

BRITISH TELECOMMUNICATION PLC

R100 Scottish Isles Fibre-optic Project

Marine Environmental Appraisal - Shetland



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R100 Scottish Isles Fibre-optic Project

Marine Environmental Appraisal - Shetland

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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	ICG-C Intercessional Correspondence Group on Cumulative Effects
Favourable Conservation Status FEAST	ICG Intercessional Correspondence Group
Feature Activity Sensitivity Tool	ICPC International Cable Protection Committee
Fishing Liaison Mitigation Action Plan	INIS Invasive Non-indigenous Species
Fishing Liaison Officer	Intertek Intertek Energy & Water Consultancy Services
Fish Producers Organisation	IoM Isle of Man
GeMS Geodatabase of Marine Features adjacent to Scotland	IRL Ireland
GES Good Environmental Status	iSPM Inorganic suspended particulate material
GIS Geographical Information System	IUCN International Union for Conservation of Nature
Global Marine Global Marine Systems Ltd	JNCC Joint Nature Conservation Committee
GM Global Marine Systems Ltd	KIM Kilometre
GMG Global Marine Group	LAT Lowest Astronomical Tide
HDPE High Density Polyethylene	LF low frequency
HES Historic Environment Scotland	Long Term Effect Effects lasting fifteen to sixty years
HF High frequency	LSE Likely Significant Effect
HM Her Majesty	LWM Low Water Mark
HRA Habitats Regulations Assessment	M Metre
ICES International Council for the Exploration of the Sea	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

ORF

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	SEA
Post lay inspection and burial	Strategic Environmental Assessment
PLGR	SEL
pre-lay grapnel run	exposure to sound
PLN	SEPA
Port Letter Number	Scottish Environment Protection Agency
PLSE	Short Term Effect
Pre-Lay Shore End	Effects lasting one to seven years
PMF	SMWWC
Priority Marine Features	Scottish Marine Wildlife Watching Code
PSA	SNCB
Projects Protected Sites Screening Assessment	Statutory Nature Conservation Body
pSPA	SOLAS
proposed Special Protection Areas	Safety of Life at Sea
PTS	SPA
permanent threshold shift	Special Protection Areas
R100	SPL
Reaching 100%	sound pressure level
R100 Project Area	SSPO
Orkney, Shetland and Inner Hebrides	Scottish Salmon Producers Organisation
Orkney, Shetland and Inner Hebrides RBMP	Scottish Salmon Producers Organisation SSSIs
Orkney, Shetland and Inner Hebrides	Scottish Salmon Producers Organisation
Orkney, Shetland and Inner Hebrides RBMP River Basin Management Plans RC	Scottish Salmon Producers Organisation SSSIs Sites of Special Scientific Interest SWFPA
Orkney, Shetland and Inner Hebrides RBMP River Basin Management Plans	Scottish Salmon Producers Organisation SSSIs Sites of Special Scientific Interest
Orkney, Shetland and Inner Hebrides RBMP River Basin Management Plans RC Route Clearance RIFG	Scottish Salmon Producers Organisation SSSIs Sites of Special Scientific Interest SWFPA Scottish White Fish Producers Association TAC
Orkney, Shetland and Inner Hebrides RBMP River Basin Management Plans RC Route Clearance RIFG Regional Inshore Fisheries Group	Scottish Salmon Producers Organisation SSSIs Sites of Special Scientific Interest SWFPA Scottish White Fish Producers Association TAC Total Allowable Catch
Orkney, Shetland and Inner Hebrides RBMP River Basin Management Plans RC Route Clearance RIFG Regional Inshore Fisheries Group RNLI	Scottish Salmon Producers Organisation SSSIs Sites of Special Scientific Interest SWFPA Scottish White Fish Producers Association TAC Total Allowable Catch
Orkney, Shetland and Inner Hebrides RBMP River Basin Management Plans RC Route Clearance RIFG Regional Inshore Fisheries Group RNLI Royal National Lifeboat Institution	Scottish Salmon Producers Organisation SSSIs Sites of Special Scientific Interest SWFPA Scottish White Fish Producers Association TAC Total Allowable Catch TTS temporary threshold shift
Orkney, Shetland and Inner Hebrides RBMP River Basin Management Plans RC Route Clearance RIFG Regional Inshore Fisheries Group RNLI Royal National Lifeboat Institution ROV	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
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	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
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	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
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	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
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	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
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	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
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	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



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 five cables within the Shetland region.

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 area 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 Shetland geographical area, Figure 1-2: Project Location Overview (Drawing reference P2308-LOC-001-D_SH); Cable 2.3 (between Sanday and Shetland), mean high water springs (MHWS) to MHWS, is being considered in this MEA.

Within Shetland, the Project proposes installation of five subsea fibre-optic cables between MHWS at the following landfall locations:

- Cable 2.1 Yell to Unst
- Cable 2.2 Shetland to Yell
- Cable 2.3 Sanday to Shetland
- Cable 2.4 Fair Isle to BU
- Cable 2.8 Shetland to Whalsay

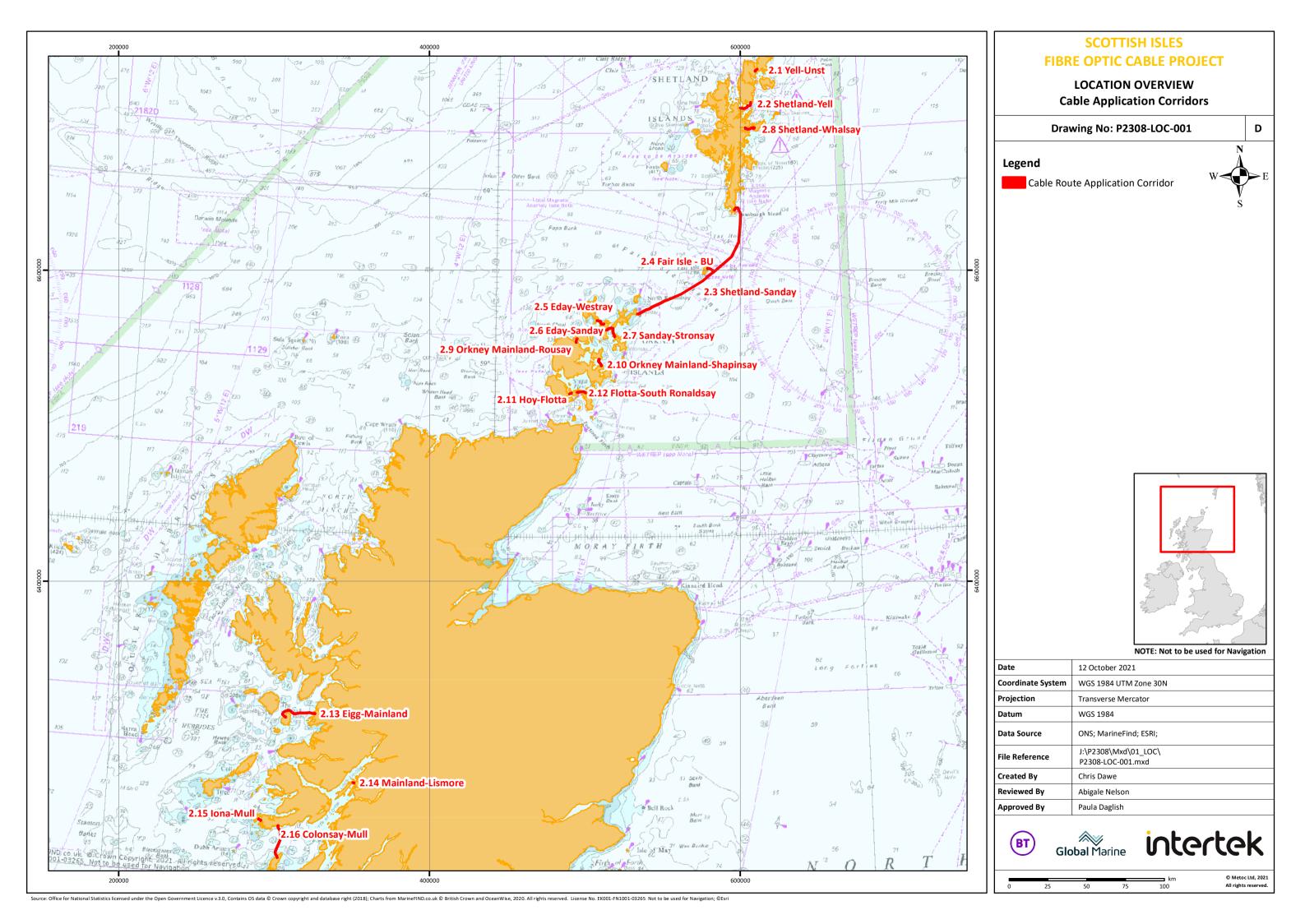
Each cable listed above will have a separate marine licence application supported by this MEA and supporting documents. Each cable marine licence application will be for an application corridor, hereafter referred to as the cable corridor. The cable corridor covers a width of 500m within which the cable 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.

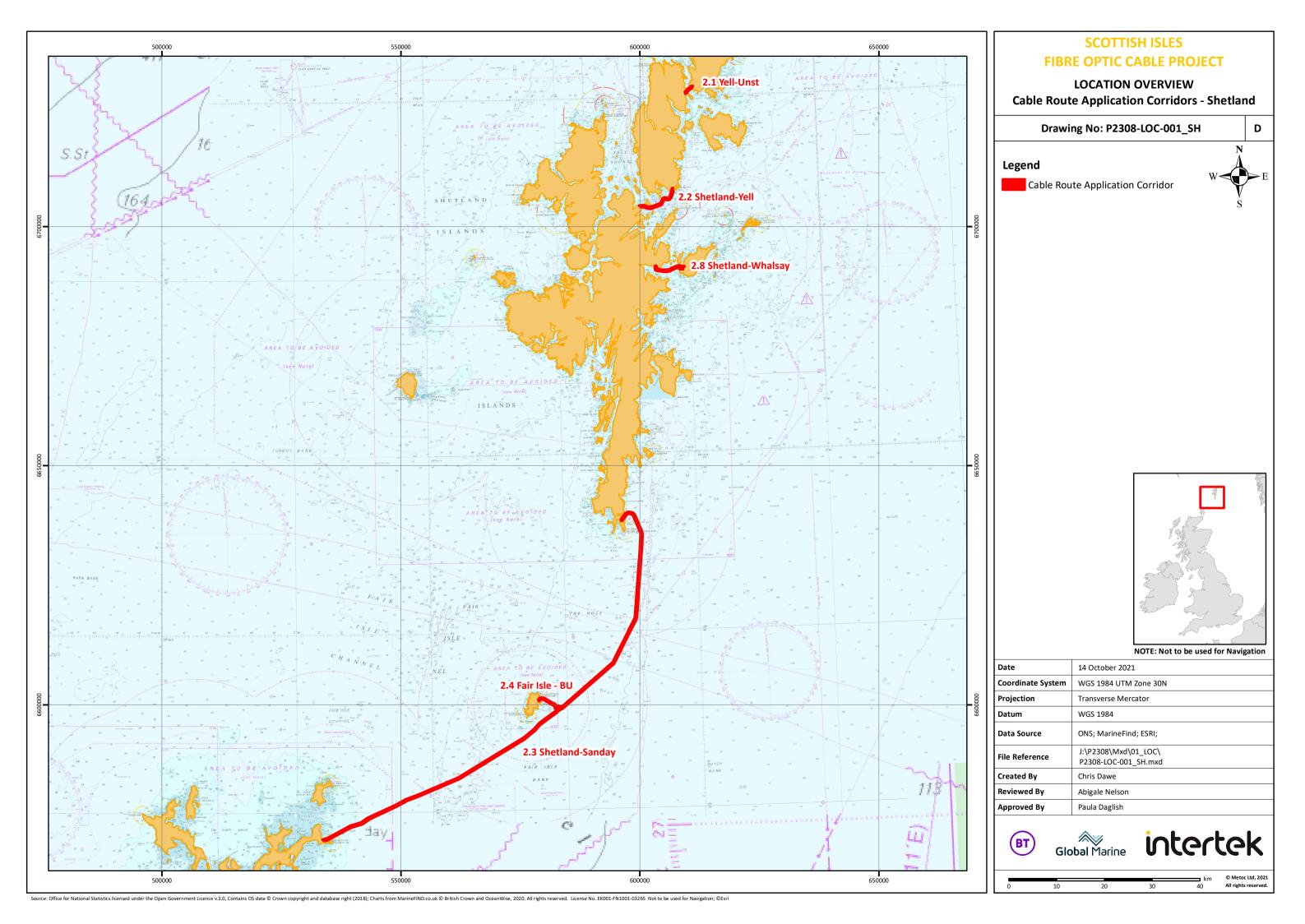




Cable Corridor 2.3 – Shetland to Sanday, crosses between the Shetland and Orkney geographical areas. As the cable corridor lies predominantly in the Shetland region it has been assessed as part of the Shetland MEA, but is also mentioned within the Orkney application documents and assessment findings regarding Corridor 2.3 in Orkney waters can be found in the Shetland MEA report.

The Project is anticipated to take approximately two-three months within the Shetland 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.







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 Scottish 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 The United Nations Convention on the Law of the Sea

The United Nations Convention on the Law of the Sea (UNCLOS) makes it a requirement for activities to be assessed if they have the potential to cause significant and harmful changes to the marine environment. UNCLOS has developed best practice measures to minimise effects from marine operations. These measures will be applied where possible through the project activities.



1.4.6 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.

1.4.7 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.

1.4.7.1 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.

1.4.7.2 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.

1.4.7.3 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.

1.4.8 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). All Cables within the Shetland Islands (Cables 2.1, 2.2, 2.3, 2.4 and 2.8) are within the Shetland Isles 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.

1.4.9 Shetland Local Development Plan

The cables outlined in Section 1.2 above fall within the area of the Shetland Local Development Plan (LDP), which was adopted in 2017. The most recent development plan is 2014, with a new plan scheduled for release in March 2022. For coastal areas, the protection of the coastal zone for fishing and recreation, and the areas natural cultural designations are most important. The plan details several natural heritage, historic environment and coastal development policies in relation to the coastal area against which any planning application will be assessed (Shetland Islands 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; and
- 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 Desktop 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.

1.5.0 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 2.1 Yell Unst; and Route 2.3 Sanday to Shetland (within Sanday SAC)
- Intertidal survey all proposed landing points
- Phase 1 Habitat Surveys
- Otter Surveys
- Archaeological walkover survey (geophysical)

1.5.1 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 stakeholders (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. Consultation responses received are provided in Appendix B.

1.5.1.1 NatureScot

Consultation has 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 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 and meeting notes are provided in Appendix B.

1.5.1.2 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).

1.5.1.3 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).

1.5.2 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).

1.5.3 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).

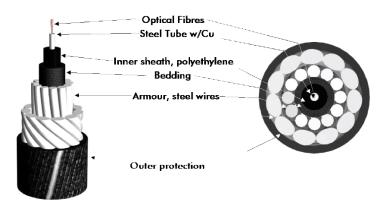
All products, equipment and/or vessel specifications detailed in this section are indicative. In the event that the Project does not/cannot use the specified equipment similar products will be selected.

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's will be constructed for all landing points. Details of the landing points are provided in Table 2-1.

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

Cable Segment	Landing Point	Estimated BMH Latitude	Estimated BMH Longitude	Cable lengths (km)
2.1	Yell	60° 40.348' N	0° 59.841' W	2.5km
	Unst	60° 41.121' N	0° 58.085' W	
2.2	Shetland	60° 27.698' N	1° 10.903' W	9.65km
	Yell	60° 29.650' N	1° 3.537' W	
2.3	Shetland	59° 52.347' N	1° 17.064' W	109.87
	Sanday	59° 16.858' N	2° 24.350' W	
2.4	Fair Isle	59° 32.237' N	1° 36.348' W	5.29km
	BU	59°31.4371'N	1°32.3124'W	
2.8	Shetland	60° 20.968' N	1° 7.556' W	7.27km
	Whalsay	60° 20.731' N	1° 1.450' 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 and some targeted and limited
 UXO survey undertaken where necessary to verify routes are safe.
- 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.

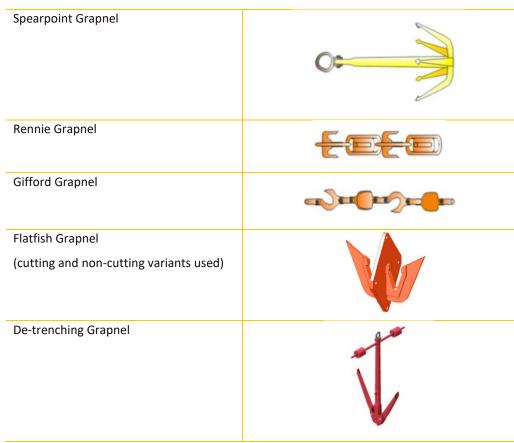
A range of cable recovery tools will be available for use, typically a 'Flatfish' cutting grapnel, detrenching grapnel, and 'Rennie and Gifford' grapnel (see Figure 2-2), together with the necessary rigging equipment. In summary, route clearance operations shall include:

- 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

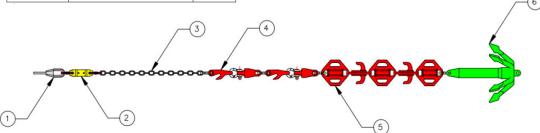


A PLGR 'Grapnel Train' (Figure 2-3) will be deployed from the vessel to the seabed and the vessel will manoeuvre along the planned cable route paying out grappling rope/winch wire. The amount of grappling rope/winch wire to be paid out will be dependent on the depth of water. Once the grapnel train has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

2.5.1.4 Multicat (or similar)

A multicat (Figure 2-5) 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 2-5 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 2-6 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 2-7).

