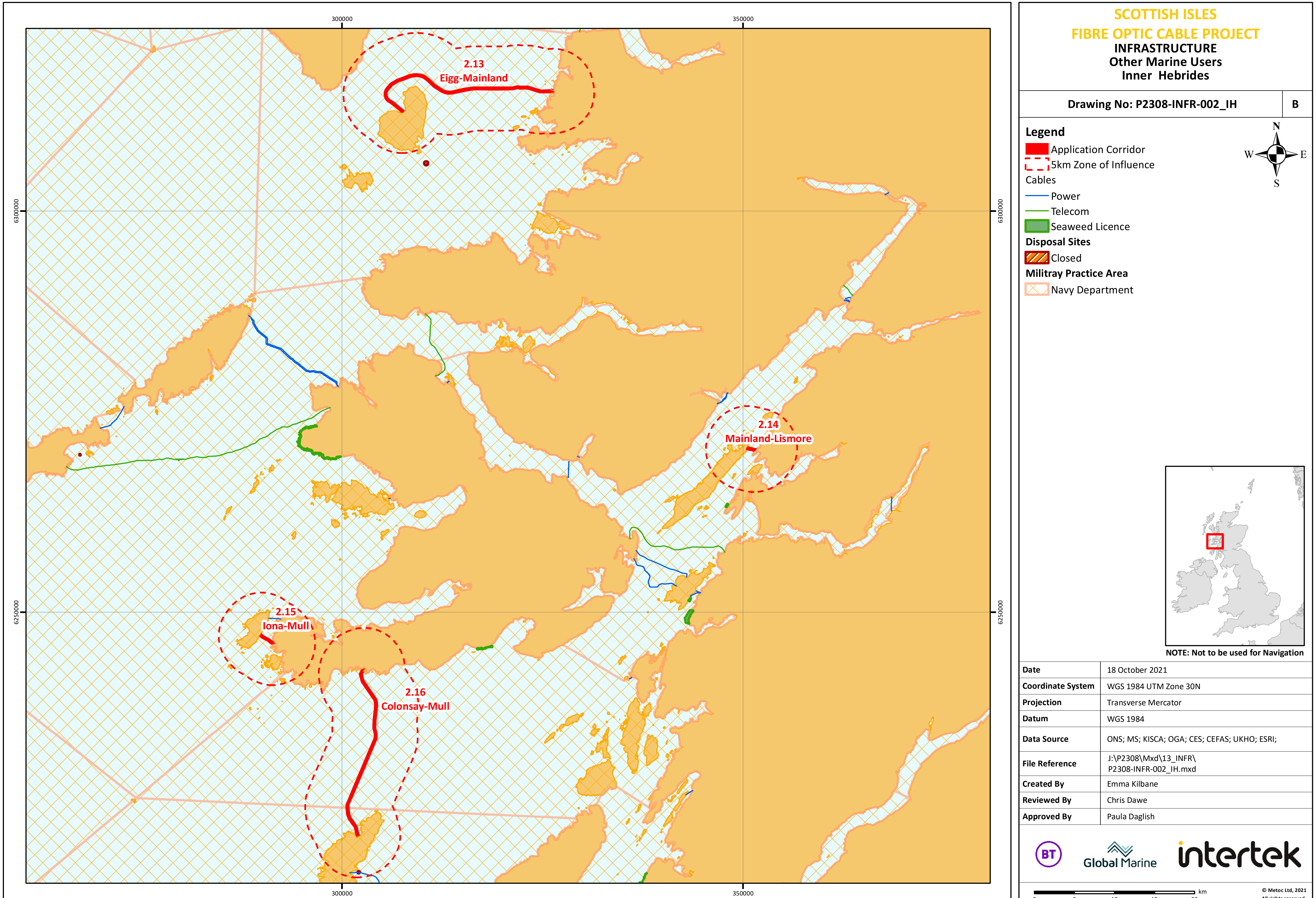
There are no renewable energy developments located within 5km of the Inner Hebrides cable corridors.

6.2.4.4 Pipelines

There are no pipelines located within 5km of the Inner Hebrides cable corridors.

6.2.4.5 Cable Infrastructure

There are a number of existing power and telecommunications cables located within 5km of the Inner Hebrides cable corridors, (Figure 6-6, Drawing reference: P2308-INFR-002_IH). Of these cables the Islay-Colonsay power cable, operated by Scottish and Southern Electricity Networks is located within close proximity to the 2.16 Colonsay-Mull cable corridor, but the proposed cable will not cross this asset. In addition, the 2.14 Mainland – Lismore cable corridor crosses a BT telecommunication cable. However, as the crossing with Cable 2.14 Mainland-Lismore is a telecommunications cable, no rock protection will be required.



SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

INFRASTRUCTURE
Other Marine Users
Inner Hebrides

Drawing No: P2308-INFR-002_IH	B

Legend

- Application Corridor
- 5km Zone of Influence

Cables
- Power
- Telecom
- Seaweed Licence

Disposal Sites
- Closed

Militray Practice Area
- Navy Department

Date	18 October 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ONS; MS; KISCA; OGA; CES; CEFAS; UKHO; ESRI;
File Reference	J:\P2308\Mxd\13_INFR\ P2308-INFR-002_IH.mxd
Created By	Emma Kilbane
Reviewed By	Chris Dawe
Approved By	Paula Daglish

BT Global Marine intertek

0 5 10 15 20 km

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6.3 Assessment of Effects

6.3.1 Shipping and Navigation

The Appendix D (NRA) identified potential risks to shipping and navigation arising from the installation of the fibre optic cables and associated activities. The study examined potential effects on existing shipping activities including fishing and recreational activities, or navigational features. This section provides a summary of the NRA findings and outlines the likely significant effects from cable installation on shipping and navigation.

6.3.1.1 Potential pressure identification and zone of influence

All effects to shipping and navigation that have been considered in Appendix D are listed in Table 6-5 below.

Table 6-5 Potential effects and zones of influence

Project Phase	Operation	Potential Pressure	Receptor	Zone of Influence
Pre-Installation	Pre-Lay Grapnel Run	▪ Abrasion/disturbance at the surface of the substratum ▪ Penetration and disturbance below the substratum including abrasion ▪ Physical change to another seabed type ▪ Local water flow (tidal current) changes ▪ Displacement of vessels due to the avoidance of Project vessels ▪ Collision risk ▪ Accidental anchoring on unburied cable ▪ Accidental snagging of fishing gear on unburied cable ▪ Project Vessels blocking navigational features and anchorages ▪ Change in water depth - affecting safe navigation ▪ Extreme weather conditions ▪ Reduced visibility	Archaeology, Commercial shipping, recreational boating and fishing vessels	Requested Safe working distance and up to 18km in any 12-hour period
	Route Clearance			
Installation	Cable lay and burial			Requested Safe working distance and up to 7.2km in any 12-hour period
	Surface Laid cable			Requested Safe working distance and up to 24km in any 12-hour period
	Post-lay inspection and burial (PLIB)			Requested Safe working distance and to 2.4km in any 12-hour period
	Diver/ROV pre installation survey at Shore ends			Requested Safe working distance at shore end survey operations (1 day per landing)
	Diver/ROV post installation survey and Shore End Burial			Requested Safe working distance at shore end burial operations (7 days per landing)
Contingency/ Change in water depth*	Boulder relocation			Requested Safe working distance for vessels carrying out contingency operations (if required)
	Concrete Mattressing			
	Rock Bags			
	Rock Placement			
No MLV installation - Multicat or subaqueous solution	Cable lay and burial including surface lay			Requested Safe working distance for vessels carrying out contingency operations (if required)

*Contingencies will be carefully engineered in water depths less than 10m so that they will not reduce the water depth by more than 5%

6.3.1.2 Compliance Mitigation

The Compliance measures outlined in Table 6-6 below are required to be undertaken to meet environmental and health and safety legislation. The assessment assumes these measures will be implemented.

Table 6-6 Compliance Mitigation

ID	Aspect	Design Measure	Source
COMP 1	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Project vessels will comply with the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs) – as amended, particularly with respect to the display of lights, shapes and signals.	International Maritime Organisation
COMP 2	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	The dropped object procedure will be followed, and any unrecovered dropped objects must be reported to the relevant authority (MS LOT) using their dropped object procedure, within 24 hours of the project becoming aware of an incident.	MS-LOT
COMP 3	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	'As-laid' co-ordinates of the cable corridor will be recorded and circulated to the UK Hydrographic Office (UKHO), KIS-ORCA service and any other relevant authorities. Cables will be marked on Admiralty Charts and KIS-ORCA charts (paper and electronic format).	Maritime and Coastguard Agency
COMP 4	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Where weather reduces visibility then vessel masters shall adhere to MGN guidelines and COLREGS to prevent collisions at sea.	International Maritime Organisation
COMP 8	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Should the project create potential hazards to shipping (such as cables temporarily buoyed off or reduction in water depth) along the cable corridors, stakeholders will be informed immediately via a NtM distribution list including Kingfisher to ensure safety is upheld.	Maritime and Coastguard Agency

6.3.1.3 Best Practice Mitigation

The Best Practice project mitigation relevant to shipping is provided in Table 6-7 below. When undertaking the assessment, it has been assumed that these measures will be complied with; either as a matter of best practice or to ensure compliance with statute.

Table 6-7 Best Practice Mitigation

ID	Aspect	Design Measure	Source
BP 1	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Early consultation with relevant contacts to notify of impending activity.	Global Marine
BP2	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Notice to Mariners will be published to inform sea users via Notices to Mariners, Kingfisher Bulletins and MCA and UKHO. Vessels will be requested to remain at least 1NM away from cable vessels during installation operations.	Maritime and Coastguard Agency
BP3	Human Environment: Commercial Fishing; Shipping and	An onshore Fishing Liaison Officer (FLO) will be provided for the project. The FLO will follow the Fishing Liaison Mitigation Action Plan (FLMAP). The	Maritime and Coastguard Agency and Global Marine

ID	Aspect	Design Measure	Source
	Navigation; Other sea users	FLO will continue in this role during installation process.	installation requirement
BP4	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	The UKHO will be informed of installation activities in order to issue navigational warnings via NAVTEX/VHF/MF as appropriate.	Maritime and Coastguard Agency
BP5	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Guidance provided by the UKHO and International Convention for the Safety of Life at Sea (SOLAS) recommend that fishing vessels should avoid trawling over installed seabed infrastructure (UKHO 2020). Vessels are advised in the Mariners Handbook not to anchor or fish (trawl) within 0.25NM of cables.	Maritime and Coastguard Agency and Mariners Handbook
BP6	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	If cables are buoyed off whilst the vessel departs the area, buoy positions will be notified to the NTM distribution list including Kingfisher and 0.25NM clearance will be requested.	NRA
BP7	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Coordination with local ferry Service and Coastguard Operations to provide 24-hour radio and radar coastal vessel traffic information which helps vessels navigate safely to help prevent collisions at sea.	NRA
BP8	Physical, Biological, Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Rock , bags/contingency protection measures will only be deployed where adequate burial cannot be achieved or as required by crossing agreements. The footprint of the deposits will be the minimum required to ensure cable safety stability.	Crossing Agreements
BP9	Human Environment: Archaeology	The geophysical survey data will be reviewed by an appropriately qualified archaeologist. Appropriate archaeological exclusion zones (AEZs) will be assigned to anomalies identified with archaeological potential. These will be avoided. If it is not possible to avoid the AEZ completely, alternative mitigation will be proposed.	The Crown Estate 2021
BP11	Human Environment: Commercial Fishing	Disruption claims will be handled in accordance with ESCA standard operating practices.	ESCA Guidance (No13, issue 11)

6.3.1.4 Impact assessment

The descriptions and definitions in the NRA risk analysis (Appendix D - Section 5) takes into consideration the applied mitigation needed to reduce the hazards to As Low As Reasonably Possible (ALARP).

The risk assessment has identified that with the identified best practice and compliance mitigation measures applied all identified hazards have been reduced to ALARP and no hazards exist that are above a moderate risk level. The greatest risk to the existing baseline has been assessed as vessel collision, either by project vessels interacting with the existing shipping or vice versa. However, due to all vessels operating in with Best Practice and Compliance mitigation (i.e. Collision Regulations (COLREGs)) the frequency has been assessed as extremely remote, lowering the overall risk rating.

6.3.2 Archaeology

6.3.2.1 Potential pressure identification and zone of influence

Key potential impacts on archaeology have been identified following searches of publicly available data and liaison with curators in the region. All potential effects to archaeology are identified in Table 6-8 below.

Table 6-8 Potential impacts and zone of influence

Project Activity	Potential Pressure	Receptor	Worst Case Zone of influence
Cable installation and surface lay	Abrasion/disturbance at the surface of the substratum	Historic environment	Immediate footprint of cable installation
Cable installation - plough burial	Penetration and disturbance below the substratum including abrasion		Immediate footprint of cable installation
Cable protection (contingency)	Physical change to another seabed type		Immediate footprint of contingency cable protection
Cable protection (contingency)	Local water flow (tidal current) changes		Immediate footprint of contingency cable protection

6.3.2.2 Compliance Mitigation

The Compliance measures outlined in Table 6-9 below will be implemented during the final route design process to further ensure the protection of marine archaeological receptors:

Table 6-9 Compliance Mitigation

Comp 9	Human Environment - Archaeology	The Crown Estate's 'Protocol for Archaeological Discoveries' (The Crown Estate, 2014) will be implemented during installation works;	The Crown Estate
Comp 10	Human Environment - Archaeology	The locations of any wrecks or features of archaeological significance will be provided to Historic Environment Scotland and the UK Hydrographic Office (UKHO).	UKHO

6.3.2.3 Best Practice Mitigation

With the exception of BP11 (Table 6-7), the Best Practice project mitigation relevant to archaeology are the same as those presented for shipping and navigation (Table 6-7).

6.3.2.4 Impact Assessment

As described in Section 6.2.1 there is the potential for features of archaeological significance to be present within the Inner Hebrides geographical area. As such, cable installation activities have the potential to damage these areas of historical interest and lead to a loss of historic record. Any damages would be likely to occur during either the initial cable laying activities or during placement of any cable protection measures. If such activities lead to the damage of an existing wreck, the effect would be permanent and constitute a significant impact on marine archaeology due to the receptors inability to recover.

A review of geophysical survey data is being undertaken to inform the final route of the new cable. This review will allow for potential historical assets to be identified and avoided prior to any cable installation works commencing. The marine archaeological technical report will be provided to MS-LOT ahead of any licensable activities taking place.

6.3.3 Commercial Fishing

6.3.3.1 Potential pressure identification and zone of influence

Key potential impacts on commercial fisheries have been identified following consultation with key fishery and aquaculture groups operating in the region. All potential impacts identified by the fishing industry are identified in Table 6-10 below.

The potential for collision risk has been assessed in Section 6.3.1 – Shipping and Navigation, with the risk expected to be minimal due to the temporary nature of vessel displacement.

Table 6-10 Potential impacts and zone of influence – commercial fishing

Project Activity	Potential Pressure	Receptor	Worst Case Zone of influence
Presence of Project vessels	Temporary displacement/ restricted access to fishing grounds	Commercial fishing vessels and static/benthic and mobile gear	10.8 km² (Based on 1NM requested clearance from the cable ship)
Installation of cable and potential cable/crossing contingency external protection measures	Risk of snagging		Immediate vicinity of surface lay measures

6.3.3.2 Compliance Mitigation

The Compliance measures included relevant to commercial fishing are the same as those presented for shipping and navigation (Table 6-6).

6.3.3.3 Best Practice Mitigation

With the exception of BP9 (Table 6-7), the Best Practice project mitigation relevant to commercial fishing are the same as those presented for shipping and navigation (Table 6-7).