Figure 2-7 Typical shallow water vessel



2.5.1.7 Rock-placement vessel

In addition to the possible cable protection rock berm at the power cable crossings (subject to crossing agreement requirements), additional rock may be required along the cable corridor 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 Shetland geographical area, the first shore end will be landed. At the time of writing is it not known which cable within Shetland 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.

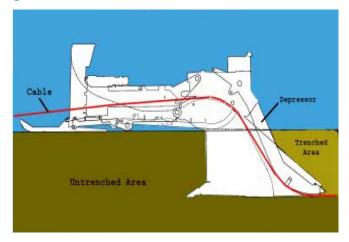
2.5.2.2 Plough installation

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.

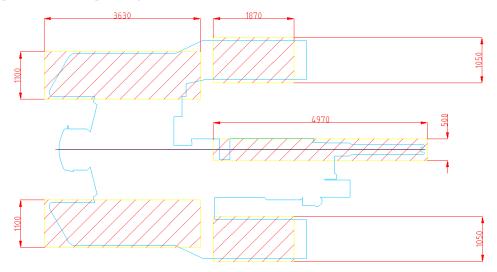


Figure 2-9 Plough schematic



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 for any landing points within the Shetland geographical area.

2.7 Post Lay Inspection and Burial

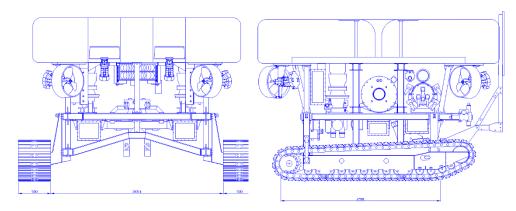
On completion of cable laying and plough burial operations there will be areas along the route where it has not been possible to utilise the plough such as In-Service cable crossings where the cable has been surface laid over the third-party cable. These areas of cable will be buried by means of a jetting 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 are four known cable crossings required within the cable corridors within the Shetland geographical area. The cable crossings are outlined in Table 2-2 below. An engineered cable crossing including rock protection, is only likely to be 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). Indicative rock berm dimensions are:

- Pre lay rock placement: Length 30m (15m either side), width 13m
- Post lay rock placement: Length 40m (20m either side), width 10m
- Total height: 1.7m

All crossings will be designed in accordance with industry best practice (namely ICPC Recommendation No.3.). Crossing designs would also be subject to crossing agreements with the individual cable asset owners. Asset owners would be notified in advance of installation operations in line with the individual crossing agreement conditions.

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

Table 2-2 Known crossings within the Shetland geographical area

Route	Asset	Owner	Туре
2.2	Mossbank- Yell	SSEN	Power
2.3	Havfrue Crossing	Aqua Comms	Telecoms
	Atlantic Crossing Seg A	Century Link	Telecoms
	Proposed power cable Shetland HVDC Link	SSEN	Power



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

Table 2-3 Indicative articulated pipe lengths required for each landfall within the Shetland geographical area

Cable Route	Landfall	Length of Articulated Pipe (BMH to 10m depth contour)*
2.1	Yell	197m
	Unst	434m
2.2	Shetland	1070m
	Yell	346m
2.3	Sanday	766m
	Shetland	1695m
2.4	Fair Isle	265m
2.8	Shetland	59m
	Whalsay	64m

^{*}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

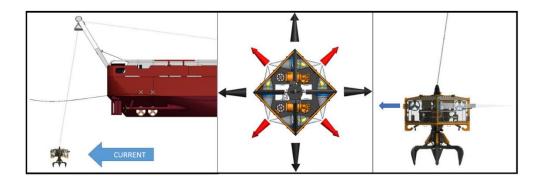
There is currently no plan for any boulder removal activity on any of the R100 cable routes however, it may be necessary a limited number of targeted boulders from the cable route to allow adequate burial to be achieved during cable installation. If required, this will be undertaken using a crane on 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 2-5 below.

Figure 2-18 Concrete mattress



2.10.3 Rock bags

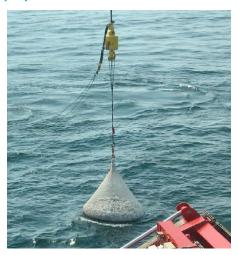
Rock bags are typically installed on top of the cable and are sized to suit each scenario dependant on current speeds and environmental conditions (Figure 2-19). The size and weight of the rock bags to be used will ultimately be dependent on the findings of the Cable Burial Assessment (CBA) and post 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 2-5 below). Typical dimensions of the rock bags likely to be used for R100 are shown in Table 2-4 below.



Table 2-4 Typical rock bag dimensions

Туре	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	1.24m³	3.1ms ⁻¹	4.6 ms ⁻¹
4 T Model	25mm	50*200mm	13kg	2.4m	0.6m	2.5m³	3.4ms ⁻¹	5.2 ms ⁻¹
8 T Model	50mm	75*200mm	48kg	3.0m	0.7m	5.0m³	3.9ms ⁻¹	5.8 ms ⁻¹

Figure 2-19 Rock bag deployment



2.10.4 Rock placement

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 Shetland geographical area consists of five 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 2-5. Table 2-5 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 required at the time of installation if required.



Table 2-5 Summary of installation methods and footprints per licence application

Cable Route	PLGR / RC Note 1	Approxim	nstallation method ^{Note 2} approximate footprint of installation width of tool x length of installation)					Contingency measures (worst case deposits)		
		Surface lay Note 3	Plough Note 4 2.6m wide x length of cable corridor	Trenching 2m deep x width of excavator bucket (assumed to be 2m)	Rock Berm Note 5 Worst case footprint: Height 1.7m (total) Length 40m (20m either side) Width 13m	ROV Note 6	Boulder relocation Note 7	No. Rock Bags Note 8 3m diameter = 7m² per rock bag (8T bag)	No. Concrete Mattress Note 9 6m x 3m = 18m² per mattress	
Cable 2.1 – Yell to Unst	✓	✓	0.005km²	√		✓	√	28 bags 196m²	3 mattress 54 m ²	
Cable 2.2 – Shetland to Yell	✓	✓	0.028km²	✓	1 power crossing 0.00052km²	√	✓	66 bags 462m²	3 mattress 54 m ²	
Cable 2.3 – Sanday Shetland	✓	✓	0.28km²	✓	1 power crossing 0.00052km²	√		186 bags 1302m²	12 mattress 216 m ²	
Cable 2.4 – Fair Isle to BU	✓	✓	0.013km²	✓		√		13 bags 91m²	3 mattress 54 m ²	
Cable 2.8 – Shetland to Whalsay	✓	✓	0.017km²	✓		✓	✓	32 bags 224m²	3 mattress 54 m ²	

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: In sections of the corridors where burial cannot be achieved, the cable may need to be surface laid for short sections of the route. As the length of these sections is not defined, the worst-case installation footprint of the plough has been used for assessment purposes using the full length of the cable given in Table 2-1.

Note 4: 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. This footprint is the worst case footprint of installation. As plough installation will not be used for the entire length of the installation route this footprint is precautionary – see note 3.

Note 5: Rock berm are only required for power cable crossings. Telecom crossings only require Uraduct as a separation and protection (Section 2.9.1).

Note 6: ROV dimensions are indicative of typical equipment used by Global Marine during cable installation for all sections of the route

Note 7: Boulder relocation is not planned and will only be undertaken, if necessary, as outlined in Section 2.3.1.

Note 8: Where rock is present across the route and the cable needs to be surface laid, the worst-case number of rock bags (assumed to be 1 every 50m) has been included for assessment purposes. The number of bags per cable route have been given based on the following potential % of no burial within the cable corridor: Route 2.1 - 84%; Route 2.2 - 46%; Route 2.3 - 43%; Route 2.4 - 43%; Route 2.8 - 66%.

Note 9: To allow flexibility within the installation process the applicant has included a contingency deposit of concrete mattressing per cable corridor.



2.12 Indicative Programme

Following approval of the Marine Licence applications, cable installation is currently planned scheduled to commence in the Q2 2022 and be complete by the end of the year. Timings may vary due to weather and/or other operational reasons such as conditions found during survey. Indicative durations for the licensable activities, including contingency time are outlined in Table 2-6 below. Cable installation for the routes within the Shetland geographical area will take between 22 and 24 days per route with the exception of Route 2.3 and 2.4 which will take longer due to longer cable route and crossing construction (Route 2.3) and branching unit integration (Route 2.4). This is not the timescale for an installation vessel to be on site within the corridor but are for worst case timings for each activity. Activities within the same cable corridor can occur simultaneously and marine works are likely to be completed within approximately 7-17 days per cable corridor (with exception of Route 2.3), this includes cable installation beach works up to 7 days per cable landing.

Table 2-6 Worst case indicative timing of works

Activity (No of days)	PLGR	Cable Lay (including cable landing)	PLIB	Diver/ ROV pre installation Survey	Diver/ROV post install survey and Shore End Burial	Contingency (Rock Bags/ Matressing/ rock placement)
Cable 2.1 – Yell to Unst	4	1.5	0.5	2	14	2
Cable 2.2 – Shetland to Yell	2.5	1.5	1	2	14	2
Cable 2.3 – Shetland to Sanday	6.5	13	6.5	15	21	2
Cable 2.4 – Fair Isle to BU	5	2	2	15	21	2
Cable 2.8 – Shetland to Whalsay	1	2	1	2	14	2

^{*}Contingencies will be carefully engineered in water depths less than 10m and therefore will not reduce the depth by 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 Shetland 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 2-7 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 2-7 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).	ИКНО



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 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
BP8	Physical, Biological, Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Rock berms and bags 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 rock berm 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)



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	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



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 process and presents its findings and conclusions. To assess the significance of the effect of the marine licensable activities of the cable installation process on the environment the appraisal followed 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 5 Shetland 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 definitions¹ of significance have been used in the assessment, derived from EPA guidance² 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
- Task 2: Defining interactions within a specific scale

² EPA. (2017). Guidelines on the information to be contained in environmental impact assessment reports.



2

¹ Adapted from EPA (2017)



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 Shetland 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 Shetland 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 within the Shetland geographical area. 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 Shetland 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 Shetland 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 Shetland geographical area and to enable the identification of areas where the physical environment 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

Shetland is located in the North Atlantic Ocean between Norway, the Faroe Islands and Scotland (Orkney Isles). Fair Isle is located between the Faroe Islands and Scotland (Orkney Isles). The Fair Isle Gap is located between Shetland and the Orkney Isles.

Shetland is characterised by relatively highly energetic conditions, resulting in strong tidal currents and frequent severe storms given its exposure to the North Atlantic and North Sea. As a result, sediments largely consist of sands and gravel, with exposed rock (Neill et al 2017).

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 islands

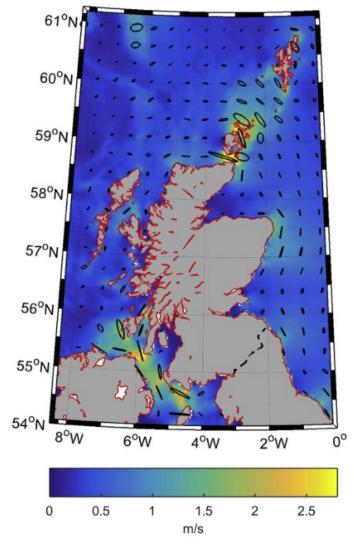


comprising the Shetland archipelago contain numerous narrow inter-island tidal channels with strong tidal flows, including Yell Sound, Bluemull Sound and Colgrave Sound, and between Whalsay and the mainland.

The main flood stream east of the Shetland Islands flows to the south and around low water, the flow direction is to the north.

Figure 4-1 shows the simulated spring tidal current amplitude around Scotland taken from Hashemi et al. (2015). Tidal currents within the Shetland Islands are generally < 1.0ms⁻¹ with the exception of flow around headlands and within channels 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 2.1 - Yell - Unst

Cullivoe, Yell has a spring and neap tidal range of 1.8m and 0.8m, respectively (TotalTide, 2021). In Bluemull Sound between Yell and Unst, a strong funnelling effect occurs (Halliday, 2011), which creates strong tidal currents reaching approximately 2.7ms⁻¹ (Global Marine, 2021), while velocities peak at approximately 1.5ms⁻¹ and 0.2ms⁻¹ in the vicinity of the Yell and Unst landfalls, respectively, as shown in Figure 4-2.



Cable Corridor 2.2 - Shetland - Yell

Burra Voe (Yell Sound), Yell has a spring and neap tidal range of 1.9m and 0.9m, respectively, while Toft Pier, Shetland has a spring and neap tidal range of 1.9m and 1.9m, respectively (TotalTide, 2021).

Current speeds along the proposed cable corridor peak at approximately 3.0ms⁻¹, while velocities peak at approximately 3.0ms⁻¹ and 0.2ms⁻¹ in the vicinity of the Shetland and Yell landfalls, respectively, as shown in Figure 4-3 (Halliday, 2011).

Cable Corridor 2.3 - Shetland - Sanday

Kettletoft Pier, Sanday has a spring and neap tidal range of 2.6m and 1.2m, respectively, while Sumburgh (Grutness Voe), Shetland has a spring and neap tidal range of 1.4m and 0.7m, respectively (TotalTide, 2021).

Current speeds along the proposed cable corridor peak at approximately 2.5 ms⁻¹ and 1.25ms⁻¹ during a spring and neap, respectively, with the highest current speeds observed in the vicinity of the Sanday landfall (ABPmer, 2017).

Cable Corridor 2.4 – Fair Isle – Branching Unit (BU)

Fair Isle has a spring and neap tidal range of 1.6m and 0.7m, respectively (TotalTide, 2021).

Current speeds along the proposed cable corridor peak at approximately 1.25ms⁻¹ and 0.75 ms⁻¹ during a spring and neap tide (ABPmer, 2017), respectively between Fair Isle and the spur with the Shetland to Sanday proposed cable, however, in the vicinity of the proposed cable landfall on Fair Isle at North Haven, the currents are likely to be lower.

Cable Corridor 2.8 - Shetland - Whalsay

Dury Voe, Shetland has a spring and neap tidal range of 1.8m and 0.7m, respectively (TotalTide, 2021).

Current speeds along the proposed cable corridor peak at approximately 1.5ms⁻¹, while velocities peak at approximately 1.5ms⁻¹ and 0.4ms⁻¹ in the vicinity of the Whalsay and Shetland landfalls, respectively (Halliday, 2011).

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)
Fair Isle	2.2	0.6	1.6	1.7	1.0	0.7
Kettletoft Pier, Sanday	3.5	0.9	2.6	2.8	1.6	1.2
Sumburgh (Grutness Voe), Shetland	1.8	0.4	1.4	1.4	0.7	0.7
Cullivoe, Yell	2.4	0.6	1.8	1.9	1.1	0.8
Burra Voe (Yell Sound), Yell	2.3	0.4	1.9	1.8	0.9	0.9
Toft Pier, Shetland	2.3	0.4	1.9	1.8	0.1	1.0
Dury Voe, Shetland	2.1	0.3	1.8	1.6	0.9	0.7



S Project Shetland Islands Wave and Tidal Resource Assessment Key
12 nautical mile limit
Maximum velocity (mile) te use of text boiles on the map base! rea Bluemull Sound

Figure 4-2 Maximum tidal velocities within Bluemull Sound (Halliday, 2011)



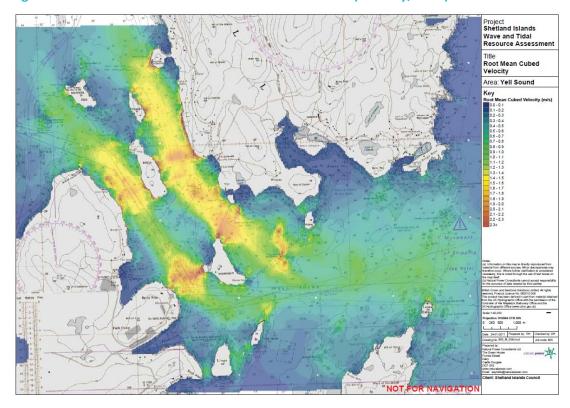


Figure 4-3 Maximum tidal velocities within Yell Sound (Halliday, 2011)

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 wave climate is dominated by waves from two sectors; 60% are experienced from 120°N and 240°N with 30% of wave conditions experienced from 340°N to 40°N (Ramsay and Brampton, 2000). Significant wave heights of up to 8m can be experienced from both directional sectors. Beyond these directional sectors, there is little wave action due to the shelter provided by the Shetland Islands to the west and the relative lack of strong wind from due east (Ramsay and Brampton, 2000).

Dominant swell wave conditions are experienced from the north with over 40% of swell conditions occurring from between 340°N and 20°N with significant swell waves (> 4m) restricted to only a few narrow directional sectors to the south-east and north.

Table 4-2 below shows the total sea and swell extreme significant wave heights east of Shetland, while Figure 4-4 shows the annual wave height around Shetland. It can be seen that Shetland itself affords some protection from the prevailing wave directions with wave heights in the vicinity of the proposed cable corridors (with the exception of Cable Corridor 2.3 – Shetland to Sanday) < 0.8m. The degree of severity of wave conditions at the shoreline depends very much on the orientation of the beach with very few beaches on the east coast orientated such that they are directly exposed to severe offshore wave conditions (Ramsay and Brampton, 2000).