6.3.3.4 Impact assessment

Temporary displacement/ restricted access to fishing grounds

The majority of potential fisheries disruption will occur during the installation period and any impact will be temporary and transient. Static gear fishers working along the installation corridor will likely be asked to temporarily move their pots from a short section of the corridor as the installation passes through (typically only 2-3 days for a given route). The entire installation process is expected to take approximately 3 months, so individual areas along that installation track are unlikely to be impacted for more than a few days at a time. In addition, a forward notice will be given so vessels can plan their activities in advance to minimise disruption and the FLO will liaise with static gear fishermen to identify a suitable temporary and transient gear displacement zone prior to installation.

During the proposed installation period (April 2022 - December 2023) key fishing activities within the Inner Hebrides geographical area are focussed on shellfish, demersal and aquaculture fishing, with shellfish being the key component. As discussed in Section 6.2.3 the seasonality of fishing activity within the vicinity of the seasonality is similar across all cable corridors with the peak time for shellfish November to December. However, should installation of the cable coincide with the peak season the disturbance will be very localised and short term (2-3 days).

Static gear is widely used across the area in the nearshore region (within 6NM). During installation, the FLO will liaise with static gear fishermen in the area to discuss installation timescales through their area of interest.

As the disturbance to fisheries is highly localised, and short term, the effects of temporary displacement/restricted access to commercial fishers within Inner Hebrides geographical area is not significant.

A Fisheries Liaison Mitigation Action Plan (FLMAP) (Appendix B) has been developed which considers the opinions of the fishing industry and stakeholders. The mitigation measures proposed will seek to minimise displacement and disturbance to commercial fishers within the Inner Hebrides geographical area as far as possible. The mitigation measures proposed in the FLMAP are summarised together with other proposed design measures in the MEA Section 8.

Cable burial to 1m is targeted for all routes, subject to seabed conditions. Clearance of 1NM (1.852km^2) around the cable vessel will be requested during the installation period, as accorded through the Submarine Telegraph Act 1885 Article 5 regulations and the vessel will exhibit appropriate cable working signals to prevent collisions at sea. Following installation, the cable may be exposed in some limited areas, or the trench may not have backfilled. Fishers should be aware that the cables may pose a hazard and charted submarine cables should be avoided. However, potential avoidance of the cable as a result of potential surface lay will be very localised and not significant.

Risk of Snagging

The risk of snagging and damage to the cables is increased in areas where bottom trawling and/or scallop dredging takes place. Where possible the cable corridors have followed the route of existing cables to reduce the area of seabed which is unavailable for trawling.

Cable burial to 1m is targeted for the entire Inner Hebrides geographical area cable installation. However, in areas where cable burial is not possible due to seabed conditions or crossing points, remedial protection may be required to help protect both the cable and other seabed users. The locations and types of potential external cable protection are not confirmed at the time of writing the MEA however, the potential options are described in Section 2 and include:

- Concrete mattresses;
- Rock placement
- Rock bags; and

There are no engineered cable crossings required within Inner Hebrides, therefore large deposits of rock will not be required. Discrete deposits of rock or concrete mattressing may be required to protect the cable. These deposits are likely to be in hard ground areas where burial cannot be achieved.

Guidance provided by the UKHO and International Convention for the Safety of Life at Sea (SOLAS) recommend that fishing vessels should avoid trawling over installed seabed infrastructure (UKHO 2020). Vessels are also advised in the Mariners Handbook not to anchor or fish (trawl) within 0.25NM of cables.

Should contingency cable protection be required for corridors within the Inner Hebrides geographical area, and vessels operate over the installed cable, the main fisheries to be affected would be shell fishermen and demersal fishers The locations and types of potential external cable protection are outlined in Section 2. However, given the best practice and compliance measures proposed in Section 2 – Project Description the effects of cable installation are not significant.

6.3.4 Other marine users

6.3.4.1 Potential pressure identification and zone of influence

The following pressures (Table 6-11) have been considered for other sea users.

Two potential pressures to other sea users have been included for further assessment. The zone of influence (the spatial extent over which effects may extend) has also been defined.

Key potential effects on recreational boating from the presence of installation vessels has been assessed in Appendix E and summarised in Section 6.2.4.

Table 6-11 Potential impacts and zone of influence – other sea users

Activity	Impact	Receiving environment	Zone of influence
Disturbance/restriction to access at landfalls	Temporary displacement/ restricted access	Recreational beach users	Within the application corridor / works area
Interaction to third-party assets	Damage to the functioning of the seabed asset	Existing asset owners	Footprint of relevant cable crossing point during installation.

6.3.4.2 Compliance Mitigation

The Compliance measures included relevant to other sea users are the same as those presented for shipping and navigation (Section, 6.3.1.2, Table 6-6).

6.3.4.3 Best Practice Mitigation

The Best Practice project mitigation relevant to other sea users are the same as those presented for shipping and navigation (Section, 6.3.1.3, Table 6-7).

6.3.4.4 Impact assessment

The installation activities are unlikely to pose a risk to other sea users and any potential effects are of a temporary nature. Following implementation of the mitigation measures outlined in Sections 6.3.4.2 and 6.3.4.3 above, the residual effects from the cable installation have been assessed as negligible.

Temporary displacement/ restricted access - all other sea users

Installation of the proposed Inner Hebrides cables in the intertidal zone at the landfall sites will be undertaken by trenching across the beach. Rock cutting is not currently planned however there may be a requirement for a short section (75m) for Route 2.13 Mainland landing point and Route 2.14 Mainland landing point (15m) to be cut within the Inner Hebrides Geographical Area.

An excavator will be used to excavate a trench down the beach to the low water mark. Where there are rock outcrops that cannot be avoided, rock cutting will excavate a 1m deep trench through the rock to allow burial.

Cable installation activities in the intertidal area will be temporary and localised. On completion of the cable burial the beach profile will be restored, and all machinery, equipment and personnel removed from site. Therefore, any impacts to beach users will be temporary and localised and is not expected to result in significant disruption or distraction to recreational beach activity. Therefore, impacts have been assessed as negligeable.

Interaction with 3rd party assets

The engineering of all crossings will be designed in accordance with industry best practice, namely International Cable Protection Committee (ICPC) Recommendation No.3. Furthermore, crossing designs will also be subject to crossing agreements with the individual cable owners. Asset owners will be notified in advance of operations in line with the individual crossing agreement or proximity agreement conditions.

6.4 Project specific mitigation

The following project specific mitigation has been proposed in this section:

- M3 - The marine archaeological technical report will be provided to MS-LOT ahead of any licensable activities taking place.

6.5 Conclusion

The effects of cable installation on the human environment have been assessed to be minor and not significant once design measures for the Project have been implemented. These best practice and compliance measures mean that the effects are minimised.

7. CUMULATIVE IMPACTS

7.1 Introduction

Scotland's National Marine Plan (Scottish Government 2015) policy GEN 21 Cumulative: Cumulative Impacts, require planning/public authorities and decision makers to consider whether the proposed Project is likely to contribute to significant adverse cumulative impacts.

Based on the requirements of the National Marine Plan, this Section identifies other plans or projects within proximity to the proposed Inner Hebrides cable corridors. Cumulative impacts are defined as '*impacts that result from incremental changes caused by other past, present, or reasonably foreseeable actions together with the projects'* (European Commission 1999).

For there to be a potential cumulative impact between the proposed installation and another project, plan or licensed activity there must be a common pressure-receptor pathway which overlaps spatially and to a certain degree temporally. A screening exercise was undertaken, presented below, to determine if any of the projects, plans and activities identified have:

- A common-pressure receptor pathway with the project;
- Activities, the effects of which overlap spatially with the project; and
- Activities, the effects of which overlap spatially and temporally with the project.

7.2 Data Sources

To identify the potential for cumulative impacts of the R100 Project within the Inner Hebrides geographical area the following information sources have been reviewed and plotted on to GIS (Figure 7-1, Drawing: P2308_CUMU-001-IH-A):

- MS-LOT Public register
- National Marine Plan interactive (NMPi)
- SEAFISH Kingfisher Bulletin (Issues 27, 32, 35 dated 2021)
- UKDEAL: Oil and gas industry information;
- Oil and Gas Authority: Oil and gas industry information;
- KIS-ORCA: Marine cables information; and
- The Crown Estate Scotland Website: Offshore wind farm and marine aggregate digital data.