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

Return Period (Years)	Total sea extreme significant wave height (m)	Total swell extreme significant wave height (m)
1	9.28	4.18
10	10.88	5.09
100	12.36	5.94



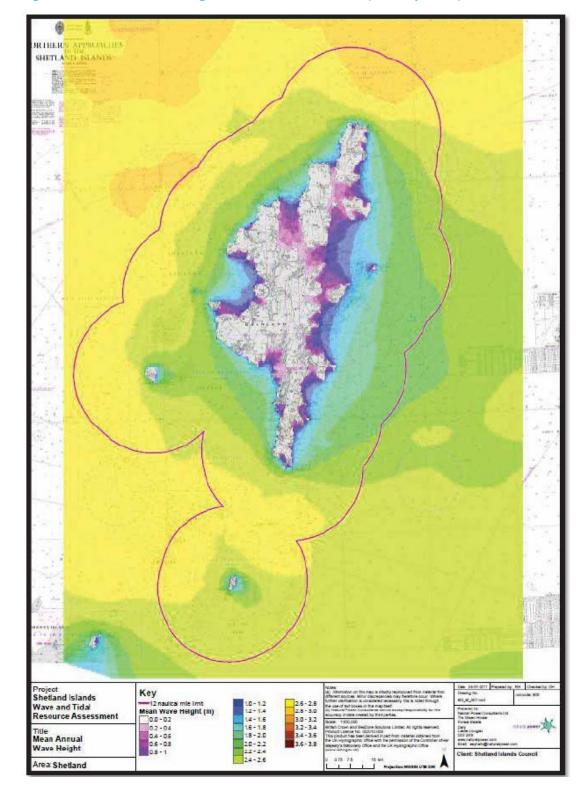


Figure 4-4 Annual wave height around Shetland Island (Halliday, 2011)

4.2.2.3 Wind

Fair Isle is a relatively exposed location, and, therefore, experiences more variable and sometimes more adverse wind conditions (Global Marine, 2021). In terms of direction, winds are well distributed with the greatest percentages of winds coming from between the south and east, and the west and



north by northwest. Speeds are generally higher, with the majority of occasions remaining between 6ms⁻¹ and 18ms⁻¹ at a total of 32%. However, winds of gale force and above are also frequent, occurring on 23% of occasions (Global Marine, 2021).

At Lerwick, the prevailing winds come from the south and to a lesser extent the north, with other peaks to the west and northeast. Speeds are predominantly in the 6-12ms⁻¹ range, at just over 32% of occasions. Calms of between 0-6ms⁻¹ occur 18% of the time, with gales occurring on 24% 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).

Salinity in this region is approximately 35.2ppt in both summer and winter, reflecting the Atlantic Ocean origin of waters throughout the year (Turrell, 1992), which is marginally higher 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 4-5 below.



UK average sea level change Pattern of change at 2100 RCP2.6 1.0 0.8 Sea Level Change (m) 0.6 0.4 0.2 0.0 2000 2020 2040 2060 2080 2100 0.5 0.6 Year RCP4.5 1.0 Sea Level Change (m) 0.2 0.0 2000 2020 2040 2060 2080 2100 0.3 0.5 0.6 0.7 Year RCP8.5 1,0 0.8 Sea Level Change (m) 0.6 0.4 0,2 0.0

Figure 4-5 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 Shetland landfalls has been projected for each cable corridor as follows. It should be noted that this does not take account of storm surge or waves under different return periods.

2100

0.4

0.5

0.6

0.3

4.2.3.2 Cable Corridor 2.4 – Fair Isle to BU and Cable Corridor 2.3 – Shetland - Sanday There is no RCP data to cover Fair Isle, therefore Fair Isle has been considered with Cable Corridor 2.3 Shetland – Sanday. 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

2080

2020

2040

2060

2000



of the proposed Shetland landfall are predicted to rise by up to 0.23m, 0.24m and 0.27m, respectively (UKCP, 2018), in 2046 for the central estimate (50th %ile). The Mean High-Water Spring (MHWS) level at Sumburgh (Grutness Voe), Shetland is 1.8m above Chart Datum (CD) (UKHO, 2021). In this respect, the MHWS level in the vicinity of the proposed Shetland landfall could increase to 2.03m CD, 2.04m CD and 2.07m CD under the low, medium, and high scenarios respectively in 2046 for the central estimate (50th %ile).

4.2.3.3 Cable Corridor 2.1 - Yell - Unst

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 cable corridor are predicted to rise by up to 0.26m, 0.27m and 0.30m, respectively (UKCP, 2018), in 2046 for the central estimate (50th %ile). The Mean High-Water Spring (MHWS) level at Cullivoe, Yell is 2.4m above Chart Datum (CD) (UKHO, 2021). In this respect, the MHWS level in the vicinity of the cable corridor could increase to 2.66m CD, 2.67m CD and 2.70m CD under the low, medium, and high scenarios respectively in 2046 for the central estimate (50th %ile).

4.2.3.4 Cable Corridor 2.2 – Shetland – Yell

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 cable corridor are predicted to rise by up to 0.25m, 0.26m and 0.29m, respectively (UKCP, 2018), in 2046 for the central estimate (50th %ile). The Mean High-Water Spring (MHWS) level at Rapness, Westray is 2.3m above Chart Datum (CD) (UKHO, 2021). In this respect, the MHWS level in the vicinity of the cable corridor could increase to 2.55m CD, 2.56m CD and 2.59m CD under the low, medium, and high scenarios respectively in 2046 for the central estimate (50th %ile).

4.2.3.5 Cable Corridor 2.8 – Shetland - Whalsay

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 cable corridor are predicted to rise by up to 0.25m, 0.26m and 0.29m, respectively (UKCP, 2018), in 2046 for the central estimate (50th %ile). The Mean High-Water Spring (MHWS) level at Dury Voe, Shetland is 2.1m above Chart Datum (CD) (UKHO, 2021). In this respect, the MHWS level in the vicinity of the cable corridor could increase to 2.35m CD, 2.36m CD and 2.39m CD under the low, medium, and high scenarios respectively in 2046 for the central estimate (50th %ile).

4.2.4 Coastal Processes

Offshore glacial deposits on mainland Scotland and the Western Isles supply a large percentage of the beach material occurring around these coastlines (Ramsay and Brampton, 2000). The quantity of beach material available for the formation of coastline of eastern Shetland is extremely restricted. Offshore of the Shetland Isles, the seabed falls steeply and is dominated by rocks with sparse sand deposits and as such, offshore glacial material is not a major source of beach sediments. Much of the shingle and cobble beach material will have derived from marine erosion of glacial till deposits which overlie the solid geology over much of the islands, and this is likely to be the main source of beach material for most of the beaches along the south-east coastline of the mainland (Ramsay and Brampton, 2000). Fragmented shell material is the final significant source of beach material with a high shell content noted particularly on the beaches south of Lerwick and in the vicinity of Balta Island off Unst (Ramsay and Brampton, 2000).

Supply of fresh beach material on the east coast of Shetland is extremely limited and although erosion of till deposits and cliffs is still occurring, this source is relatively limited (Ramsay and Brampton, 2000). Wave action dominates littoral processes on all of the beaches on the east coast of Shetland, giving rise to a number of coastal features, such as tombolos and spits with the majority of the sand and shingle beaches comprising equilibrium bay shapes, dependent on the incident wave directions,

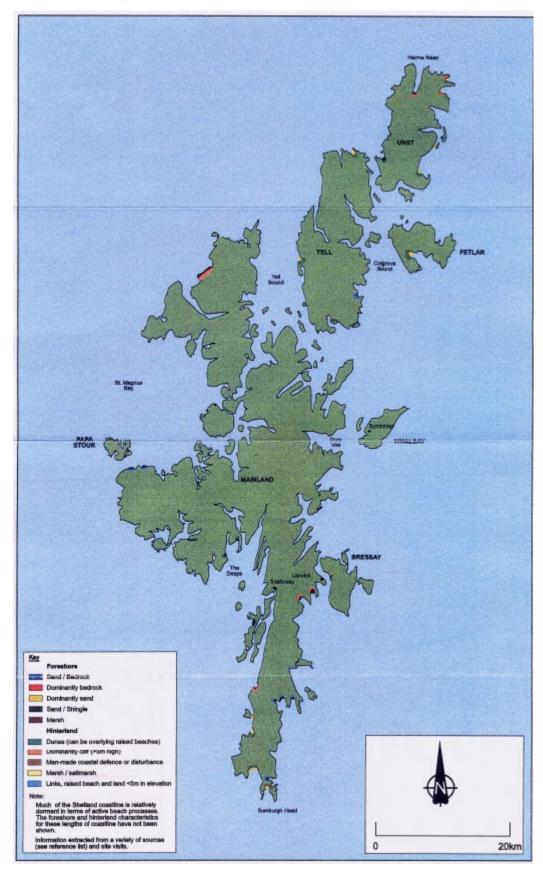


particularly swell waves and little evidence of longshore drift (Ramsay and Brampton, 2000). That said, the wave conditions along this coastline dominate and tend to have a destructive influence upon the beach areas with erosion of the coastal edge a common feature on the majority of the beaches (Ramsay and Brampton, 2000). This, coupled with a lack of fresh beach material, results in a general lack of accretion.

Figure 4-6 shows the main foreshore and hinterland characteristics of the Shetland Isles.



Figure 4-6 Foreshore and hinterland characteristics of the Shetland Isles (Ramsay and Brampton, 2000)





4.2.5 Bathymetry, Geology and Seabed Sediments

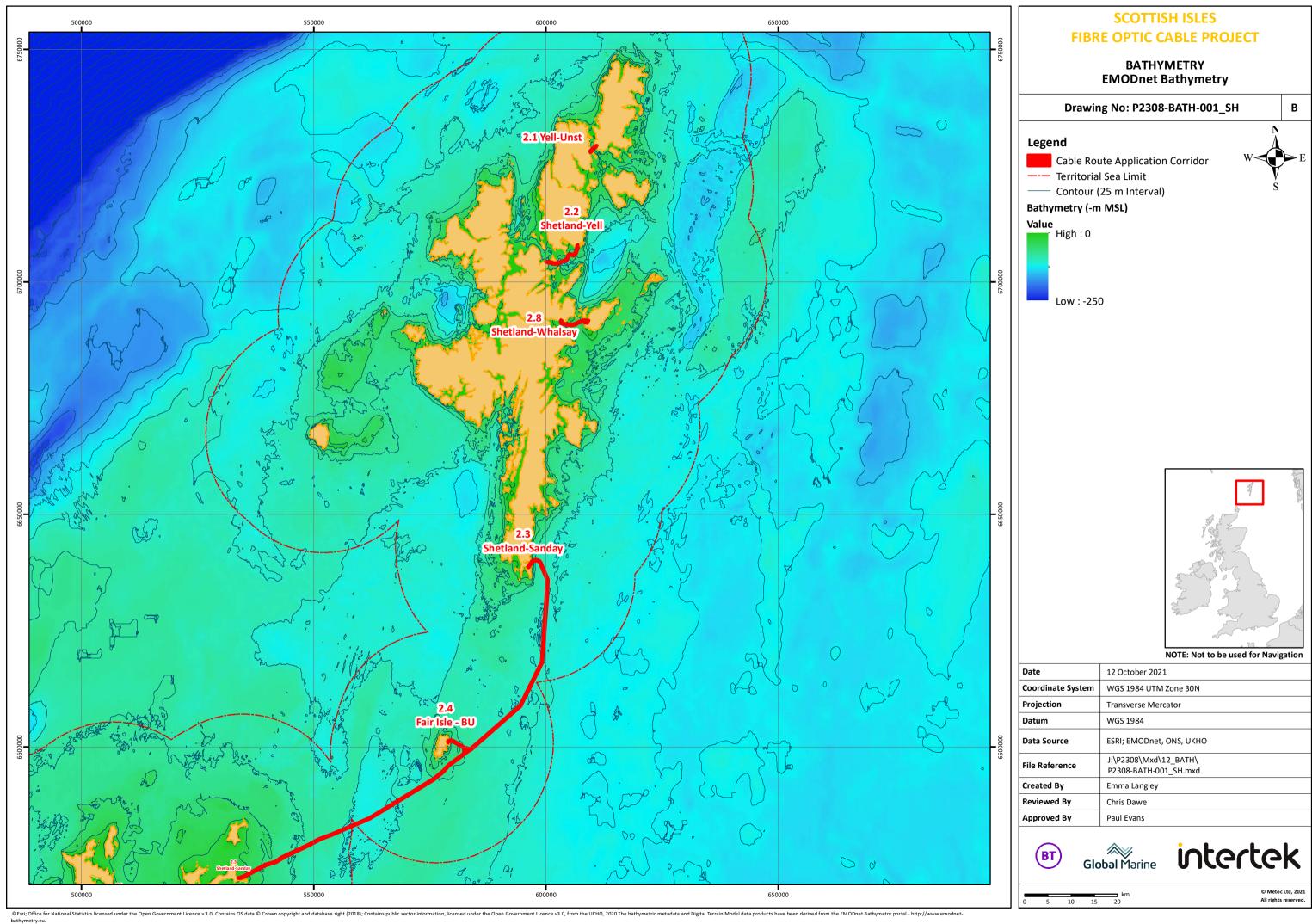
4.2.5.1 Bathymetry

The bathymetry within the Shetland geographical area is characterised by relatively shallow depths within the internal waters of the archipelago with increasing depths in the peripheral offshore areas. The maximum water depths are given in Table 4-3 and an overview of bathymetry within the cable corridors is presented in Figure 4-7 (Drawing Reference: P2308-BATH-001_SH).

Table 4-3 Cable corridor depths

Cable corridor	2.1 Yell - Unst	2.2 Shetland - Yell	2.3 Shetland - Sanday	2.4 Fair Isle - BU	2.8 Shetland - Whalsay
Maximum depth (m below MSL)	-38m	-90m	-115m	-80m	-50m

Source: EMODnet 2021 and UKHO 2021





4.2.5.2 Underlying Geology

Shetland is much more geologically complex than both Orkney and Fair Isle (Global Marine, 2021). The solid geology of the Shetland Isles is largely composed of ancient metamorphic and igneous rocks (Ramsay and Brampton, 2000). The eastern coastline is heavily faulted producing a complex structure with north-south trends of basic and acid intrusive igneous rocks, metamorphic limestones and hornblende schists present (Ramsay and Brampton, 2000).

Sedimentary and volcanic rocks of Devonian age overlie the basement rock in places, particularly on the west coast, while around Sumburgh Head and the immediate coast to the north, this tends to be Middle Old Red Sandstone (ORS) with Upper ORS deposits occurring at Bressay and around Lerwick (Ramsay and Brampton, 2000). A small number of sandy bays, constrained between rock outcrops or headlands, exist on Shetland and it is thought that the majority of the beach material comprising these bays has been derived from erosion of ORS outcrops (Ramsay and Brampton, 2000).

The landfall at Whalsay and Unst are underlain by metamorphic hornblende-gneiss, calcareous schist and limestone of Dalradian Proterozoic age (Global Marine, 2021). Yell is largely composed of metamorphosed mudstones and sandstones of late Proterozoic age, with the mainland landings of the Whalsay and Yell cables in areas of intrusive igneous rocks, which are predominantly granitic or granodioritic and of early Carboniferous age (Global Marine, 2021).

Fair Isle is comprised of Lower to Middle Old Red Sandstone, with bands of dolomitic mudstone and shale – at the proposed landfall in the North and South Havens, the underlying rock type is finergrained mudstones and shales (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).

An overview of seabed sediments within the Shetland geographical area application corridors is presented in Figure 4-8 (Drawing Reference: P2308-SED-001_SH).

Cable Corridor 2.1 - Yell - Unst

The Yell – Unst Cable Corridor is not covered by BGS seabed sediment maps, however, UKHO charts suggest mainly shells, sand and rock close to the proposed cable route with rock outcrops being prevalent in the channel (Global Marine, 2021).

EMODnet bathymetry data indicates that the area between the two islands north of Linga island is very rocky – sediments are likely in the bay at Belmont on Unst and sandwaves are visible in the centre of the channel (Global Marine, 2021).

Cable Corridor 2.2 - Shetland - Yell

UKHO charts suggest that sediments along the proposed Shetland-Yell cable corridor are expected to comprise muddy sandy gravel with gravelly sand dominating south of Samphrey and approaching the sheltered southern coast of Yell (Global Marine, 2021).

Cable Corridor 2.3 - Sanday - Shetland

The Sanday-Shetland Cable Corridor is largely laid within a band of gravelly sand that stretches from Fair Isle to Shetland, then sandy gravel around Fair Isle and in the approaches to Sanday (Global Marine, 2021). UKHO charts suggest that there are also scattered areas of rock in this region.