7.3 Assessment Methodology

The proposed method for the assessment of potential cumulative impacts is based on 'A Strategic Framework for Scoping Cumulative Effects' (Marine Management Organisation 2014). The guidance sets out a two-stage approach to identifying cumulative impacts as summarised below:

- Task 1: Identification of activities, receptors, and pressures
- Task 2: Defining interactions within a specific scale

7.3.1 Task 1 - Identification of activities, receptors, and pressures

To first identify which projects and plans are likely to interact with the proposed Project cable corridors, it was established whether a common pressure-receptor pathway exists with the Project cable installation and other types of projects and plans. For there to be potential cumulative impacts, this Project and another project or plan must share a common pressure-receptor pathway which overlaps spatially and to a certain degree temporally. Based on professional judgement, projects and plans were grouped into categories and then each category was assessed to determine whether it would have a pathway likely to induce similar pressures as the Project activities. Where project categories had a pressure-receptor pathway, these were considered in further detail.

7.3.2 Task 2 - Defining interactions within a specific scale

The nature of a linear telecommunications cable project means that many potential pressures result in temporary or short-term and localised impacts restricted to an area smaller than the footprint of the Project cable corridors. The search area for other projects has been defined as anything within the 5km zone of influence from the Inner Hebrides cable corridors, herein referred to as the assessment search area. Although it is recognised that certain pressures may exceed this spatial extent these have been scoped out of the Marine Environmental Assessment (MEA) as they will have a negligible impact.

A review of projects identified in Section 7.4 was undertaken to identify any projects and plans that fall within or intersect the Inner Hebrides cable corridors.

7.3.3 Assumptions

It should be noted that the extent to which impacts of other projects can be assessed is dependent on the level of information available. The assessment is based on information available in the public domain or provided to the applicant at the time of writing this MEA Report (October 2021), as such the assessment relies on the accuracy of records sourced. This cumulative impact assessment considers activities associated with installation of the cable corridors proposed for the Inner Hebrides geographical area only.

7.4 Projects Considered

In addition to a review of information available on the Marine Scotland public register, GIS analysis of known infrastructure in the area was undertaken. A summary of the projects identified during this analysis is presented in Figure 7-1 (Drawing No. P2308_CUMU-001-IH-A) below. Table 7-1 and 7-2 outline the projects identified within the assessment search area which will be taken forward for further consideration.

Only projects extending over01/04/22 and 31/12/23 have been included. The application period is to December 2023, there may be further projects during that time that would fall into the assessment. Therefore, if the project completion date is likely to move beyond 31/12/23 then an addendum will be provided to assess any further impacts based on known projects at that time.

7.4.1 Marine Licence Public Registers

A review of the Marine Scotland Marine Licence Applications Public Register was undertaken in August 2021 to identify projects to be included in the assessment. Projects which had a license expiry date before January 2022 were not included as it is assumed that the licensable activity of these works will have taken place before the expiry date (any application variations with extended dates were included). All projects within the Inner Hebrides geographical area 5km assessment search area were considered for initial assessment. Table 7-1 below outlines the types of projects listed and establishes whether any are within the assessment search area or induce similar pressures to this Project and therefore may have an inter-project impact.

Marine Scotland provided a list of projects within the Inner Hebrides geographical area, these sites are listed below:

- Pipes and Cables – 3420 Scottish Water (Expired)

- Pipes and Cables – 5861 Scottish Water (Expired)
- Mooring- 4395 Mr Brown (Expired)
- Mooring – 4498 Mr Gourlay (Expired)
- Mooring – 4507 Mr Poett (Expired)
- Mooring – 4512 Mr Greer (Expired)
- Mooring – 5386 Scottish Sea Farms Ltd (Active)
- Mooring – 5655 Marine Harvest (Scotland) Ltd (Active)

However, these projects have not been included in the assessment as the status of these works is either active or expired. This indicates the projects have either been completed or there are no licensable activities being carried out. Additionally, it is assumed that there will be negligible effects between the works given the categories of the active projects.

Table 7-1 Proposed projects identified using MS-LOT within Inner Hebrides geographical area assessment search area (Marine Scotland 2021a)

Project Category	Name	MS LOT Reference Number	Distance to cable corridor (km)				Does project category induce similar pressures to R100?	Projects to be taken forward to assessment?
			Cable 2.13	Cable 2.14	Cable 2.15	Cable 2.16		
Construction, alteration or improvement of any works	Marine Licence - Slipway Remedial Works - Iona Ferry Terminal, Iona	00009009			0.6		Yes	No – The main impact of this project is the potential for seabed habitat loss. The project is located 600m from Cable Corridor 2.15 and has an area impact of 92m^2 therefore the projects will not interact. Additionally, this project has a limited seabed footprint and Argyll and Bute Council have deemed there are no foreseen impacts as it is maintenance of an existing slipway. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts.
Fish (including shellfish) farm	Marine Licence - Marine Farm - Port na Moralachd, Loch Linnhe, Argyll	00009017	2.3				No	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Mooring	Moorings - Port Appin, Argyll	00009047	0				Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has a limited seabed footprint. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts. This is also an existing site and the current licence application is to extend the existing licence.
Mooring	Mooring - Isle of Lismore	00009244		1			Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has a limited seabed footprint. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts.

Project Category	Name	MS LOT Reference Number	Distance to cable corridor (km)				Does project category induce similar pressures to R100?	Projects to be taken forward to assessment?
			Cable 2.13	Cable 2.14	Cable 2.15	Cable 2.16		
Mooring	Marine Licence - Existing Moorings	00009275		2.4			Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has a limited seabed footprint. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts.
Chemotherapeutant	Wellboat Discharge - Creran B, Loch Creran	06613		4.9			No	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Fish (including shellfish) farm	New Shellfish Farm - Poll nam Partan, Isle of Eigg	06775	4				No	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Fish (including shellfish) farm	Marine Licence - Marine Farm - Shuna Island, Loch Linnhe	00009254		4.9			No	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Mooring	16 Private Moorings - South Shian Bay, Loch Creran	06791/180912		2.8			Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has a limited seabed footprint. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts.
Pontoon	Existing Pontoon - South Shian, Loch Creran	06845		3.4			Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has a limited seabed footprint. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts. This is also an existing site and the current licence application is to extend the existing licence.

Project Category	Name	MS LOT Reference Number	Distance to cable corridor (km)				Does project category induce similar pressures to R100?	Projects to be taken forward to assessment?
			Cable 2.13	Cable 2.14	Cable 2.15	Cable 2.16		
Mooring	Existing Commercial Moorings- Rubha Dearg, Loch Creran	06878		5			Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has a limited seabed footprint. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts.
Mooring	Marine Licence - Moorings - Loch Nan Ceall, Arisaig - 00009373	00009373	4				Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has a limited seabed footprint. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts
Chemotherapeutant	Marine Licence - Wellboat Discharge - Colonsay, Isle of Colonsay	07002				2.3	No	No project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Pontoon	Marine Licence Application- Pontoon- Isle of Eriska, Benderloch	07058		1.7			Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has a limited seabed footprint. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts.
Mooring	Marine Licence - Moorings - Loch Staosnaig, Colonsay	07289				4	Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has a limited seabed footprint. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts.
Construction, alteration or improvement of any works	Fionnphort Harbour Redevelopment	N/A			0.6 (Iona) and 0.9 (Mull)		Yes	No – MS-LOT lists this project as Pre-Application stage. No application has been submitted at present and licence has not been granted yet. If the project progresses it will be required to include

Project Category	Name	MS LOT Reference Number	Distance to cable corridor (km)				Does project category induce similar pressures to R100?	Projects to be taken forward to assessment?
			Cable 2.13	Cable 2.14	Cable 2.15	Cable 2.16		
								the R100 project in its assessment of cumulative impacts.
Construction, alteration or improvement of any works	Screening Request – Fionnphort Breakwater and Overnight Berth	N/A			0.6 (Iona) and 0.9 (Mull)		Yes	No – MS-LOT lists this project as Pre-Application stage. No application has been submitted at present and licence has not been granted yet. If the project progresses it will be required to include the R100 project in its assessment of cumulative impacts.

7.4.1 Marine Scotland NMPi

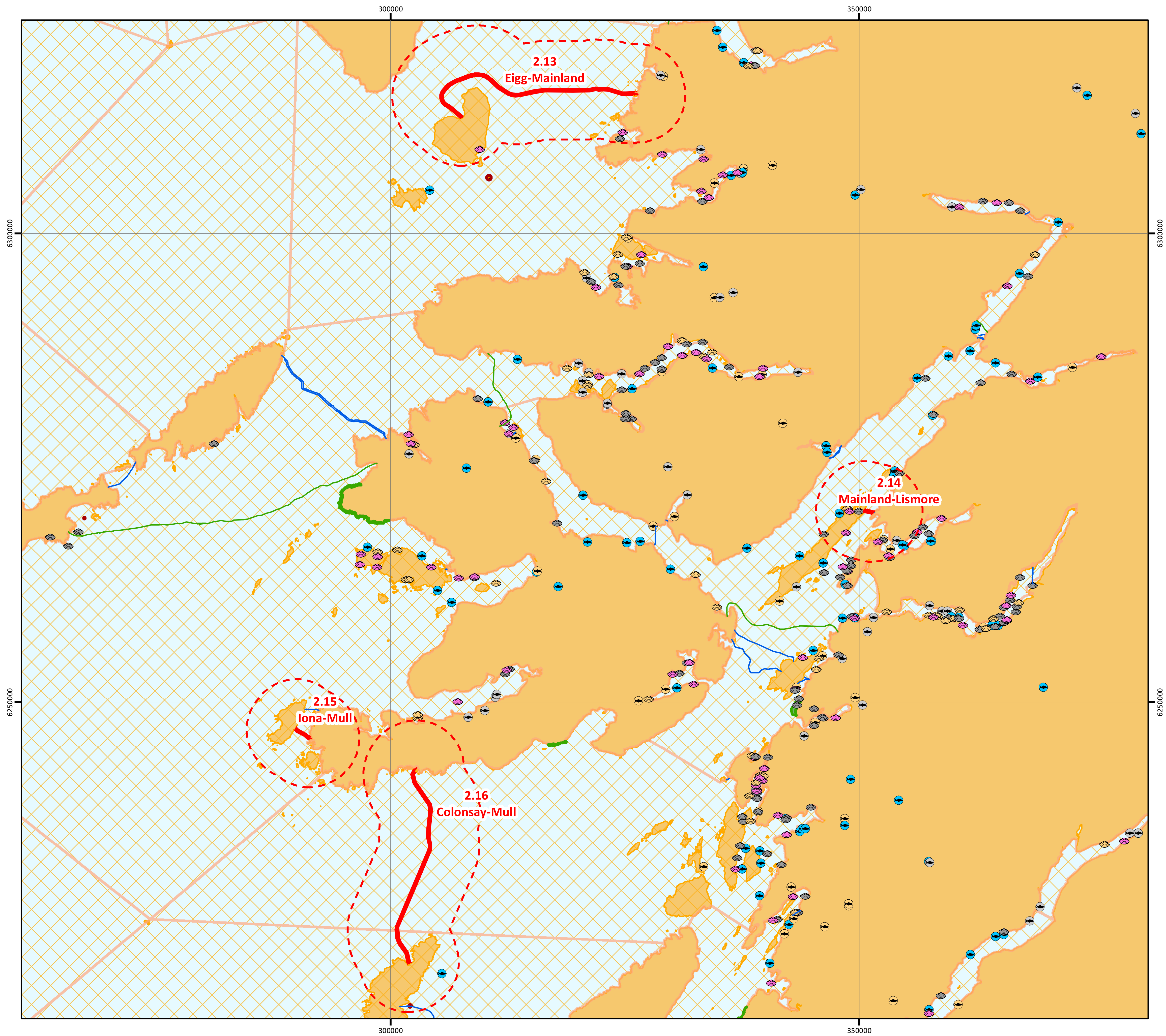
A review of the NMPi tool did not identify any other proposed projects or plans that would induce similar pressures and/or that were located within the assessment search area of the Inner Hebrides cable corridors (Marine Scotland 2021b).

7.4.2 GIS Search

In addition to the Marine Scotland public registers, GIS analysis of known infrastructure in the area was undertaken. Table 7-2 outlines the categories identified within the assessment search area of the Inner Hebrides geographical area, which will be taken forward for further consideration. A summary of the projects identified during this analysis is presented in Figure 7-1 (Drawing: P2308-CUMU-001-IH-A) below.

Table 7-2 Projects identified using GIS analysis within Inner Hebrides geographical area assessment search area

Project Category	No. of Applications	Does project category induce similar pressures to R100?	Are there any other to be taken forward to assessment?
Cables (Power) – Active	3	Yes	No – Cables are already installed and there are currently no other applications on MS-LOT to carry out planned maintenance on the existing cables.
Fish (including shellfish) farm - Active	12	No	No – project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Fish (including shellfish) farm - Inactive	8	No	No – project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Fish (including shellfish) farm – De-registered	5	No	No – project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Disposal (including sea disposal) – Closed	1	No	No – project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Military Practice Areas	4	Yes	No – there is no detail of specific planned operations online. Therefore, it is unlikely that interaction with activities will occur. Additionally, if unknown military exercises are planned, Notice to Mariners will be disseminated to inform other sea users (including military interests) of operations relating to the cable installation activities of the Inner Hebrides geographical region.



SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

CUMULATIVE IMPACT
Other Marine Users
Inner Hebrides

Drawing No: P2308-CUMU-001_IH	B

Legend

- Application Corridor
- 5km Zone of Influence
- Cables
  - Power
  - Telecom
- Aquaculture Site
  - Fish, Active
  - Fish, Inactive
  - Fish, De-Registered
  - Shellfish, Active
  - Shellfish, Inactive
  - Shellfish, De-Registered
- Seaweed Licence
- **Disposal Sites**
  - Closed
- **Military Practice Area**
  - Navy Department

N W E S

NOTE: Not to be used for Navigation

Date	18 October 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ONS; MS; KISCA; OGA; CES; CEFAS; UKHO; ESRI;
File Reference	J:\P2308\Mxd\14_CUMU\ P2308-CUMU-001_IH.mxd
Created By	Emma Kilbane
Reviewed By	Chris Dawe
Approved By	Paula Daglish

BT Global Marine intertek

0 5 10 15 20 km

7.4.3 Fishing Activity

Within the Inner Hebrides proposed cable corridors the key fishing activities are related to shellfish.. Shellfish are the most landed species with crab, European lobster, Norway lobster razor clam and scallop as target species. Static gear is widely used across the area in the nearshore region (within 6NM). The most landed shellfish species in the Inner Hebrides geographical area are Norway lobster, brown crab and scallops. Demersal fishing is low across the Inner Hebrides geographical area (See Appendix E for more information on Inner Hebrides fishing activities, Document Reference: P2308-R5436-Rev0-FAS).

Both scallop dredging and demersal fishing induce the pressures penetration and/or disturbance to the substratum on the surface of the seabed including abrasion, and abrasion/disturbance of the substratum below the surface of the seabed. As a result, there is the potential for the Inner Hebrides geographical area cable installations to have inter-project effects with scallop dredging and demersal fishing activity. Despite this, the Inner Hebrides cable installation will be a temporary and one-off disturbance. Furthermore, the installation of the Inner Hebrides cables would only induce these pressures on a narrow footprint on the seabed, therefore potential cumulative impacts with scallop dredging and demersal fishing activities will be highly limited and are therefore not considered further.

7.4.4 Relevant Projects

A total of 17 projects were identified using MS-LOT and 29 projects identified using GIS analysis that were within the assessment search area. The initial screening process of the projects did not identify any project needing further assessment as there were either no potential pathway receptors, the projects licences were expired or there were negligible effects. Therefore, an in-combination effect is not expected to occur in the Inner Hebrides geographical area.

7.5 Mitigation

No mitigation is proposed as no significant cumulative impacts have been identified.