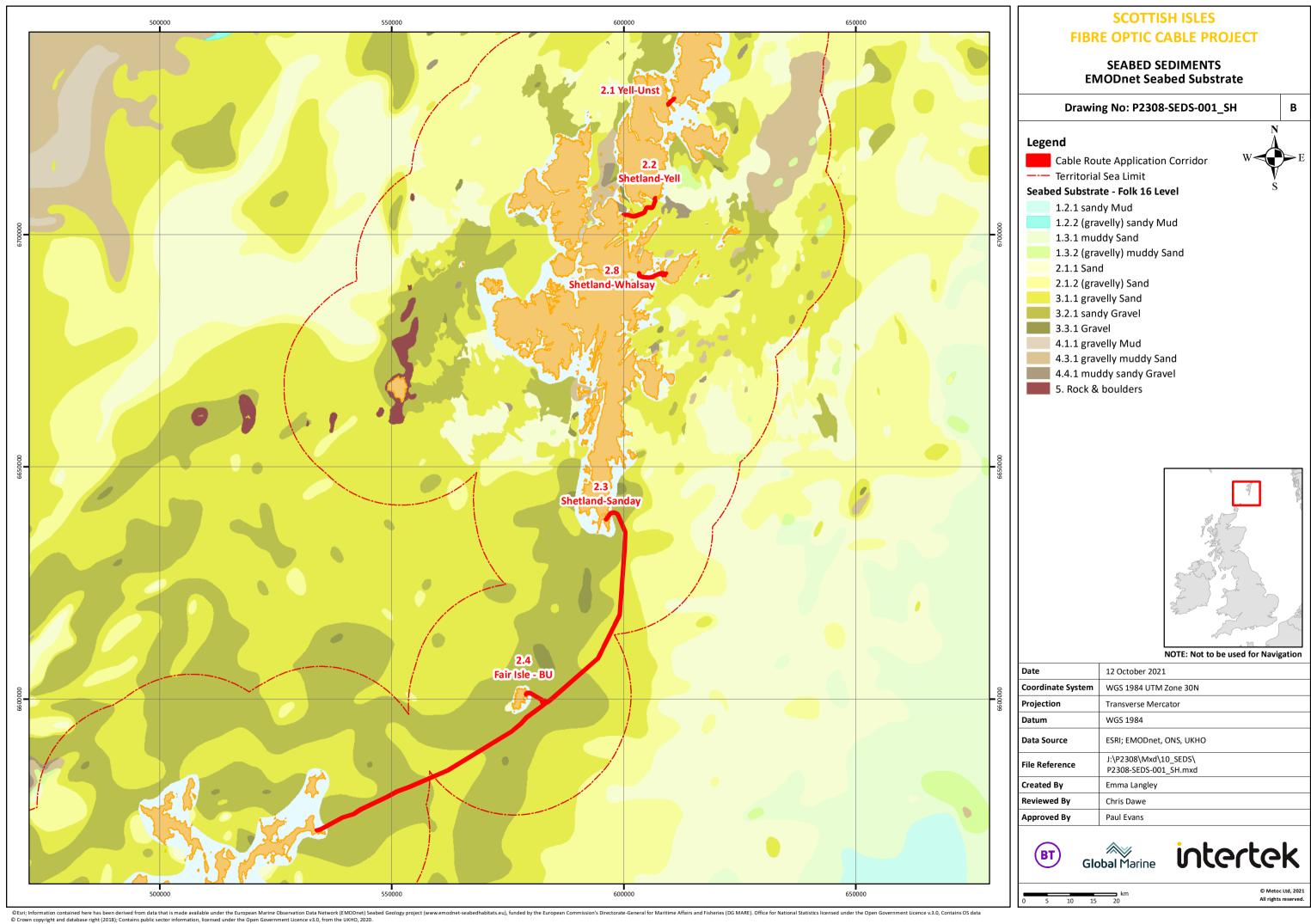
Cable Corridor 2.4 - Fair Isle - BU

The proposed Fair Isle-BU cable corridor lies entirely within an area mapped as sandy gravel by the BGS (Global Marine, 2021). Within the shore end into North Haven on Fair Isle the seabed is expected to be sandyCable Corridor 2.8 Shetland – Whalsay





The Sanday to Whalsay Corridor is likely to have highly variable sediments with a band of gravelly sand (Global Marine, 2021). It is likely that there will be bedforms present due to moderate strength currents in this area (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 Shetland Isles, 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 are no known munitions in the vicinity of the cable corridors.

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 Shetland Isles is Dounreay, which is located on the north coast of Scotland approximately 200km to the south-west of southern Shetland. 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. As such, it is extremely unlikely that artificial radionuclides will affect sediment quality in the vicinity of the proposed cables.

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 3 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	Water body the corridors pass through
2.1 – Yell - Unst	Bluemull Sound and West Fetlar (ID: 200289) with an overall waterbody status of Good in 2016 (Atkins Geospatial, 2019)
2.2 – Shetland - Yell	Yell Sound (ID: 200503) with an overall waterbody status of Good in 2016 (Atkins Geospatial, 2019)
2.3 – Shetland – Sanday	Passes through two WFD waterbodies: Noup Head to Start Point waterbody (ID: 200244) and Isle of Noss to Sumburgh Head waterbody (200256) both with an overall waterbody status of Good in 2016 (Atkins Geospatial, 2019)
2.4 – Fair Isle – BU	Fair Isle waterbody (ID: 200245) with an overall waterbody status of Good in 2016 (Atkins Geospatial, 2019)
2.8 – Shetland – Whalsay	Passes through two WFD waterbodies: Dury Voe (ID: 200267) and Heoga Ness to The Keen with an overall waterbody status of Good in 2016 (Atkins Geospatial, 2019)

Bathing Waters

There are no designated bathing waters in the vicinity of the landfall sites at present.

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 several Shellfish Water Protected Areas located in relatively close proximity to Cable Corridor 2.2 Shetland-Yell, including Scarvar Ayre, Dales Voe, Shetland, Lunna, Shetland and Hamna Voe, Yell, all of which are Class A, indicating very good water quality.

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 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 Shetland Isles, contamination levels are expected to be low. Operations at Dounreay Nuclear Power Development Establishment, approximately 110km south-west of the closest proposed cable corridor (Cable Corridor 2.3 Shetland to Sanday), 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, 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 Shetland Isles R100 cable system. Average measured iSPM for the period 1998-2015 within the southern Shetland Isles 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.

4.3 Assessment of Effects

An assessment of the effects of the installation activities on the physical environment has been undertaken. Table 4-5 summarises the pressures which have been assessed.

Table 4-5 Pressures considered for proposed cable corridors in Shetland 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 ploughed and backfilled along the majority of their lengths coupled with the small footprint of each cable where ploughing 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.



4.3.2 Compliance and best practice measures

The R100 Project within the Shetland 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 berms and bags 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 rock berm 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

4.3.3 Abrasion/disturbance at the surface of the substratum

During installation, a plough will be towed along the proposed Shetland 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 less than 0.028km² along the length of each cable (figure given is worst case for the longest Cable Corridor 2.3 Shetland to Sanday, all other cable corridors are significantly less).

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 due to 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.

4.3.4 Penetration and disturbance below the substratum including abrasion

4.3.5 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 (depending on seabed type). As the PLGR is 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 the PLGR can penetrate up to 40cm of the seabed, the sediments along the cable corridors, where seabed preparation is required, are primarily sands and gravels, which will be moved and naturally backfill. 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 in line 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 the PLGR and cable installation are, therefore, considered negligible.

4.3.6 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. However, 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 and cable installation are, therefore, considered negligible.

4.3.7 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.

4.3.7.1 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 are two telecommunication cable crossings required within Cable Corridor 2.3 Shetland to Sanday. HDPE may be used approximately 50m either side of the crossing location and buried where possible. The HDPE diameter is small (94mm), therefore the overall footprint of the seabed to be affected within Cable Corridor 2.3 Shetland to Sanday 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 Shetland geographical area on seabed sediments is negligible.

4.3.7.2 Contingency External Cable Protection

External cable protection includes rock berm, rock bags and concrete mattresses. These measures may be used at power cable crossings or areas where further cable stability is required.

There are two power cable crossings within the Shetland geographical area; one power cable crossing each for Cable Corridor 2.2 Shetland to Yell and Cable Corridor 2.3 Shetland to Sanday. Each power cable crossing typically requires a rock berm as protection. For the proposed power cable crossings an approximate rock berm footprint of $0.00052 \, \text{km}^2$ ($520 \, \text{m}^2$ dependant on final crossing agreements) per crossing has been assessed. The sediments within Cable Corridor 2.2 Shetland to Yell are expected to be comprised of muddy sandy gravel with gravelly sand dominating south of Samphrey and approaching the sheltered southern coast of Yell. The sediments within Cable Corridor 2.3 Sanday to Shetland are expected to be comprised of sandy gravel. Therefore, the deposit of rock within a gravelly seabed will sightly change the character of the seabed in the immediate vicinity of the crossing, however the change will be highly localised and will not have a wider effect on the character of the seabed and effects have been assessed as minimal.



Concrete mattresses have been included in the marine licence application as a contingency measure within the Shetland geographical area (see Table 2-5 for the worst-case number per application corridor). Each mattress covers an area of $18m^2$. 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-lay surveys. For the purposes of assessment, this MEA has considered the number of rock bags to be used per cable as a worst case scenario (see Table 2-5 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.

4.3.8 Local water flow (tidal current) changes

External cable protection (rock berms) may be required offshore in two locations within the Shetland geographical area; one within Cable Corridor 2.2 Shetland to Yell; and one within Cable Corridor 2.3 Shetland to Sanday. Other areas of contingency cable protection may also be required during cable installation where target burial depth is not achievable. This is likely to be areas of exposed rock or hard ground.

The presence of external cable protection in the offshore regions may cause very localised changes in water flows where exposed, i.e. in areas unsuitable for ploughing, i.e. cable crossings, hard bed rock where rock bags may be required. This in turn could cause localised scour, depending on the seabed type that the cable protection is deposited on to. Scour will only occur in areas of soft sediment where bottom currents either already exceed the critical bedload parting velocity, or where external cable protection results in an increase in current velocity to above the critical bedload parting velocity.

A typical rock berm for this project would have a footprint of approximately 520m^{2,} however is dependent on crossing agreements.

The location of the cable crossing within Cable Corridor 2.2 Shetland to Yell is within an area predicted to be muddy sandy gravel at approximately 20m water depth. There is the potential for localised scour in this location, however as the area consists of muds the key process is deposition and over time the net effect will be minor and highly localised, unlikely to affect the wider environment.

The location of the cable crossing within Cable Corridor 2.3 Shetland to Sanday is within an area predicted to be within a predominantly gravelly sand area at approximately 40m water depth. Therefore sediments at this crossing location will be relatively firm and resistant to scour and the effects will be negligible.

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.



4.4 Project Specific Mitigation

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

4.5 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.



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 Shetland 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 Shetland geographical area, benthic habitat surveys were undertaken during August 2021 for:

- Cable Corridor 2.1 Yell Unst
- Cable Corridor 2.3 Sanday Shetland (within Sanday SAC and East Sanday Coast SSSI)

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.





Data Source	Description
	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.
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 along the coast in each direction 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.



Table 5-2 Summary of the predominant habitats and protected benthic features for cable corridors within Shetland 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
2.1 Yell to Unst	Yell landing point: Central gravel, shingle and cobble area with rock and boulder habitats to the north and south. Unst Landing point: Central cobble area, with sloping bedrock cliffs to the east and a small beach followed by bedrock and boulders to the west.	Atlantic and Mediterranean high energy infralittoral rock (EUNIS habitat A3.1)	Yes — Fetlar to Haroldswick NCMPA Circalittoral sand and coarse sediment communities Shallow tideswept coarse sands with burrowing bivalves	Potential Annex I reef Kelp Bed PMF Tide-swept algal communities PMF	Yes
2.2 Shetland to Yell	Shetland Landing Point: Predominantly cobbles and boulders with some rock outcrops and craggy bedrock. Yell Landing Point: A range of rocky shore, bedrock, cobbles and boulders backed by grass and agricultural land.	Circalittoral coarse sediment (EUNIS habitat A5.14)	No	Potential Annex I reef	Yes
2.3 Sanday to Shetland	Shetland Landing Point: Large central sandy bay backed by dunes. Northern and southern shores are rocky, with a pier on the southern shore. Sanday Landing Point: Sandy beach backed by dunes and sandy cliffs to the west, with rocky shore and outcrops to the east.	Deep circalittoral coarse sediment (EUNIS habitat A5.15)	Yes — Sanday SAC and East Sanday Coast SSSI Annex I bedrock reef / Rocky shore	Potential Annex I reef	Yes
2.4 Fair Isle to BU	Fair Isle Landing Point: Shallow sandy inlet backed by a band of cobbles	Deep circalittoral coarse sediment (EUNIS habitat A5.15)	No	UK BAP species Fucus distichus	Yes





2.8	Shetland Landing Point: Craggy shore with cobbles and bedrock at the top	Atlantic and Mediterranean high energy	No	Burrowed mud PMF	Yes
Shetland to Whalsay	of the shore. The area below the BMH is mobile cobbles flanked by bedrock on either side. Whalsay Landing Point: Predominantly steep ragged bedrock, cobble bays and flat rock peninsula with rock armouring and deposited debris from the quarry above near the harbour.	, , , , , , , , , , , , , , , , , , ,		Kelp and seaweed communities on sublittoral sediments PMF	



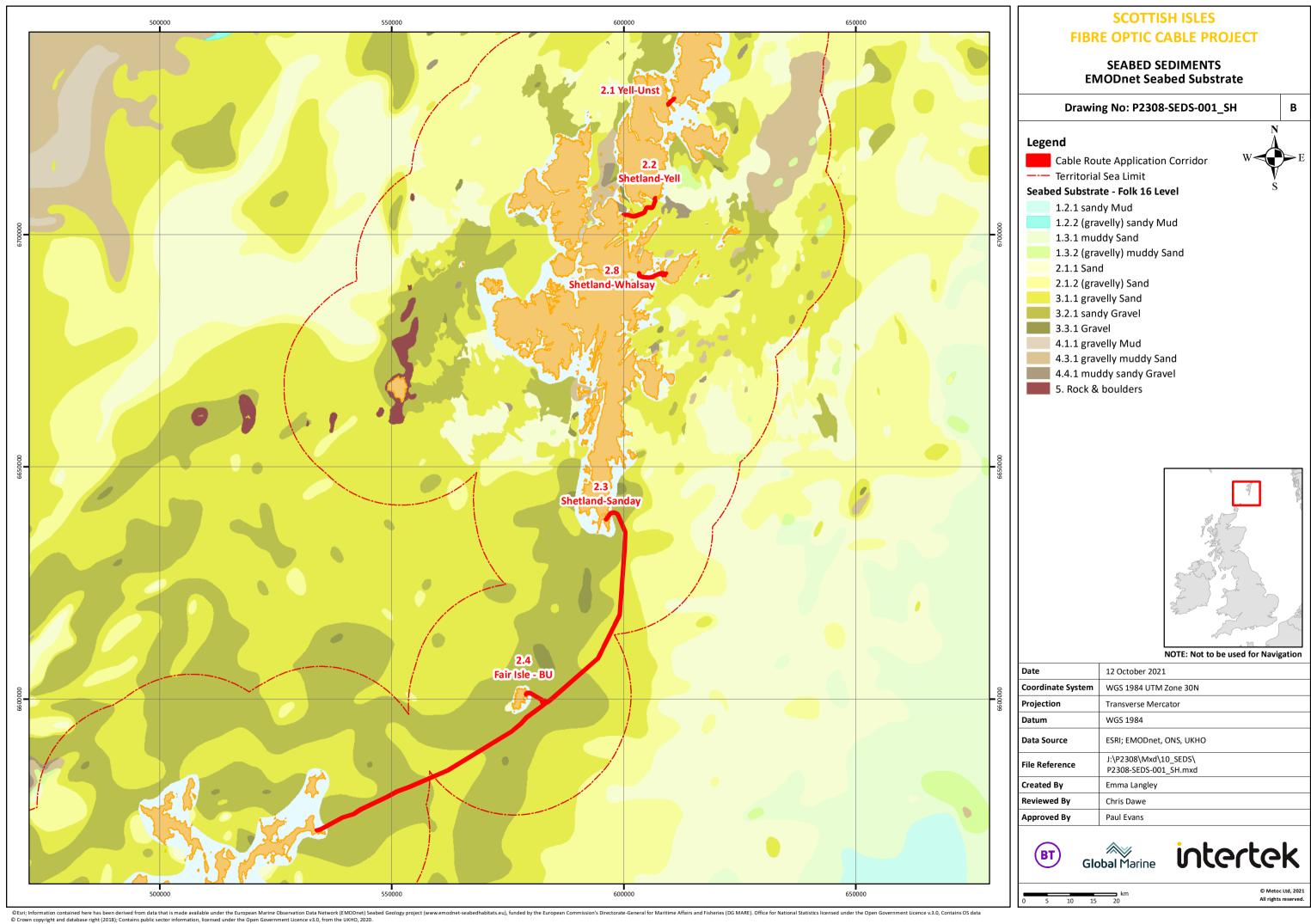
5.3.2 Subtidal habitats

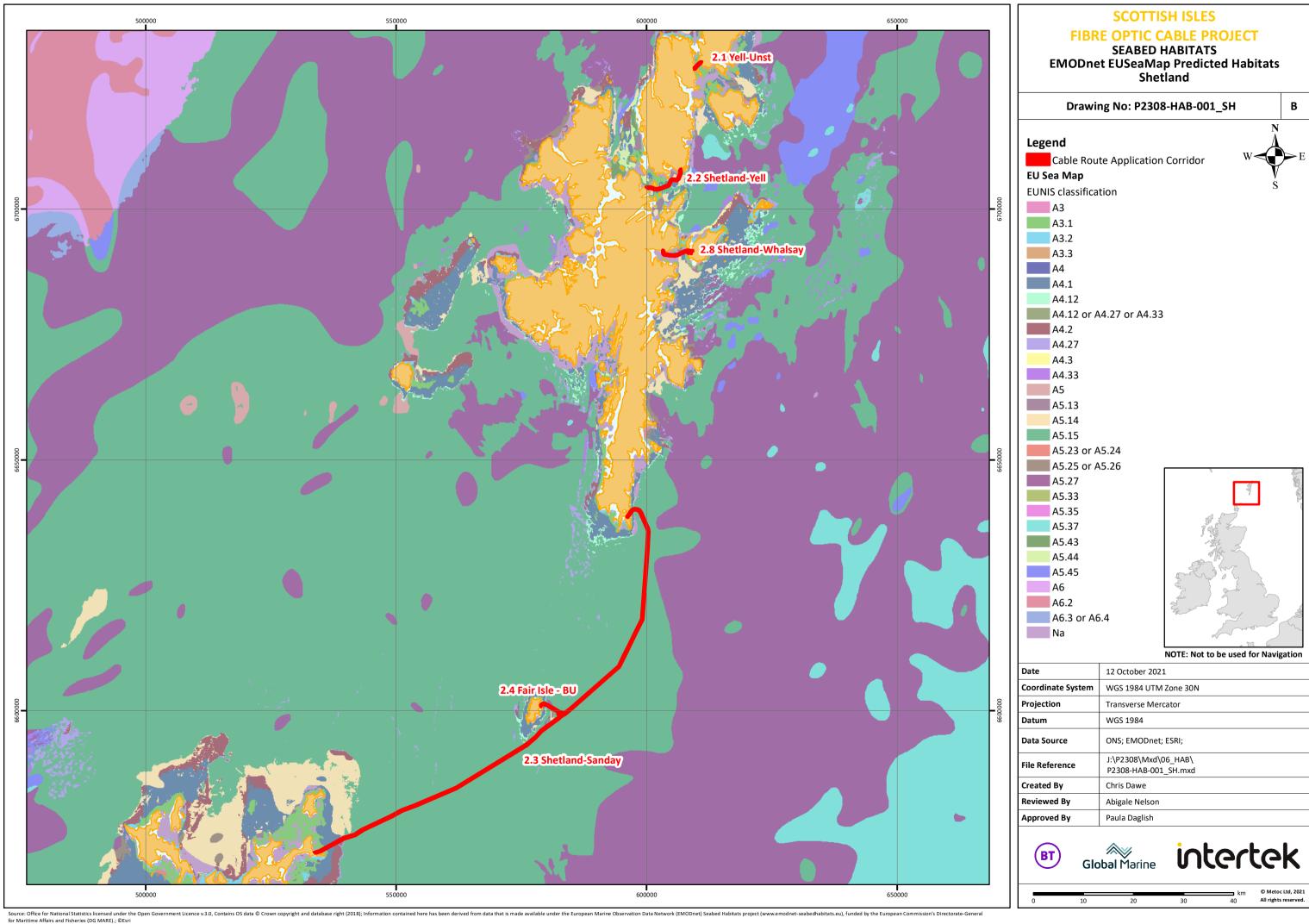
The Shetland geographical area displays predominantly infralittoral rock and circalittoral coarse sediment habitats, whose communities are determined primarily on the level of exposure to water currents (SAMS Research Services, 2005). The sediments are predominantly comprised of sandy gravels and gravelly sands (Figure 5-1, Drawing Ref: P2308-SEDS-001-SH-B). The coastline is indented with narrow channels and numerus small islands. Between the islands is relatively sheltered, whilst the western coast is exposed to the Atlantic currents (SAMS Research Services, 2005).

Sixteen 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-SH-B) listed within Table 5-3, below. However, the broad-scale habitat map does not cover all of Shetland, so broad habitat types could not be determined for the full extent of all cable corridors.

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

Broad Scale EUNIS Habitat Type and Description		2.1 Yell - Unst	2.2. Shetland - Yell	2.3 Shetland - Sanday	2.4 Fair Isle – BU	2.8 Shetland - Whalsay
		Percent	age of corri	dor where th	e habitat i	s present (%)
Infralittoral rock and other hard substrata	A3	11.90	0.73	0.03	0.36	0.09
Atlantic and Mediterranean high energy infralittoral rock	A3.1	46.28	5.99	2.22	1.00	6.45
Atlantic and Mediterranean moderate energy infralittoral rock	A3.2	0	0	0.43	0.86	0
Atlantic and Mediterranean low energy infralittoral rock	A3.3	22.32	5.31	0.04	0	2.70
Circalittoral rock and other hard substrata	A4		0.59		0.26	
Atlantic and Mediterranean high energy circalittoral rock	A4.1		24.86	2.37	11.96	0.01
Sponge communities on deep circalittoral rock	A4.12		3.07	0.02	2.13	
Atlantic and Mediterranean moderate energy circalittoral rock	A4.2			1.32	0.83	
Faunal communities on deep moderate energy circalittoral rock	A4.27			0.40		
Atlantic and Mediterranean low energy circalittoral rock	A4.3		6.28			
Infralittoral coarse sediment	A5.13		0.26			
Circalittoral coarse sediment	A5.14		26.09	0.02	0.71	1.16
Deep circalittoral coarse sediment	A5.15		14.63	91.72	15.50	
Circalittoral fine sand or Circalittoral muddy sand	A5.25 or 26				7.61	
Deep circalittoral sand	A5.27			0.54	5.78	
Infralittoral mixed sediments	A5.43		0.60			
Data Deficient	-	19.50	11.60	0.88	53.00	89.59







5.3.3 Protected features

5.3.3.1 Introduction

Several potential Annex I habitats and PMFs were identified as occurring within the Shetland 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 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	Reef - Bedrock and / or stony reef
(Sanday SAC)	Sandbanks slightly covered by seawater all of the time
	Mudflats and sandflats not covered by seawater at low tide
	Horse mussel beds
(NCMPA) protected features	Circalittoral sand and coarse sediment communities
(Fetlar to Haroldswick NCMPA)	Kelp and seaweed communities on sublittoral sediment
	Shallow tide-swept coarse sands with burrowing bivalves
	Maerl beds
Site of Special Scientific Interest (SSSI)	Rocky shore
(East Sanday Coast SSSI)	Sandflats
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 of the horse mussel beds PMF to the closest cable corridor (approximately 380m from Cable Corridor 2.8 Shetland to Whalsay) no pressure pathway to this PMF was identified, and this PMF has not be 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 digitate), 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 Circalittoral sand and coarse sediment communities

Circalittoral sand and coarse sediment communities encompasses a range of sub-habitat types and is found across Shetland. The broadscale habitat is a protected feature of the Fetlar to Haroldswick NCMPA. The sub-habitat *Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel is of the greatest conservation interest within the NCMPA (NatureScot, 2021b). This sub-habitat is comprised of predominantly circalittoral gravels, coarse to medium sands, and shell gravels in water generally deeper than 15-20m. It is characterised by polychaetes, such as *Mediomastus fragilis*, *Lumbrineris* spp and also supports amphipods and bivalves (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). However, as a mobile bedform, it typically has high resilience to sub-surface abrasion and penetration (Marine Scotland, 2021). Whilst some individuals may be injured or killed by penetration of the subsurface, robust species are buried within the sediments, and other species are adapted to habitats with frequent disturbance and will quickly recover (MarLIN, 2021). Circalittoral sand and coarse sediment communities has low sensitivity to low levels of siltation rate changes, though depending on the depth of overburden smothering and mortality could be caused (MarLIN, 2021).

5.3.3.3 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).

5.3.3.4 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.



5.3.3.5 Shallow tide-swept coarse sands with burrowing bivalves

This habitat appears in infralittoral medium to coarse sand and gravelly sand subject to strong tidal water movement, usually on exposed open coasts and estuaries with moderately strong tidal currents (JNCC, 2015). The community is characterized by *Morella* spp (e.g. *Moerella pygmaea, Moerella donacina*) with the polychaete *Clycera lapidum* and venerid bivalves (e.g. *Dosinia lupinus, Timoclea ovata, Goodallia triangularis* and *Chamelea gallina*) (MarLIN, 2021). Venerid bivalves reach sexual maturity in two years, and spawn at least once a year (Guillou and Sauruau, 1985). This community is typically found from 0-20m depth and may be present in waters deeper than is characteristic of typical infralittoral biotopes (NatureScot, 2021b).

Due to the large number of species which are recorded in the biotopes, recovery from disturbance can vary. Mobile bivalves may be able to reposition within the sediment to colonise disturbed sites, whereas immobile species will rely on recolonisation by pelagic larvae which can take much longer and be unpredictable (Olfasson *et al.*, 1994). Additionally, whilst recruitment can be rapid, restoration of the biomass by growth of the colonising individuals is likely to take many years (MarLIN, 2021). Abrasion and penetration of the surface can cause direct damage and mortality to bivalves and other associated species. Bivalves are a shallow, burrowing infauna which feed via suspension feeding and therefore require their siphons to remain above the sediment for feeding and respiration, meaning they can be sensitive to siltation rate changes.

The species that are present in the biotope can be broadly characterised as either opportunist species that rapidly colonise disturbed habitats and increase in abundance, or species that are larger and longer-lived and that may be more abundant in an established, mature assemblage. Species with opportunistic life strategies will recolonise habitat which has been disturbed first within 1-2 years. The recovery of bivalves that recruit episodically and the establishment of a representative age-structured population for larger, longer lived organisms may require longer than two years.

A review of recovery studies undertaken by MarLIN (2021), suggested that recovery takes between 2 and 10 years, classifying the habitat as having 'medium' resilience. Recovery of the seabed from severe physical disturbances that alter sediment character may also take up to 10 years or longer (Le Bot et al., 2010). However, the ability to recover from human induced pressures depends on a combination of the environmental conditions of the site, the frequency (repeated disturbances versus a one-off event) and the intensity of the disturbance. As the installation activities are a one-off, localised event, recovery is expected to be less than ten years.

5.3.3.6 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.

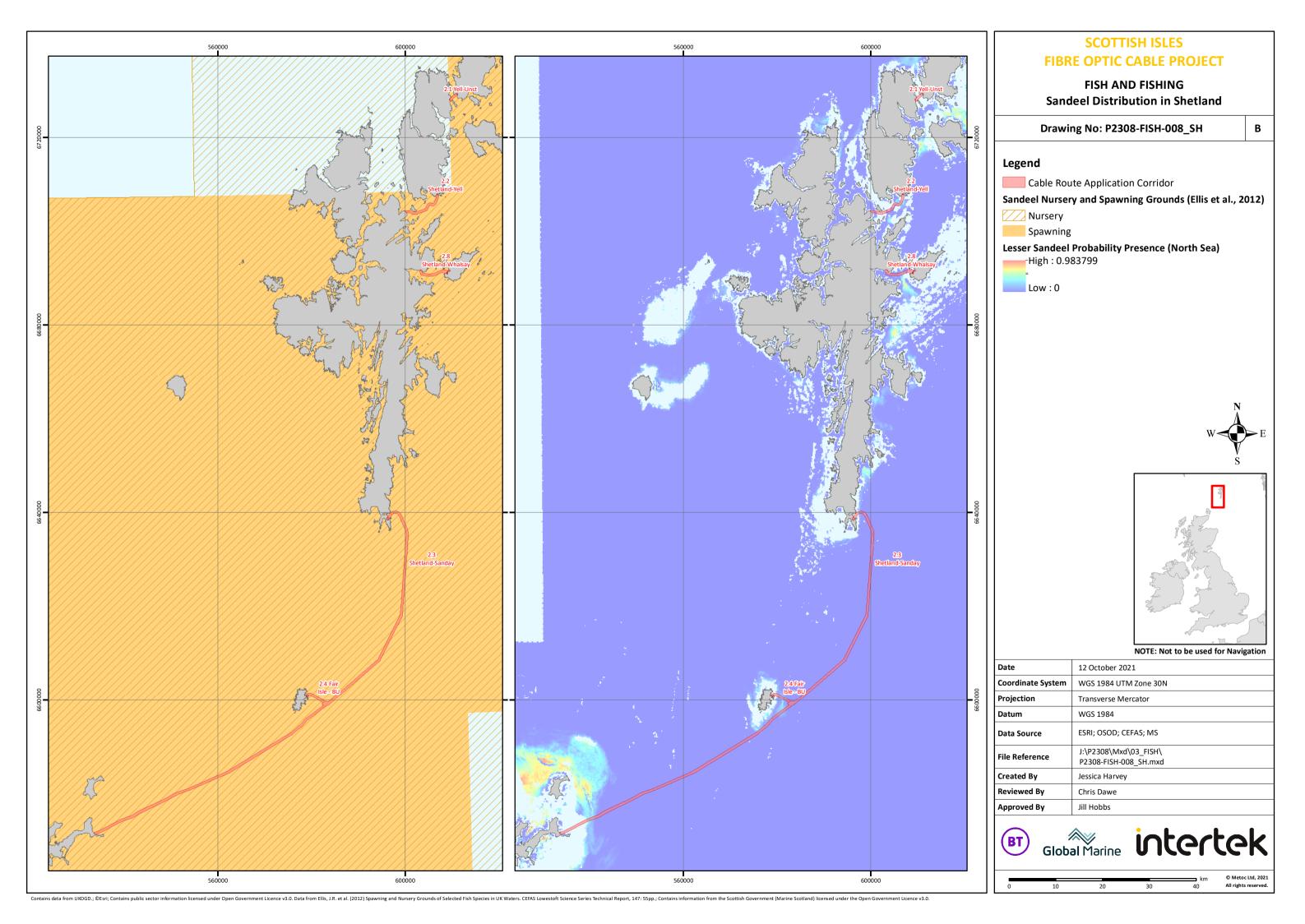
Five species of sandeel are currently found in UK waters, namely Greater sandeel (*Hyperoplus lanceolatus*); Corbin's sandeel (*Hyperoplus immaculatus*); lesser sandeel (*Ammodytes tobianus*); smooth sandeel (*Gymnammodytes semisquamatus*); and Raitt's sandeel (*Ammodytes marinus*). Raitt's sandeel is 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). Sandeel larvae hatch off Orkney coasts and travel on ocean currents to Shetland in the north and the Moray Firth in the south (Lynam et al., 2013). Sandeel also pass from Mousa to Boddam NCMPA on the east coast across the Shetland isle.

A review of broad-scale seabed habitat (EMODnet, 2020a), sediment (EMODnet,2020b), 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 Shetland geographical area. The entire Shetland geographical area 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_OR-A). However, no areas in Shetland were identified by Ellis et al. (2012) as having high intensity spawning grounds.

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).





5.3.5 Cable Corridor 2.1 Yell to Unst

Cable Corridor 2.1 Yell to Unst is located within Bluemull Sound and passes across the north of Linga sound between Yell and Linga island. There are strong tidal currents in Bluemull sound, created by a strong funnelling effect (Halliday, 2011).

5.3.5.1 Intertidal area

Table 5-5 summarises the intertidal information for the 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 2.1 Yell to Unst landing points

Cable Corridor 2.1	Yell landing point	Unst landing point
Location	The Yell landing point is located at Gutcher, south of Gutcher ferry terminal on northeast of Yell.	The Unst landing point is located at Belmont, on the south of Unst, to the north of the Belmont ferry terminal.
Description	North shore is backed by artificial excavated rock above a mosaic of barnacle covered rock and fucoid seaweed. Gravel, shingle and cobbles in the central area, except for rock armouring around the ferry terminal. Rocky coast, boulders and emergent rock to the south.	Eastern area has sloping bedrock cliffs. Cobbles and fucoid seaweed in the central area, with occasional emergent bedrock. Small sloping beach west of this. Bedrock and large boulders to the far west.
No. of biotopes recorded by Phase 1 intertidal survey	19	18
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 four broad EUNIS habitat types were identified within the cable corridor (Table 5-6). The subtidal seabed habitat within and surrounding the installation corridor are dominated by Atlantic and Mediterranean high energy infralittoral rock (EUNIS habitat 3.1) with patches of the other habitats along Yell and Unst coastlines (Figure 5-4, Drawing Reference: P2308-HAB-002_2.1 Yell-Unst).

Cable Corridor 2.1 Yell to Unst intersects bedrock/stony Annex I reef habitat across the majority of the cable corridor. As discussed in Appendix C – Protected Sites Assessment, Cable Corridor 2.1 is within Fetlar and Haroldswick NCMPA, which is designated for the following habitat features:

- Circalittoral sand and coarse sediment communities,
- Horse mussel beds,
- Kelp and seaweed communities on sublittoral sediment,
- Maerl beds,
- Shallow tide-swept coarse sands with burrowing bivalves.





A summary of the condition of these habitats within the NCMPA, according to the NCMPA proposal documents, and the distance of the habitats to Cable Corridor 2.1 is given in Table 5-7.

Tide-swept algal communities PMF has been previously identified along the Yell coast and was confirmed by DDV surveys as within the cable corridor (Table 5-7, Table 5-8). Kelp bed PMF has been previously identified just outside the cable corridor and was found offshore of Yell and in the centre of the cable corridor during DDV surveys (Table 5-7, Table 5-8). Full details of the DDV benthic survey and supporting figures are provided in Appendix A. Seagrass PMF has previously been identified at Yell coast inland of the BMH and was not found in Phase 1 habitat surveys of the area (survey report available on request).

Table 5-6 EUNIS habitats within the Cable Corridor 2.1 Yell to Unst (EMODnet, 2020)

Habitat	EUNIS code
Infralittoral rock and other hard substrata	A3
Atlantic and Mediterranean high energy infralittoral rock	A3.1
Atlantic and Mediterranean moderate energy infralittoral	A3.2
Atlantic and Mediterranean low energy infralittoral rock	A3.3

Table 5-7 Feature condition and distance to Cable Corridor 2.1 Yell to Unst for the Fetlar and Haroldswick NCMPA qualifying habitat and geodiversity features

Qualifying feature	Feature Condition	Approximate distance from Cable Corridor 2.1
Circalittoral sand and coarse sediment communities	There are good examples of this habitat, which are widely distributed across the NCMPA (Hirst <i>et al.</i> , 2013). It is not considered to be threatened and/or declining.	Within
Horse mussel beds	Abundance varies from 10-20% cover, up to 40-79% cover off the south coast of Unst (Hirst et al., 2013). Horse mussel beds within the NCMPA are collectively considered to represent seabed habitats of high biological diversity. This habitat is considered to be threatened and declining in Scottish waters.	1.1km
Kelp and seaweed communities on sublittoral sediment	This feature is naturally highly fragmented within shallow waters around Scotland. The examples of this feature within the NCMPA are of high quality.	1.1km
Maerl beds	The maerl beds consist of dense carpets of large live maerl fragments (40 - 79 % cover, Hirst et al., 2013). These beds have high biodiversity and appear to be in good condition. There is estimated to be 0.27km ² of maerl within Bluemull Sound (Hirst et al., 2013). This habitat is considered to be threatened and declining in Scottish waters.	1.9km
Shallow tide-swept coarse sands with burrowing bivalves	There are a small number of discrete and widely dispersed locations of this habitat within the NCMPA. No indicators of damage to this feature were recorded during the most recent marine biological survey which was undertaken in 2012 (Hirst et al., 2013). The feature is therefore considered in good condition and to be in a natural state. This habitat is considered to be threatened and declining in Scottish waters.	Within
Marine geomorphology of the Scottish Shelf Seabed	The Fetlar to Haroldswick NCMPA lies fully within the Shetland Carbonate Production Area, which is a key geodiversity area in Scottish waters, and an internationally important example of a non-tropical shelf carbonate system (the biological production of marine sediments with high calcium carbonate content -	Within



derived from the shells of animals that live in on the seabed or from coralline algae such as maerl).