7.6 Conclusion

Within each section of the MEA, design measures (compliance and best practice) are adhered to in the execution of the R100 Project. No significant cumulative impacts have been identified when considering other planned projects within the Inner Hebrides geographical area; no project specific mitigation has been proposed.

8. SCHEDULE OF MITIGATION

The R100 Project has been developed through an iterative process which involved seeking to avoid or reduce potential environmental effects through careful consideration of the routing of the marine cable. This was the first Project specific step in mitigating potential effects by seeking to avoid or reduce environmental disturbance as far as practicable.

The R100 Project within the Inner Hebrides Geographical Area includes a range of primary mitigation measures that have been 'designed' into the development proposals to demonstrate that the applicant will comply with national and international statute and best practice guidance as determined by the cable industry as a basic standard for how to proceed on a project. These design measures will help to reduce the effects of cable installation.

The design measures are detailed within each Section of the MEA (where relevant) and gathered in Table 8-1 below. Where project specific mitigation measures are required to further reduce the effects of cable installation, the mitigation measures have been proposed from within the MEA Report and supporting documents. The project specific mitigation measures are defined in Table 8-2 below. For clarity, each mitigation measure has been given an identification number and document reference for the source of the mitigation.

Design measures form part of the project. These can be:

Comp - Compliance measures which are undertaken to meet environmental, health and safety legislation, or;

BP - Best practice measures as a matter of good operating procedures or to comply with statute.

M – Mitigation introduced in this MEA Report which is project specific.

Table 8-1 Project design measures

ID	Aspect	Design Measure	Source
COMP 1	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Project vessels will comply with the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs) – as amended, particularly with respect to the display of lights, shapes and signals.	International Maritime Organisation
COMP 2	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	The dropped object procedure will be followed, and any unrecovered dropped objects must be reported to the relevant authority (MS LOT) using their dropped object procedure, within 24 hours of the project becoming aware of an incident.	MS-LOT
COMP 3	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	'As-laid' co-ordinates of the cable route will be recorded and circulated to the UK Hydrographic Office (UKHO), KIS-ORCA service and any other relevant authorities. Cables will be marked on Admiralty Charts and KIS-ORCA charts (paper and electronic format).	Maritime and Coastguard Agency
COMP 4	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Where weather reduces visibility then vessel masters shall adhere to MGN guidelines and COLREGS to prevent collisions at sea.	International Maritime Organisation
COMP 5	Physical Environment; ; Biological Section: Benthic and Intertidal Ecology	Ballast water discharges from Project vessels will be managed under the International Convention for the Control and Management of Ships' Ballast Water and Sediments standard.	International Maritime Organisation

ID	Aspect	Design Measure	Source
COMP 6	Biological Section: Benthic and Intertidal Ecology	Project vessels will be equipped with waste disposal facilities (sewage treatment or waste storage) to IMO MARPOL Annex IV Prevention of Pollution from Ships standards.	International Maritime Organisation
COMP 7	Biological Section: Benthic and Intertidal Ecology	Control measures and shipboard oil pollution emergency plans (SOPEPs) will be in place and adhered to under MARPOL Annex I requirements for all project vessels.	International Maritime Organisation
COMP 8	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Should the project create potential hazards to shipping (such as cables temporarily buoyed off or reduction in water depth) along the cable routes, stakeholders will be informed immediately via a NtM distribution list including Kingfisher to ensure safety is upheld.	Maritime and Coastguard Agency
COMP 9	Human Environment - Archaeology	The Crown Estate's 'Protocol for Archaeological Discoveries' (The Crown Estate, 2014) will be implemented during installation works;	The Crown Estate
COMP 10	Human Environment - Archaeology	The locations of any wrecks or features of archaeological significance discovered during the project will be provided to Historic Environment Scotland and the UK Hydrographic Office (UKHO).	UKHO
BP 1	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Early consultation with relevant contacts to notify of impending activity.	Global Marine
BP2	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Notice to Mariners will be published to inform sea users via Notices to Mariners, Kingfisher Bulletins and MCA and UKHO. Vessels will be requested to remain at least 1NM away from cable vessels during installation operations.	Maritime and Coastguard Agency
BP3	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	An onshore Fishing Liaison Officer (FLO) will be provided for the project. The FLO will follow the Fishing Liaison Mitigation Action Plan (FLMAP). The FLO will continue in this role during installation process.	Maritime and Coastguard Agency and Global Marine installation requirement
BP4	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	The UKHO will be informed of installation activities in order to issue navigational warnings via NAVTEX/VHF/MF as appropriate.	Maritime and Coastguard Agency
BP5	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Guidance provided by the UKHO and International Convention for the Safety of Life at Sea (SOLAS) recommend that fishing vessels should avoid trawling over installed seabed infrastructure (UKHO 2020). Vessels are advised in the Mariners Handbook not to anchor or fish (trawl) within 0.25NM of cables.	Maritime and Coastguard Agency and Mariners Handbook
BP6	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	If cables are buoyed off whilst the vessel departs the area, buoy positions will be notified to the NTM distribution list including Kingfisher and 0.25NM clearance will be requested.	NRA
BP7	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Coordination with local ferry Service and Coastguard Operations to provide 24-hour radio and radar coastal vessel traffic information which helps vessels navigate safely to help prevent collisions at sea.	NRA

ID	Aspect	Design Measure	Source
BP8	Physical Environment Biological Environment Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Rock bags/contingency protection measures will only be deployed where adequate burial cannot be achieved or as required by crossing agreements. The footprint of the deposits will be the minimum required to ensure cable safety and stability.	Crossing Agreements
BP9	Human Environment: Archaeology	The geophysical survey data will be reviewed by an appropriately qualified archaeologist. Appropriate archaeological exclusion zones (AEZs) will be assigned to anomalies identified with archaeological potential. These will be avoided. If it is not possible to avoid the AEZ completely, alternative mitigation will be proposed.	The Crown Estate 2021
BP10	Biological Environment Marine Birds; Marine mammals; Fish and shellfish; Protected sites	The installation vessels will be moving at a speeds less than 6 knots during installation activities. Typical installation speeds are likely to be 1knot for surface lay and 0.3 knots for plough installation.	Global Marine installation requirement
BP11	Human Environment: Commercial Fishing	Disruption claims will be handled in accordance with ESCA standard operating practices.	ESCA Guidance (No13, issue 11)
BP12	Biological Environment: Benthic and Intertidal Ecology	Route development and micro-routing has been used where possible to avoid or minimise the footprint of the application corridor routes through potentially sensitive habitats.	Global Marine installation requirement
BP13	Physical environment; Biological Environment: Benthic and Intertidal Ecology	Construction vehicle movement will be minimised as far as practical to minimise effects to compacting the beach; beach profile will be restored following cable installation.	Global Marine installation requirement
BP14	Biological Environment	The 'Guide to Best Practice for Watching Marine Wildlife' guidance will be followed where practicable	Global Marine installation requirement

Table 8-2 Project specific mitigation measures

ID	Aspect	Project specific mitigation	Source
M1	Chough	Following licence submission and confirmation by NatureScot Ornithology expert on the use of Cable Corridor 2.16 Colonsay to Mull (Colonsay landing point) by breeding chough, appropriate local mitigation will be agreed.	Protected Sites Assessment – Appendix C
M2	Red-throated diver	All vessels associated with the cable installation operations within Cable Corridor 2.13 Eigg to Mainland will follow the "Guide to Best Practice for Watching Marine Wildlife' guidance on birds where practicable and reduce their speed on approach to the cable corridor to below 6knots should rafting birds be observed ahead.	Protected Sites Assessment – Appendix C
M3	Archaeology	The marine archaeological technical report will be provided to MS-LOT ahead of any licensable activities taking place.	MEA Chapter 6 – Human Section

9. CONCLUSIONS

9.1 Introduction

The conclusions to the environmental appraisal for telecommunication cable installation within the R100 cable corridors, within the Inner Hebrides geographical area are presented below. The assessment has been undertaken for each individual marine licence application corridor within the MEA and supports each separate marine licence application for the Inner Hebrides geographical area. The standard width of cable to be installed across the majority of the routes is 45mm in diameter. The cable has a worst-case diameter of 150mm to include integrated protection and will only be installed where cable stability or additional protection is required. A 500m wide working corridor has been applied across each route to allow flexibility during installation to avoid any constraints within the cable corridor, should they arise.