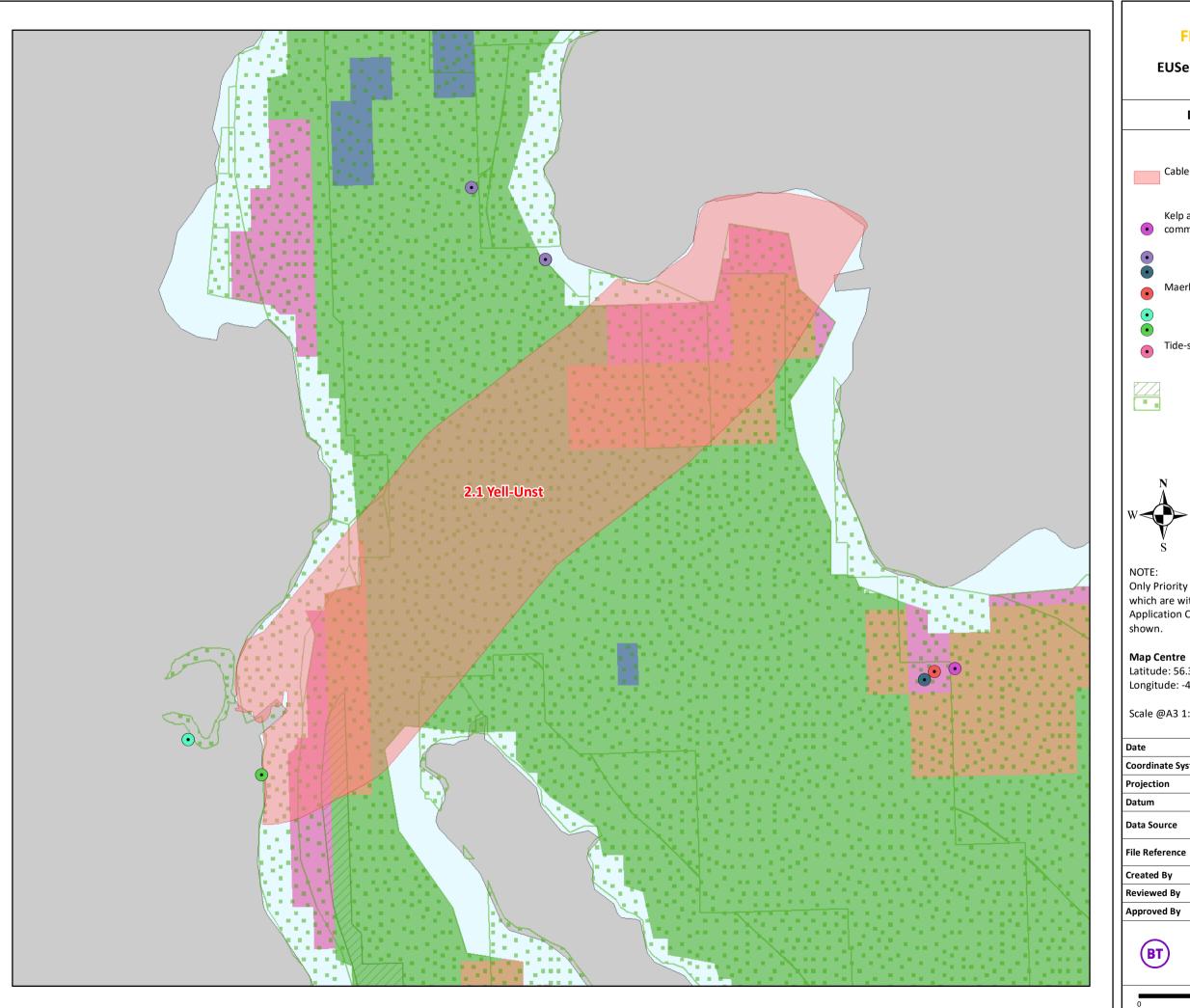
Table 5-8 Habitat types identified from the video and still imagery analysis for the Cable Corridor 2.1 Yell to Unst (Appendix A).

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	At one location outside of the Wick of Belmont, on the northern end of the cable corridor, and at two locations just off the coast of Yell.
A3.223	Mixed kelp and red seaweeds on infralittoral boulders, cobbles and gravel in tidal rapids	None	None	At one location outside of the Wick of Belmont, on the northern end of the cable corridor.
A4.214	Faunal and algal crusts on exposed to moderately wave- exposed circalittoral rock	None	Reef	At one location in the centre of the cable corridor.
A4.2142	Alcyonium digitatum, Pomatoceros triqueter, algal and bryozoan crusts on wave-exposed circalittoral rock	None	Reef	At two locations in the centre of the cable corridor.
A5.14	Circalittoral coarse sediment	Sandeel	None	At three locations in the centre of the cable corridor and one location just off the coast of Yell.
A5.445	Ophiothrix fragilis and/or Ophiocomina nigra brittlestar beds on sublittoral mixed sediment	None	Reef	At three locations outside of the Wick of Belmont, on the northern end of the cable corridor, and at four locations on the south end of the cable corridor near Yell.
A5.5	Sublittoral macrophyte- dominated sediment	None	None	Two locations at Unst nearshore, in the Wick of Belmont.

5.3.5.3 Sediment characterisation and sandeel potential

Cable Corridor 2.1 Yell to Unst was outside of the extent of data available for BGS sediment and sandeel probability mapping. The EUSM broad habitat types identified across the cable corridor are types of infralittoral and circalittoral rock.

During the DDV benthic habitat surveys (Provided in Appendix A) sandeel were observed at one location in the nearshore area on approach to the Unst landing point, where there are circalittoral coarse sediments (EUNIS Habitat A5.14).



SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT SEABED HABITATS

EUSeaMap and Priority Marine Features 2.1 Yell-Unst

Drawing No: P2308-HAB-002

В



Kelp and seaweed communities on sublittoral

Maerl or coarse shell gravel

Tide-swept algal communities



Only Priority Marine Features which are within 1km of the Application Corridors are

Latitude: 56.3156°N Longitude: -4.9219°W

Scale @A3 1:20,000,000



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







5.3.6 Cable Corridor 2.2 Shetland to Yell

Cable Corridor 2.2 Shetland to Yell is located within Yell Sound, passing from the south of Yell, below the islands Orfasay and Samphrey, to the north-east side of Shetland mainland. Strong currents pass through the sound driven by tidal streams in the area.

5.3.6.1 Intertidal area

Table 5-9 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 5-9 Characteristics of Cable Corridor 2.2 Shetland to Yell landing points

Cable Corridor 2.2	Shetland	Yell
Location	The Shetland mainland landing point is located at Mossbank on the east side of Shetland Mainland, just south of Sullom Voe.	The Yell landing point is located at entrance to Burra Voe on the south side of Yell.
Description	North shore is predominantly cobbles and boulders and some rock outcrops, with a small pier backed by rock armouring. South of the pier there is steep craggy bedrock with embayments of cobbles.	Small pier area and sheltered rocky shore backed by grass faced sloping cliff and some rock armouring north of the BMH. Mid and south survey area is comprised of bedrock, cobbles and boulders, backed by a stone wall and agricultural land. At the BMH there is a small strandline of decaying seaweed.
No. of biotopes recorded by Phase 1 intertidal survey	17	13
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

5.3.6.2 Subtidal area

A total of 11 broad EUNIS habitat types were identified within Cable Corridor 2.2 Shetland to Yell (Table 5-10). The habitats were patchy across the cable corridor and the surrounding area, with Atlantic and Mediterranean high energy circalittoral rock (EUNIS habitat A4.1) and circalittoral coarse sediments (EUNIS habitat A5.14) dominating the cable corridor (Table 5-10; Figure 5-5, Drawing Reference: P2308-HAB-002_2.2 Shetland-Yell).

Cable Corridor 2.2 Shetland to Yell intersects bedrock/stony Annex I reef habitat across the majority of the cable corridor. As discussed in Appendix C – Protected Sites Assessment, Cable Corridor 2.2 Shetland to Yell does not intersect any protected sites designated for benthic species or features. No PMFs have been identified as present from the desk-backed search of literature.

Table 5-10 EUNIS habitats within the Cable Corridor 2.2 Shetland to Yell (EMODnet, 2020)

Habitat	EUNIS code
Infralittoral rock and other hard substrata	A3

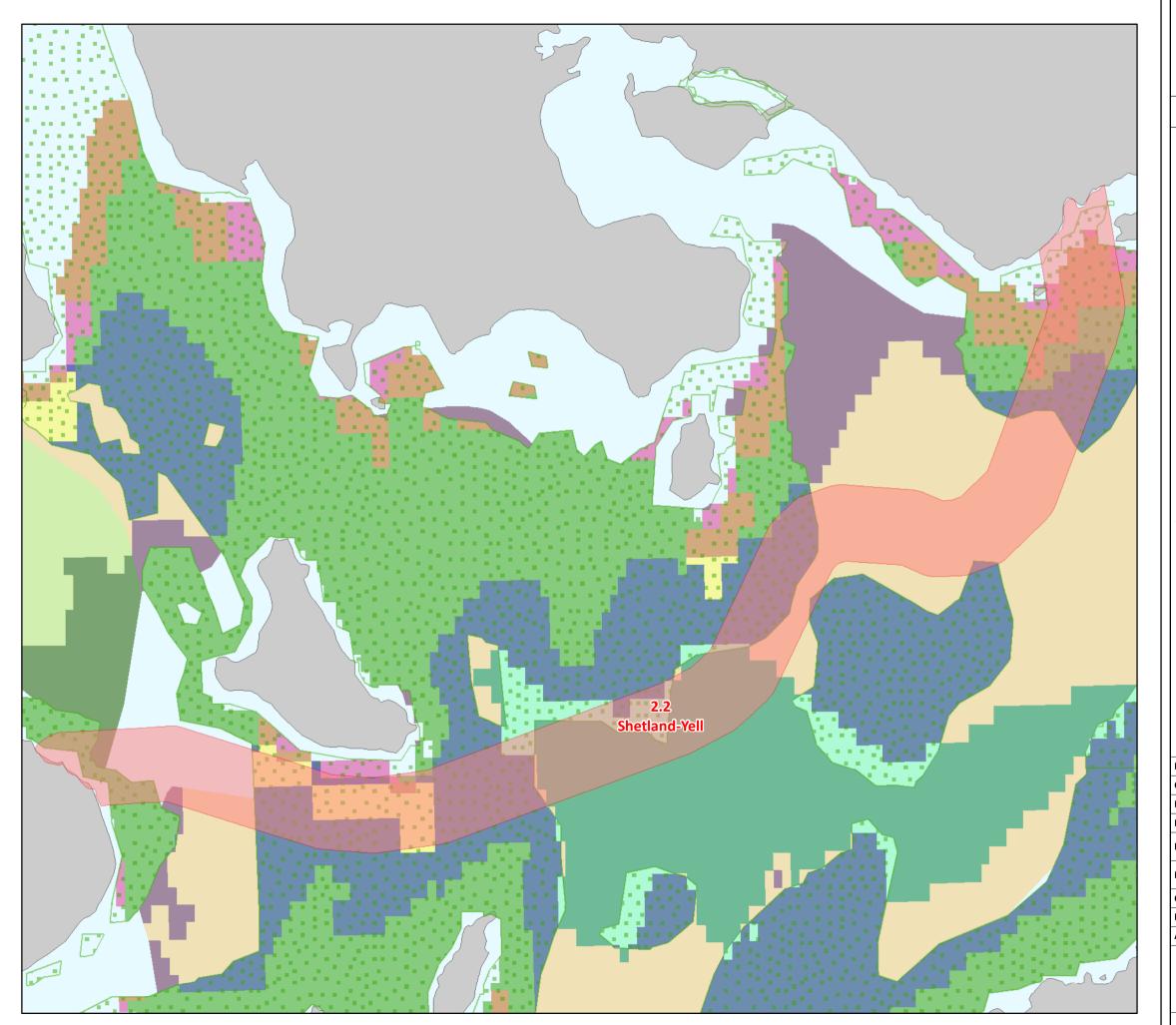




Habitat	EUNIS code
Atlantic and Mediterranean high energy infralittoral rock	A3.1
Atlantic and Mediterranean low energy infralittoral rock	A3.3
Circalittoral rock and other hard substrata	A4
Atlantic and Mediterranean high energy circalittoral rock	A4.1
Sponge communities on deep circalittoral rock	A4.12
Atlantic and Mediterranean low energy circalittoral rock	A4.3
Infralittoral coarse sediment	A5.13
Circalittoral coarse sediment	A5.14
Deep circalittoral coarse sediment	A5.15
Infralittoral mixed sediments	A5.43

5.3.6.3 Sediment characterisation and sandeel potential

According to BGS sediment mapping, Cable Corridor 2.2 Shetland to Yell crosses gravelly sand across the majority of the corridor, with a small area of muddy sandy gravel near the Shetland landing point (BGS, 2020). The EUSM broad habitat type identified across the corridor range include coarse sediments which could provide suitable habitat for sandeel.



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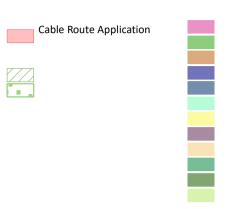
FIBRE OPTIC CABLE PROJECT
SEABED HABITATS
SeaMan and Priority Marine Feature

EUSeaMap and Priority Marine Features 2.2 Shetland-Yell

Drawing No: P2308-HAB-002

2

В





NOTE: Only Priority Marine Features

which are within 1km of the Application Corridors are shown.

Map Centre

Latitude: 56.3156°N Longitude: -4.9219°W

Scale @A3 1:20,000,000



NOTE: Not to be used for Navigation

Date	12 October 2021
Coordinate System	WGS 1984 UTM Zone 30N
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Created By	Jessica Harvey
Reviewed By	Chris Dawe
Approved By	Paula Daglish







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5.3.7 Cable Corridor 2.3 Sanday to Shetland

Cable Corridor 2.3 Sanday to Shetland connects the Orkney and Shetland geographical areas, passing from the north east side of Sanday, Orkney, to Grutness on the southern tip of Shetland. It crosses the Fair Isle Channel, passing east of Fair Isle. The waters off Sanday are clear and relatively shallow, hosting a complex coastline dominated by extensive sandy beaches and sheltered inlets, interspersed with rocky headlands (JNCC, 2021b). Sanday is notable for the extensive subtidal bedrock reefs that surround the island and provide a habitat for dense forests of kelp *Laminaria* spp (JNCC, 2021b).

5.3.7.1 Intertidal area

Table 5-11 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 5-11 Characteristics of Cable Corridor 2.3 Sanday to Shetland

Cable Corridor 2.3	Shetland landing point	Sanday landing point
Location	The Shetland landing point is located at Grutness, on the eastern side of the Shetland Mainland at Grutness Voe.	The Sanday landing point is located at Scuthvie Bay on the northeast side of Sanday, where there is moderate surf and a very high tide.
Description	Large central sandy bay backed by dunes, with an airport immediately to the west and north of the voe. Northern and southern shores are rocky, with a pier on the southern shore.	The upper shore is sandy, backed by dunes and eroding sandy cliffs. In the intertidal area there are large outcrops of rock from the mid to lower shore. East of the proposed BMH there is flatter rocky shore.
No. of biotopes recorded by Phase 1 intertidal survey	12	12
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

A total of 10 broad EUNIS habitat types were identified within the cable corridor (Table 5-12). The entire cable corridor is dominated by deep circalittoral coarse sediment (EUNIS habitat A5.15). Just offshore of the Sanday landing point within the Bay of Stove, EUNIS habitats A2.231 and A5.234 have also been identified (Table 5-12; Figure 5-6, Drawing Reference: P2308-HAB-002-B_2.3 Sanday-Shetland).

DDV and still image surveys at Sanday nearshore area identified two *Laminaria hyperborea* dominated habitats which qualify as Kelp Bed PMFs and Annex 1 bedrock reef habitats (Table 5-13; Appendix A). This is consistent with the PMF's identified by NatureScot at Sanday. Kelp bed PMFs have also been identified within the cable corridor offshore of the Shetland landing point (Figure 5-6, Drawing Reference: P2308-HAB-002-B_2.3 Sanday-Shetland). Tide-swept algae community PMF had also been previously identified north of the cable corridor at the Sanday landing point, however these were not identified within the cable corridor during DDV and still image surveys. Full details of the DDV benthic survey and supporting figures are provided in Appendix A.



Previous EMODnet seabed habitat partner surveys identified 'Grazed *Laminaria hyperborea* forest with coralline crusts on upper infralittoral rock' and Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock' (EUNIS habitat A4.214) near the Shetland landing point at Sumburgh Head (Table 5-12).

Potential Annex I bedrock/stony reef was identified at both landing points and confirmed within Sanday nearshore areas during DDV and still image surveys (Table 5-12, Table 5-13). No potential sandbank features were found in the vicinity of the cable corridor.

As discussed in Appendix C – Protected Sites Assessment, the landing point at Sanday is within the Sanday SAC and East Sanday Coast SSSI which are designated for the following habitat features:

Sanday SAC

- Bedrock reef habitat
- Sandbanks which are slightly covered by sea water all the time
- Mudflats and sandflats not covered by seawater at low tide

East Sanday Coast SSSI

- Rocky Shore
- Sandflats

However, sandbank and mudflat features were not identified in DDV and still image surveys undertaken within the cable corridor within Sanday SAC.



Table 5-12 EUNIS habitats within the Cable Corridor 2.3 Sanday to Shetland

Habitat	EUNIS code	Species/ benthic features identified from previous surveys	Source
Infralittoral rock and other hard substrata	А3	NA – Broad-scale seabed habitat map only available	1
Atlantic and Mediterranean high energy infralittoral rock	A3.1	NA – Broad-scale seabed habitat map only available	1
Atlantic and Mediterranean moderate energy infralittoral	A3.2	NA – Broad-scale seabed habitat map only available	1
Grazed <i>Laminaria hyperborea</i> forest with coralline crusts on upper infralittoral rock	A3.214	Shetland landing point nearshore: Mixed angular boulders and cobbles with coarse sand/pebble Rare bedrock outcrops Large kelp plants Crustose algae on most upward facing surfaces Echinus on sides/overhang	2
Atlantic and Mediterranean low energy infralittoral rock	A3.3	NA – Broad-scale seabed habitat map only available	1
Atlantic and Mediterranean high energy circalittoral rock	A4.1	NA – Broad-scale seabed habitat map only available	1
Sponge communities on deep circalittoral rock	A4.12	NA – Broad-scale seabed habitat map only available	1
Atlantic and Mediterranean moderate energy circalittoral rock	A4.2	NA – Broad-scale seabed habitat map only available	1
Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock	A4.214	Shetland landing point nearshore: Mixed angular boulders and cobbles with coarse sand/pebble Rare bedrock outcrops Large kelp plants. Crustose algae on most upward facing surfaces Echinus on sides/overhang Off Sumburgh Head coast: Heavily grazed coralline encrusted bedrock below the kelp zone. Frequent Echinus and chitons Crevices filled with Chlamys sp., brittle stars and Galathea squamifera	2
Faunal communities on deep moderate energy	A4.27	NA – Broad-scale seabed habitat map only available	1
Circalittoral coarse sediment	A5.14	Heterogeneous coarse sediment of between Fair Isle and Sumburgh Head Shell and stone gravel with shells sediment Low diversity epifauna dominated by Alcyonidium diaphanum	1,2
Deep circalittoral coarse sediment	A5.15	NA – Broad-scale seabed habitat map only available	1



Habitat	EUNIS code	Species/ benthic features identified from previous surveys	Source
Deep circalittoral sand	A5.27	NA – Broad-scale seabed habitat map only available	1

Sources:

Table 5-13 Habitat types identified from the video and still imagery analysis for the Cable Corridor 2.3 Sanday to Shetland (Appendix A).

EUNIS Code	Habitat	PMF	Annex I	Location
A3.1151	Laminaria hyperborea forest with dense foliose red seaweeds on exposed upper infralittoral rock	Kelp Beds	Bedrock Reef Sub-feature	Across the cable corridor from 5m to 11m depth.
A3.1152	Laminaria hyperborea park with dense foliose red seaweeds on exposed lower infralittoral rock	Kelp Beds	Bedrock Reef Sub-feature	Across the cable corridor from 14m to 25m depth.
A5.2	Sublittoral sand	None	None	At two point in the nearshore area at 8m depth.

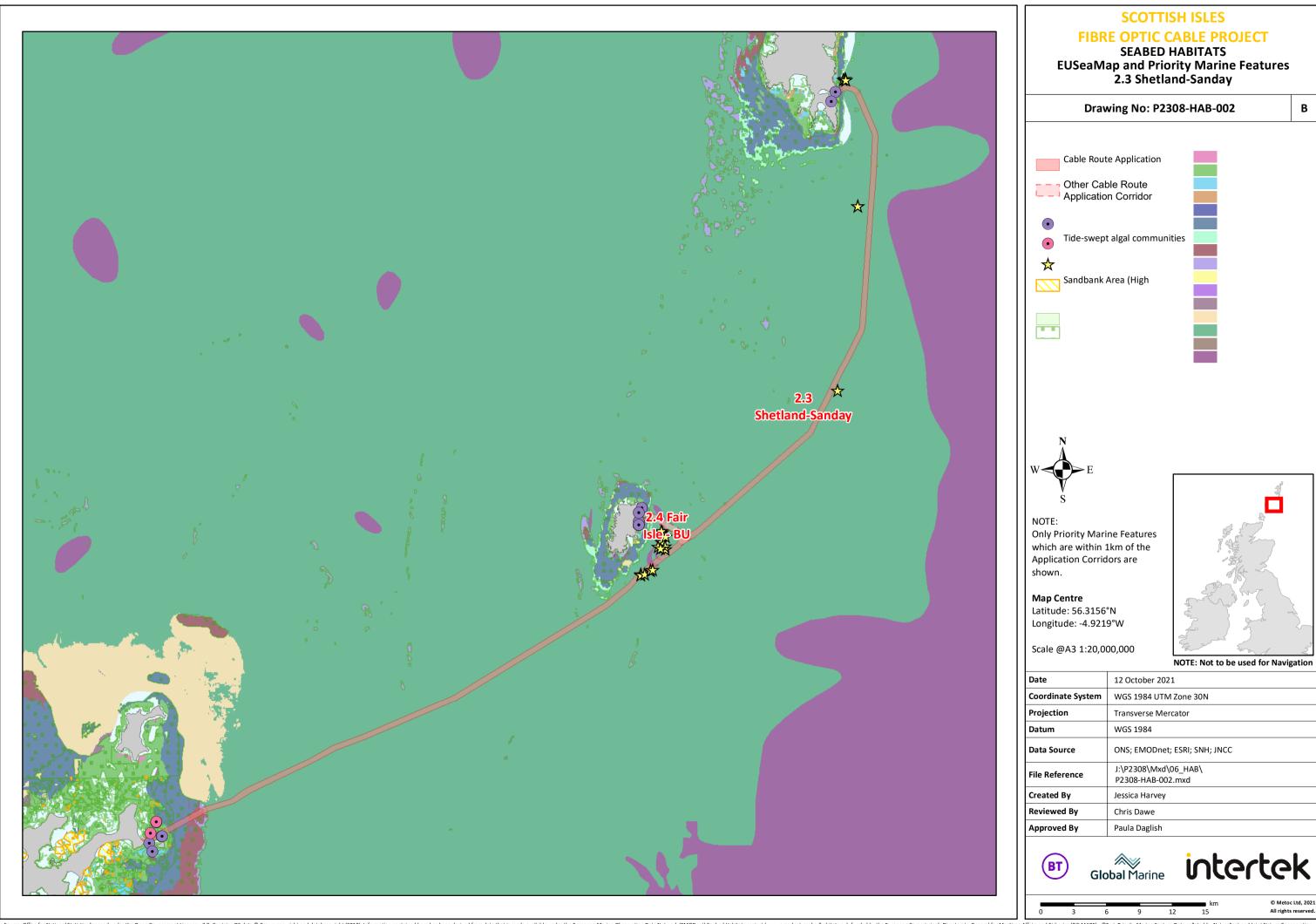
5.3.7.3 Sediment characterisation and sandeel potential

According to BGS sediment data, Cable Corridor 2.3 Sanday to Shetland predominantly crosses areas of gravelly sand and sandy gravel (BGS, 2020). This is consistent with the EUSM broad habitat map which shows that the area is dominated by deep circalittoral coarse sediment (Figure 5-6, Drawing Reference: P2308-HAB-002-B_2.3 Sanday-ShetlandSanday-Shetland), which could provide suitable habitat for sandeel. Additionally, sandeel PMF have been previously identified offshore of Fair Isle and, in two locations in the northern half of the cable corridor as well as approximately 470m north of the cable corridor near Sumburgh Head (Figure 5-6: Drawing Reference: P2308-HAB-002-B_2.3 Sanday-ShetlandSanday-Shetland).

As sandeel require sediment substrates, and sandeel PMF have been previously identified along the cable corridor, there is likely to be suitable sandeel habitat within Cable Corridor 2.3 Sanday to Shetland.

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)



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5.3.8 Cable Corridor 2.4 Fair Isle to BU

Cable Corridor 2.4 Fair Isle to BU connects Fair Isle to Cable 2.3 Sanday to Shetland. It runs from the north-east of Fair Isle to the connection point on Cable 2.3 east of Fair Isle.

5.3.8.1 Intertidal area

Table 5-14 summarises the intertidal information for the Fair Isle landing point. A detailed description of the biotopes and features observed are provided in the intertidal survey reports (Appendix A).

Table 5-14 Characteristics of Cable Corridor 2.4 Fair Isle landing point

Cable Corridor 2.4	Fair Isle landing point
Location	The Fair Isle landing point is at North Haven on the north east of the island.
Description	Shallow inlet bounded by cliffs approximately 20m high to the east and west. The southern boundary is a wide sandy beach, backed by a band of cobbles. An isthmus separating North and South Haven has a retaining wall, with a road to access the North Haven pier. There is an old slipway in the middle of the beach.
No. of biotopes recorded by Phase 1 intertidal survey	10
Presence of Annex I habitat or PMF	The Fair Isle coastal fringe, including North Haven, is within the Fair Isle Special Area of Conservation (SAC). However, there are no biotopes of conservation importance within 30 m of the cable corridor (nearest 31 m).
Presence of OSPAR Listed Threated and/or Declining Species or BAP priority marine species	BAP species Fucus distichus occurs at the base of North Haven's east cliff.

5.3.8.2 Subtidal area

Seven broad EUNIS habitat types were identified within the cable corridor (Table 5-15; Figure 5-7, Drawing Reference: P2308-HAB-002_2.4 Fair Isle-BU). The dominant habitat types were Atlantic and Mediterranean high energy circalittoral rock (EUNIS habitat A4.1) and Deep circalittoral coarse sediment (EUNIS habitat A5.15), with the majority of the other habitats occurring near Fair Isle outside of North Haven (Figure 5-7; Drawing Reference: P2308-HAB-002_2.4 Fair Isle-BU). Previous surveys by EMODnet seabed habitat partners have identified a number of cave habitats along the Fair Isle coast, in addition to several rock and sediment habitats within North Haven bay, and at the beach (Table 5-15).

The cable corridor intersects bedrock/stony Annex I reef habitat near Fair Isle but does not intersect any protected sites which are designated for benthic species or features. It also does not intersect with any PMFs or Annex I sandbank habitat features. However, sandeel PMF are found approximately 50m south of centre of the cable corridor (Figure 5-7). The BAP species *Fucus distichus* was identified at the base of the North Haven east cliff at the entrance to the bay during intertidal surveys (Appendix A, Cable Corridor 2.4 Fair Isle to BU Intertidal Survey).

Table 5-15 EUNIS habitats within Cable Corridor 2.4 Fair Isle to BU

Habitat	EUNIS code	Species/ benthic features identified from previous surveys	Source
Semibalanus balanoides, Patella vulgata and Littorina spp. on exposed to moderately exposed or vertical sheltered eulittoral rock	A1.1131	Middle shore, bedrock.at North Haven beach dominated by Patella and Balanus balanoides Littorina neritoides	2





Habitat	EUNIS code	Species/ benthic features identified from previous surveys	Source
		Saxitilis, neglecta	
		 Few Fucus spiralis plants 	
Himanthalia elongata and red seaweeds on exposed lower eulittoral rock	A1.123	Lower shore bed rock at North Haven beach dominated by:	2
		 Himanthalia and Mastocarpus patella, Balanus balanoides and 	
		 Mytilus present in crevice 	
Fucus spiralis on full salinity upper eulittoral mixed substrata	A1.3122	Upper shore bedrock at North Haven beach supporting:	2
		 Community dominant in Fucus spiralis. 	
		 Porphyra and Verrucaria maura also present 	
Infralittoral rock and other hard substrata	A3	NA – Broad-scale seabed habitat map only available.	1
Atlantic and Mediterranean high energy infralittoral rock	A3.1	NA – Broad-scale seabed habitat map only available.	1
Atlantic and Mediterranean moderate energy infralittoral	A3.2	NA – Broad-scale seabed habitat map only available.	1
<i>Laminaria digitata</i> on moderately exposed sublittoral fringe rock	A3.211	None specified.	2
Robust faunal cushions and crusts in surge gullies and caves	A3.71	Caves near North Haven with communities dominated by the following species:	2
		 Dendrodo grossularia 	
		 Clathrina coriacea 	
		Balanus crenatus	
		 Pomatoceros triqueter Verruca stroemia 	
Circalittoral rock and other hard substrata	A4	NA – Broad-scale seabed habitat map only available.	1
Atlantic and Mediterranean high energy circalittoral rock	A4.1	NA – Broad-scale seabed habitat map only available.	1
Sponge communities on deep circalittoral rock	A4.12	NA – Broad-scale seabed habitat map only available.	1
Fucoids and kelp in deep eulittoral rockpools and Green seaweeds	A1.412 and	Middle shore pools at North Haven beach containing:	2
(Enteromorpha spp. and Cladophora spp.) in shallow upper shore rockpools	A1.421	 Uplifted Himanthalia, Corallina, Dumontia and Laminaria sporelings. 	
		 Cladophora spp dominated some pools. 	
Atlantic and Mediterranean moderate energy circalittoral rock	A4.2	NA – Broad-scale seabed habitat map only available.	1
Infralittoral coarse sediment	A3.13	Rippled sand at North Haven coast supporting:	2
		Frequent Lanice sp and Sepiola spDrift alga	
		 Arenicola community 	



Habitat	EUNIS code	Species/ benthic features identified from previous surveys	Source
Prasiola stipitata on nitrate-enriched supralittoral or littoral fringe rock	B3.112	Supralittoral fringe at North Haven beach with: Dominant <i>Prasiola</i> and <i>Verrucaria maura</i> Sparse <i>Caloplaca</i> and <i>Xanthoria</i> .	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
Circalittoral fine sand or Circalittoral muddy sand	A5.25 or 26	NA – Broad-scale seabed habitat map only available.	1
Deep circalittoral sand	A5.27	NA – Broad-scale seabed habitat map only available.	1

Sources:

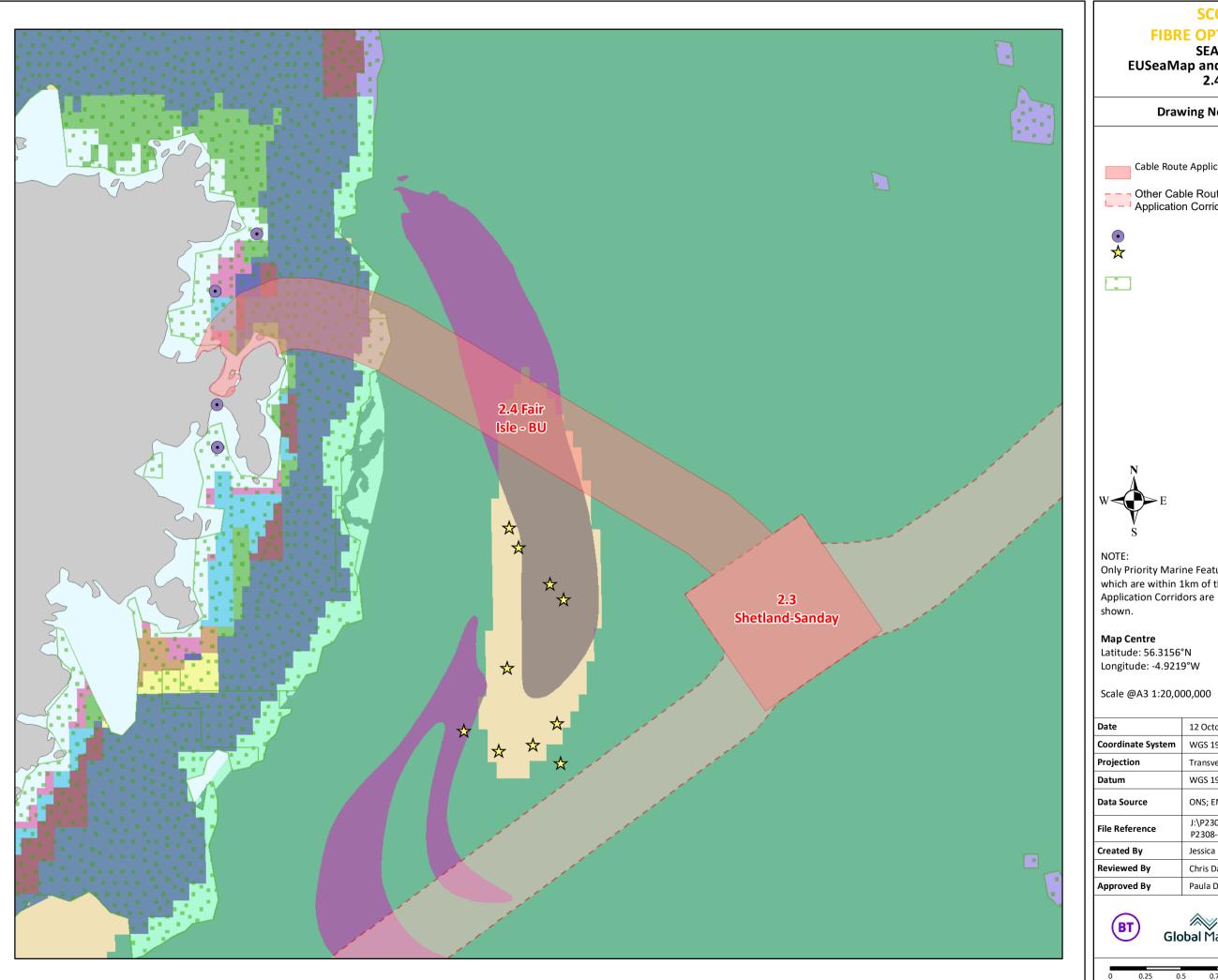
5.3.8.3 Sediment characterisation and sandeel potential

Cable Corridor 2.4 Fair Isle to BU lies entirely within the area mapped by BGS as sandy gravel (BGS, 2020). The cable corridor also crosses a range of rock and sediment broad habitat types (Figure 5-7). Additionally, sandeel PMF have been previously identified in sediment habitats offshore of Fair Isle, approximately 50m south of the cable corridor.