Approximately 99% of international communications are carried by a network of cables under the sea. The reliance and critical importance of resilient telecommunications networks in recent times have been brought sharply into focus during the Covid-19 pandemic. Without reliable access to the internet, the ability for communications traffic, economic activity, emergency and essential services, radio and broadcast services and remote working is limited. The ability to communicate across the world without travelling has potentially further implications on reducing carbon footprint and mitigating the effects of climate change into the future.

The installation of the R100 telecommunication cables is of vital importance to improving essential services and connectivity for the Scottish Isles, both in the rollout of Broadband and 5G, but also as part of the greater network of cables supporting the global communications networks. It is generally recognised that the installation of telecommunications cables has benign effects in the marine environment.

The effects of cable installation activities from the installation of four complete cables within the Inner Hebrides geographical area are summarised by cable corridor in the sections below. During the appraisal, the worst case has been considered, therefore effects shall be as summarised below or less.

Based on the assessment methodology set out in Section 3, effects which are Negligible, Not Significant and Minor typically do not require mitigation measures other than compliance with environmental statute and best practice.

The effects of cable installation within the Inner Hebrides geographical area are considered to be not significant and adequately controlled by project design (best practice and compliance measures set out in Section 8 of the MEA). The residual effects of cable installation and mitigation measures proposed to minimise effects to the physical, biological and human environment are summarised in Table 9-1. The best practice, compliance and project specific mitigation proposed for each cable corridor is provided in full within each summary below and summarised in Table 9-1. Project specific mitigation has been proposed for installation where there is potential for significant effects. Project specific short-term disturbance effects have been identified for chough and project specific mitigation has been proposed to reduce significance of effects. In addition, the applicant has proposed project specific mitigation for red-throated diver as best practice.

9.2 Cable Corridor 2.13 Eigg to Mainland

Cable Corridor 2.13 Eigg to Mainland is between the Bay of Laig on the northwest coast of Eigg and is approximately 26.6km long. The cable route will be installed using an installation plough and/or surface lay (plus Post Lay Inspection and Burial by Jetting Sled and/or ROV) to a target depth of 1m, with no planned surface lay or external cable protection measures (contingency protection measures and surface lay have been included and assessed as a precaution including 10 rock bags, 3 mattresses [mattress will only be installed if requested by a third party as part of a crossing agreement]). There are no known cable crossings within the cable corridor. Within the intertidal area the cable will be buried to a target depth of 2m where practicable and subject to the tidal conditions on the day. Rock cutting may also be required for approximately 75m at the Mainland landing point. A marine grade cement such as Bentonite or similar will be used to backfill any areas where rock cutting has taken place. The worst-case footprint of the installation is approximately $0.07km^2$.

Five European sites have been considered for potential likely significant effects arising from works within Cable Corridor 2.13 Eigg to Mainland. Three of these protected sites are within the cable corridor; Inner Hebrides and the Minches SAC, Rum SPA, and the Sea of Hebrides NCMPA. Small Isles NCMPA (located 2.3km away) and Treshnish Isles SAC (located 44.7km away) were also assessed for potential significant effects. The assessment for four of the protected sites, Inner Hebrides and the Minches SAC, Treshnish Isles SAC the Sea of Hebrides NCMPA, and Small Isles NCMPA, concluded that no likely significant effect would occur. There is potential for temporary disturbance occurring to red-throated diver from the Rum SPA during the installation activities on the approach to the Eigg landing point, in the adjacent offshore waters. The duration of the installation activities within Cable Corridor 2.13 Eigg to Mainland may occur over 26 days (including contingency) for the route installation and burial from BMH to BMH. However, most of this time is contingency or transit time and cable installation activities will only occur for approximately 5-14 operational days within this time scale. Any disturbance will be short term and transient. The Protected Sites Assessment (Appendix C) concluded no likely significant effect on red-throated diver. Without prejudice to this conclusion, the Applicant has proposed project specific mitigation ID M2 as best practice.

The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.13 Eigg to Mainland, are provided in Section 8 Schedule of Mitigation and are as follows:

- M2 - All vessels associated with the cable installation operations within Cable Corridor 2.13 Eigg to Mainland will follow the "Guide to Best Practice for Watching Marine Wildlife' guidance on birds where practicable and reduce their speed on approach to the cable corridor to below 6knots should rafting birds be observed ahead.
- M3 - The marine archaeological technical report will be provided to MS-LOT ahead of any licensable activities taking place.

The effects to the physical, biological and human environment once design and project specific mitigation has been applied are summarised in Table 9-1. No lasting residual effects to the environment have been identified from installation operations within Cable Corridor 2.13 Eigg to Mainland.

9.3 Cable Corridor 2.14 Mainland to Lismore

Cable Corridor 2.14 Mainland to Lismore is between Port Appin, Mainland to the northeast tip of Lismore and is approximately 1.4km long. The cable route will be installed using installation plough and/ or surface lay (plus Post Lay Inspection and Burial by Jetting Sled and/or ROV) to a target depth of 1m, with no planned cable lay or external cable protection measures (contingency protection measures and surface lay have been included and assessed as a precaution including 10 rock bags, 3 mattresses [mattress will only be installed if requested by a third party as part of a crossing agreement]). There is one telecommunication cable crossing within the cable corridor, which will require Uraduct cable protection. No rock protection is required. Rock cutting may also be required for approximately 15m at the Mainland landing point. A marine grade cement such as Bentonite or similar will be used to backfill any areas where rock cutting has taken place. The worst-case footprint of the installation is approximately $0.004km^2$.

The cable corridor does not pass through any protected sites however, four European sites (Inner Hebrides and the Minches SAC, Treshnish Isles SAC, North Colonsay and Western Cliffs SPA and Rum SPA) and one NCMPA (Sea of Hebrides NCMPA) have been considered for potential likely significant effects arising from works within Cable Corridor 2.14 Mainland to Lismore. The duration of the installation activities within Corridor 2.14 Mainland to Lismore may occur over 30.5 days (including contingency) for the route installation and burial from BMH to BMH. However, most of this time is contingency or transit time and cable installation activities will only occur for approximately 5-14 operational days within this time scale. The potential for disturbance to protected birds, pinniped and cetaceans are short term and transient and there is no effect to the protected integrity of the sites. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.14 Mainland to Lismore, to reduce the effects of cable installation to not significant or ALARP are provided in Section 8 Schedule of Mitigation and are as follows:

- M3 - The marine archaeological technical report will be provided to MS-LOT ahead of any licensable activities taking place.

The effects to the physical, biological and human environment once design and project specific mitigation has been applied are defined in Table 9-1. No lasting residual effects to the environment have been identified from installation operations within Cable Corridor 2.14 Mainland to Lismore.

9.4 Cable Corridor 2.15 Iona to Mull

Cable Corridor 2.15 Iona to Mull is between Sligneach on the east coast of Iona, and Port Mòr on the southwest tip of Mull and is approximately 2.6km in length. The cable route will be installed using installation plough and/or surface lay (plus Post Lay Inspection and Burial by Jetting Sled and/or ROV) to a target depth of 1m, with no planned cable lay or external cable protection measures (contingency protection measures and surface lay have been included and assessed as a precaution including 20 rock bags, 3 mattresses [mattress will only be installed if requested by a third party as part of a crossing agreement]). There are no known cable crossings within the cable corridor. Within the intertidal area the cable will be buried to a target depth of 2m where practicable and subject to the tidal conditions on the day. Rock picking may also be required for a short section at the Mull landing point. The worst-case footprint of the installation is approximately 0.007km^2.

Five European sites have also been considered for potential likely significant effects arising from works within Cable Corridor 2.15 Iona to Mull. Two of these protected sites are within the cable corridor; Inner Hebrides and the Minches SAC, and the Sea of Hebrides NCMPA. Treshnish Isles SAC (located 16.1km away), North Colonsay and Western Cliffs SPA (located 22.8km away) and Rum SPA (located 63.9km away) were also assessed for potential significant effects. The duration of the installation activities within Cable Corridor 2.15 Iona to Mull may occur over 30.5 days (including contingency) for the route installation and burial from BMH to BMH. However, most of this time is contingency or transit time and cable installation activities will only occur for approximately 5-14 operational days within this time scale. Therefore, the assessment concluded that no likely significant effect would occur to the protected features of the site. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.15 Iona to Mull, to reduce the effects of cable installation to not significant or ALARP are given in Section 8 Schedule of Mitigation and are as follows:

- M3 - The marine archaeological technical report will be provided to MS-LOT ahead of any licensable activities taking place.

The effects to the physical, biological and human environment once design and project specific mitigation has been applied are defined in Table 9-1. No lasting residual effects to the environment have been identified from installation operations within Cable Corridor 2.15 Iona to Mull.

9.5 Cable Corridor 2.16 Colonsay to Mull

Cable Corridor 2.16 Colonsay to Mull passes from Kilvickeon Bay at the South of Mull to Kiloran Bay at the North of Colonsay and is approximately 23.6km in length. The route will be installed using installation plough and/or surface lay (plus Post Lay Inspection and Burial by Jetting Sled and/or ROV) to a target depth of 1m, with no planned cable lay or external cable protection measures (contingency protection measures and surface lay have been included and assessed as a precaution including 10 rock bags, 3 mattresses [mattress will only be installed if requested by a third party as part of a crossing agreement]). There are no known cable crossings within the cable corridor. Within the intertidal area the cable will be buried to a target depth of 2m where practicable and subject to the tidal conditions on the day. The worst-case footprint of the installation is approximately 0.06km^2.

The Cable Corridor 2.16 Colonsay to Mull passes through the Inner Hebrides and the Minches SAC, the North Colonsay and Western Cliffs SPA, the Sea of Hebrides NCMPA and the North Colonsay SSSI. A further two European sites (Cnuic agus Cladach Mhuile SPA and Rum SPA) have also been considered for likely significant effects arising from the works within Cable Corridor 2.16 Colonsay to Mull. The installation activities are short term and transient however project specific mitigation has been proposed to minimise the effects to site integrity. The duration of the installation activities within Cable Corridor 2.16 Colonsay to Mull may occur over 25 days (including contingency) for the route installation and burial from BMH to BMH. However, most of this time is contingency or transit time and cable installation activities will only occur for approximately 5-14 operational days within this time scale. Therefore, the assessment concluded that no likely significant effect would occur to the protected features of the sites, except for chough in the North Colonsay and Western Cliffs SPA and North Colonsay SSSI. There is potential for disturbance to protected breeding and non-breeding Chough from installation activities at Colonsay landing point within these sites, should chough utilise the landing point area. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.16 Colonsay to Mull, to reduce the effects of cable installation to not significant or ALARP are given in Section 8 Schedule of Mitigation and are as follows:

- M1 – Following licence submission and confirmation by NatureScot Ornithology expert on the use of Cable Corridor 2.16 Colonsay to Mull (Colonsay landing point) by breeding chough, appropriate local mitigation will be agreed.
- M3 - The marine archaeological technical report will be provided to MS-LOT ahead of any licensable activities taking place

The effects to the physical, biological and human environment once design and project specific mitigation has been applied are defined in Table 9-1. No lasting residual effects to the environment have been identified from installation operations within Cable Corridor 2.16 Colonsay to Mull.

9.6 Summary

In conclusion, the effects from the R100 Project cable installation to the Inner Hebrides geographical area have been assessed as not significant and adequately controlled by Project specific mitigation measures, compliance and best practice measures. The residual effects of cable installation with the proposed mitigation are summarised by route in Table 9-1 below.

Table 9-1 Conclusion of the residual effects of cable installation within the Inner Hebrides geographical area

Section	Potential Pressure	Potential Effect	Residual effect of Cable installation			
			Corridor			
			2.13 Eigg-Mainland	2.14 Mainland-Lismore	2.15 Iona-Mull	2.16 Colonsay-Mull
Physical Processes	Abrasion/disturbance at the surface of the substratum.	Disturbance to the seabed	Negligible	Negligible	Negligible	Negligible
	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion		Negligible	Negligible	Negligible	Negligible
	Siltation rate changes including smothering (depth of vertical sediment overburden)	Resuspension of sediments from the seabed into the water column and deposition	Negligible	Negligible	Negligible	Negligible
	Physical change (to another seabed type)	Reduction in extent of seabed sediments	Not Significant	Not significant	Not Significant	Not significant
	Local water flow (tidal current) changes	Scour and erosion / deposition of sediments to the seabed	Negligible	Negligible	Negligible	Negligible
Benthic and Intertidal Ecology	Abrasion/disturbance at the surface of the substratum.	Mortality, injury or disturbance to benthic habitats and species	Negligible	Negligible	Negligible	Negligible
	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Mortality, injury or disturbance to benthic habitats and species	Negligible	Negligible	Negligible	Negligible
	Physical change (to another substratum type)	Reduction in extent of reef habitats and sub habitats – Contingency external cable protection: Rock bags or mattressing	Negligible	Negligible	Negligible	Minor
Benthic and Intertidal Ecology	Siltation rate changes including smothering (depth of vertical sediment overburden)	Localised and temporary increase in turbidity and depth of sediment overburden.	Negligible	Negligible	Negligible	Negligible
Fish and Shellfish	Underwater noise changes	Basking shark / fish species	Negligible	Negligible	Negligible	Negligible

Section	Potential Pressure	Potential Effect	Residual effect of Cable installation			
			Corridor			
			2.13 Eigg-Mainland	2.14 Mainland-Lismore	2.15 Iona-Mull	2.16 Colonsay-Mull
	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion.	Disturbance of species with demersal life stages (sandeel)	Negligible	Negligible	Negligible	Negligible
Protected Sites and Species	Visual and above water noise disturbance	Disturbance to protected birds	Negligible	Negligible	Negligible	Not significant M1
	Visual and above water noise disturbance	Disturbance to pinniped	Negligible	Negligible	Negligible	Negligible
	Underwater noise changes	Injury to pinniped	Negligible	Negligible	Negligible	Negligible
	Underwater noise changes	Disturbance to pinniped	Negligible	Negligible	Negligible	Negligible
	Underwater noise changes	Disturbance to cetaceans (EPS) including minke whale harbour porpoise	Negligible	Negligible	Negligible	Negligible
Marine Archaeology	Abrasion/disturbance at the surface of the substratum	Damage to archaeological assets	Not Significant* M3	Not Significant* M3	Not Significant* M3	Not Significant* M3
	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion.	Damage to archaeological assets	Not Significant* M3	Not Significant* M3	Not Significant* M3	Not Significant* M3
Shipping and Navigation	Displacement of vessels due to avoidance of Project vessels	Temporary displacement due to the avoidance of Project vessels	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable
	Collision Risk	Damage to vessels and injury to personnel	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable

Section	Potential Pressure	Potential Effect	Residual effect of Cable installation			
			Corridor			
			2.13 Eigg-Mainland	**2.14 Mainland-Lismore**	**2.15 Iona-Mull**	**2.16 Colonsay-Mull**
	Accidental anchoring on surface laid cable	Damage to surface laid cable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable
	Project vessels blocking navigational features	Temporary displacement or restricted access	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable
	Extreme weather conditions	Cable installation risk	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable
	Reduced visibility	Cable installation risk	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable
Commercial Fishing	Temporary displacement/ restricted access	Reduction in fishing activity and increase in fishing effort	Not Significant	Not Significant	Not Significant	Not Significant
Other Sea Users	Temporary displacement / restricted access	Disruption to activities	Negligible	Negligible	Negligible	Negligible
	Damage to third-party assets	Physical damage to third-party assets	Negligible	Negligible	Negligible	Negligible
Cumulative Effects	Abrasion/disturbance at the surface of the substratum.	Disturbance to the seabed, support habitats and species	Not Significant	Not Significant	Not Significant	Not Significant
	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion		Not Significant	Not Significant	Not Significant	Not Significant
	Physical change (to another seabed type)		Not Significant	Not Significant	Not Significant	Not Significant

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