As sandeel require sediment substrates which are present within Cable Corridor 2.4 Fair Isle to BU, and sandeel PMF have been previously identified close to the cable corridor, there is likely to be suitable sandeel habitat within Cable Corridor 2.4 Fair Isle to BU.

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)

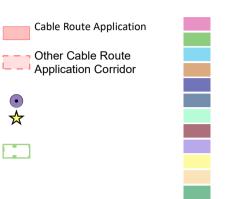


SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT SEABED HABITATS

EUSeaMap and Priority Marine Features 2.4 Fair Isle - BU

Drawing No: P2308-HAB-002

В



Only Priority Marine Features which are within 1km of the



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; EMODnet; ESRI; SNH; JNCC
J:\P2308\Mxd\06_HAB\ P2308-HAB-002.mxd	
Created By	Jessica Harvey
Reviewed By Chris Dawe	
Approved By	Paula Daglish





5.3.9 Cable Corridor 2.8 Shetland to Whalsay

Cable Corridor 2.8 Shetland to Whalsay passes across Drury Voe from the east side of Shetland Mainland to the west side of Whalsay.

5.3.9.1 Intertidal area

Table 5-16 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 5-16 Characteristics of Cable Corridor 2.8 Shetland to Whalsay landing points

Cable Corridor 2.8	Shetland landing point	Whalsay landing point
Location	The Shetland landing point is southwest of Levaneap, on the east side of Shetland Mainland on the Northern shore of Drury Voe and 2.5km east of Laxo ferry port.	The Whalsay landing point is west of Symbister town, northwest of Symbister Bay. Southwest of the proposed BMH there is a harbour and marina.
Description	Craggy shore with cobbles and bedrock at the top of the shore. The area below the BMH is mobile cobbles flanked by bedrock on either side.	Northeast of the harbour, near the BMH, the shore has steep ragged bedrock, cobble bays and flat rock peninsulas. West of the harbour there is rock armouring and deposited debris from the quarry above.
No. of biotopes recorded by Phase 1 intertidal survey	12	20
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

5.3.9.2 Subtidal area

The majority of Cable Corridor 2.8 Shetland to Whalsay was outside of the predictive broad scale habitat map (Table 5-3, above). Habitats which were within the extent of the map were dominated by Atlantic and Mediterranean high energy infralittoral rock (EUNIS habitat A3.1). The cable corridor also overlaps with a small area of circalittoral coarse sediment (EUNIS Habitat A5.14), which extends over a wide area south of the cable corridor (Table 5-17; Figure 5-8, Drawing Reference: P2308-HAB-002_2.8 Shetland-Whalsay).

Cable Corridor 2.8 Shetland to Whalsay overlaps with small areas of potential bedrock/stony reef adjacent to both the Shetland and Whalsay landing points. Burrowed mud PMF has been previously identified within the western side of the cable corridor. Kelp and seaweed communities on sublittoral sediment PMF and horse mussel beds PMF have been identified near the Shetland landing point, approximately 88m and 380m west of the cable corridor, respectively (Figure 5-8, Drawing Reference: P2308-HAB-002_2.8 Shetland-Whalsay).

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

Table 5-17 EUNIS habitats within the Cable Corridor 2.8 Shetland to Whalsay (EMODnet, 2020)



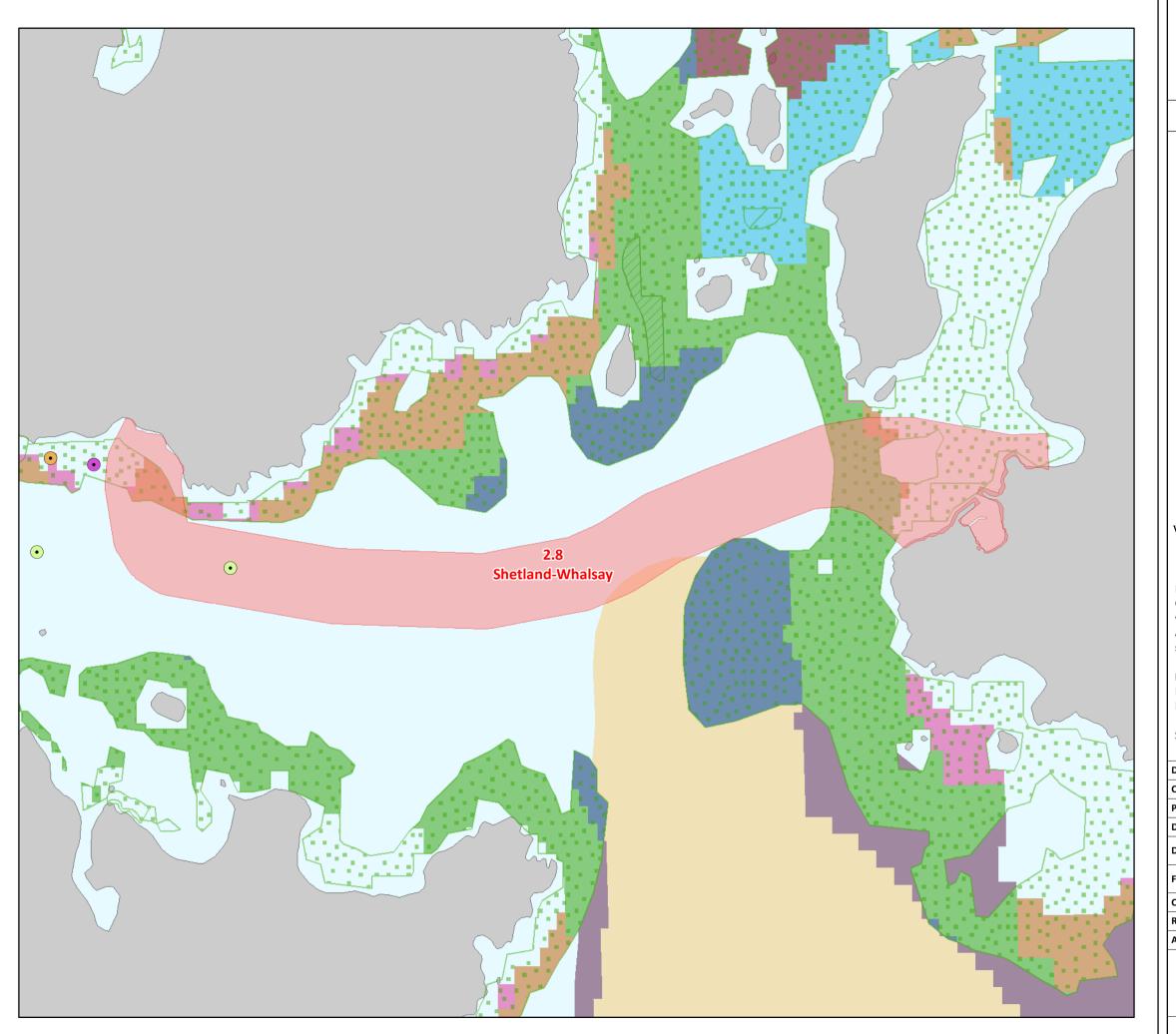


Habitat	EUNIS code
Infralittoral rock and other hard substrata	А3
Atlantic and Mediterranean high energy infralittoral rock	A3.1
Atlantic and Mediterranean low energy infralittoral rock	A3.3
Atlantic and Mediterranean high energy circalittoral rock	A4.1
Circalittoral coarse sediment	A5.14

5.3.9.3 Sediment characterisation and sandeel potential

Cable Corridor 2.8 Shetland to Whalsay is expected to cross a mix of gravels, sands and occasional rock outcrops. This is based on a combination of charted seabed types and BGS data covering the area to the south of the route (Global Marine, 2021). Gravels and sands, depending on their composition, have potential to provide suitable habitat for sandeel.

As sandeel require sediment substrates there is potential for suitable sandeel habitat within Cable Corridor 2.8 Shetland to Whalsay.

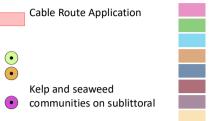


SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

SEABED HABITATS EUSeaMap and Priority Marine Features 2.8 Shetland-Whalsay

Drawing No: P2308-HAB-002

В







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

Map Centre

Latitude: 56.3156°N Longitude: -4.9219°W

Scale @A3 1:20,000,000



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









5.4 Benthic and Intertidal Ecology - Assessment of Effects

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 5-18 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 5-18 Pressures considered for cable corridors in Shetland 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 5-19, 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.

Cable crossings occur within Cable Corridors 2.2 Shetland to Yell, and Cable Corridor 2.3 Sanday to Shetland. These crossings do not occur within any identified protected benthic features, or in the vicinity of any PMFs.



Table 5-19 Potential pressures, installation activities and key sensitive receptors

Potential pressure	Activities resulting in pressure	Footprint	of Installation	Key sensitive receptor
		Cable Corridor	Approximate Footprint (m²)	
Abrasion /	Plough (skids and share) and	2.1	6500	 Reef habitat
disturbance at the	Jetting Plough Pre-Lay Grapnel	2.2	25090	Kelp bed PMF
surface of the	Run (PLGR) and surface cable	2.3	285700	 Burrowed mud PM
substratum	lay. Footprint: 2.6m wide x length of cable corridor with cable burial (worst case)	2.4	13760	
		2.8	18900	 Kelp and seaweed communities on sublittoral sedime PMF
				 Circalittoral sand and coarse sediment communities
				 Shallow tide-swept coarse sands with
				burrowing bivalves
				 Tide-swept algal communities
				 Sandeel
Penetration and/or disturbance of the	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)	2.1	5000	 Burrowed mud PMI
substrate below		2.2	28000	 Circalittoral sand
the surface of the		2.3	280000 13000	and coarse
seabed, including		2.4	17000	sediment
abrasion			17000	communities
				 Shallow tide-swept coarse sands with
				 burrowing bivalves
				_
				 Tide-swept algal communities
				Sandeel
Physical change to	External cable protection	2.1	28 rock bags +	Reef habitat
another seabed type	(concrete mattresses, rock bags, rock berms) Footprint (worse case deposits): 7m² per rock bag		3 mattresses =	Kelp bed PMF
			250m²	 Burrowed mud PMI
		2.2	66 rock bags +	 Kelp and seaweed
			3 mattresses + 1 rock berm =	communities on
			100k beriii = 1036 m²	sublittoral sedimen
		2.3	186 rock bags	PMF
	18m² per mattress		+ 12	 Circalittoral sand
	Length 40m, width 13m per		mattresses + 1	and coarse
	rock berm at power crossings.		rock berm =	sediment
			2038 m²	communities
		2.4	13 rock bags	 Shallow tide-swept coarse sands with
			and 3	
			mattresses =	 burrowing bivalves
		20	145 m ²	 Tide-swept algal
		2.8	32 rock bags + 3 mattresses =	communities
			278 m ²	 Sandeel
Siltation rate		2.1	500000	Sandeel
changes including		2.2	1930000	



smothering (depth	Siltation from the Plough and	2.3	21974000	•	Reef habitat
of vertical	Jetting Plough	2.4	1058000		Kelp bed PMF
sediment overburden)	Footprint (worst case): 200m x length of the cable corridor with cable burial	2.8	1454000		Kelp and seaweed communities on sublittoral sediment PMF Burrowed Mud PMF

For each of the pressures which have been screened in Table 5-19, the cable corridors where the pressure applies, and the relevant protected receptors present within each cable corridor has been summarised in Table 5-20.

Cable Corridor 2.1 Yell to Unst is within Fetlar and Haroldswick NCMPA, which has six designated habitat and geology features. The following habitats are designated habitat features of the NCMPA, but have not been previously found within the cable corridor according to the NCMPA proposal documents, and were not identified during the DDV surveys of the cable corridor:

- Horse mussel beds,
- Kelp and seaweed communities on sublittoral sediment,
- Maerl beds.

Therefore, no effect will occur to these habitats from the installation activities at Cable Corridor 2.1 Yell to Unst.

The BAP species *Fucus edentates sensu stricta* was identified at the base of the North Haven east cliff at the entrance to the bay near the Cable Corridor 2.4 Fair Isle landing point. As installation activities will avoid the cliffs, there will be no impact to this species during installation activities, and no further assessment has been provided.

Table 5-20 Summary of pressures and relevant protected receptors identified for cable corridors in Shetland geographical area

Potential Pressure	Cable Corridor				
	2.1	2.2	2.3	2.4	2.8
Abrasion/disturbance at the surface of the substratum	Reef Habitat Circalittoral sand and coarse sediment communities Shallow tide-swept coarse sands with burrowing bivalves Tide-swept algal communities Sandeel	Reef Habitat Sandeel	Reef Habitat / Rocky Shore Kelp Bed PMF Sandeel	Reef Habitat Sandeel	Reef Habitat Kelp and seaweed communities on sublittoral sediment PMF Burrowed Mud PMF Sandeel
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Circalittoral sand and coarse sediment communities Shallow tide-swept coarse sands with burrowing bivalves Tide-swept algal communities Sandeel	Sandeel	Kelp Bed PMF Sandeel	Sandeel	Reef Habitat Kelp and seaweed communities on sublittoral sediment PMF Burrowed Mud PMF Sandeel
Physical change to another seabed type	Reef Habitat	Reef Habitat	Reef Habitat	Reef Habitat	Reef Habitat



	Circalittoral sand and coarse sediment communities Shallow tide-swept coarse sands with burrowing bivalves Tide-swept algal communities Sandeel	Sandeel	Kelp Bed PMF Sandeel	Sandeel	Kelp and seaweed communities on sublittoral sediment PMF Burrowed Mud PMF Sandeel
Siltation rate changes including smothering (depth of vertical sediment overburden)	Reef Habitat Sandeel	Reef Habitat Sandeel	Reef Habitat Kelp Bed PMF Sandeel	Reef Habitat Sandeel	Reef Habitat Kelp and seaweed communities on sublittoral sediment PMF Burrowed Mud PMF Sandeel

5.4.2 Compliance and best practice measures – biological environment

The R100 Project within the Shetland 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 5-21, below. When undertaking the assessment, it has been assumed that these measures will be complied with.

Table 5-21 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
BP7	Rock berms and bags 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 rock berm stability.	Existing Asset Owner (BT)
BP9	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
BP11	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
BP12	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
BP13	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. 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 Shetland 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:

- **Sediment habitats:** including circalittoral sand and coarse sediment communities and shallow-tide-swept coarse sands with burrowing bivalves.
- 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, kelp and seaweed communities on sublittoral sediment PMF and rocky shore habitats.
- Burrowed mud PMF.
- Sandeel.

Sediment habitats

Sediment habitats, including circalittoral sand and coarse sediment communities and shallow-tide-swept coarse sands with burrowing bivalves within the cable corridors are mobile bedforms of high energy environments, and have been assessed as not sensitive to surface disturbance and abrasion (Marine Scotland, 2021). The installation activities will be transient, with pre-installation conditions quickly returning following natural sediment transport processes. The area affected will also be highly localised, limited to only 2.6m width (worst case) along the cable corridors.





The effects from abrasion and/or disturbance of the substrate on the surface of the seabed on sediment habitats (circalittoral sand and coarse sediment communities and shallow-tide-swept coarse sands with burrowing bivalves) has been assessed as negligible.

Potential Annex I reef and related sub-features

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. Rocky shores, such as those protected under East Sanday Coast SSSI, are rock-dominated habitats which occur in the intertidal zone. The recoverability of rocky reef and rocky shore 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 across Shetland, 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, tide-swept algal communities and rocky shore habitats) 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).

Additionally, 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 potential mudflats and sandflats not covered by seawater at low tide and burrowed mud PMF has been assessed as negligible.

Sandee

Sandeel prefer sand ripple sediments. The pressure has the potential to affect habitat preferences and settlement of sandeel (Wright et al 2000). Sandeel have therefore been assessed to have medium sensitivity to surface abrasion (Marine Scotland, 2021). Additionally, if sandeel or their eggs are present, disruption to the surface could cause local mortality to burrowing individuals or their eggs.

Potential suitable sandeel habitat was found at all cable corridors in the Shetland geographical area. Sandeel PMF have been previously identified in the vicinity of Cable Corridor 2.3 Sanday to Shetland and Cable Corridor 2.4 Fair Isle to BU, and sandeel were identified in DDV surveys at Cable Corridor 2.1 Yell to Unst. 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).



The area of suitable habitat affected within these cable corridors 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 abrasion and/or disturbance of the substrate 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. The sediments along Cable Corridor 2.3 Sanday to Shetland, Cable Corridor 2.4 Fair Isle to BU and Cable Corridor 2.8 Shetland to Whalsay and approximately 40% of Cable Corridor 2.2 Shetland to Yell are primarily sands and gravels, 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:

- Sediment habitats: including circalittoral sand and coarse sediment communities and shallowtide-swept coarse sands with burrowing bivalves,
- 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.





Sediment habitats

Sediment habitats, including circalittoral sand and coarse sediment communities and shallow-tide-swept coarse sands with burrowing bivalves, along the cable corridors are mobile bedforms of high energy environments, meaning they have high resilience to sub-surface abrasion and penetration (Marine Scotland, 2021). The installation activities will be transient with the trench being backfilled by the action of the equipment. Pre-installation conditions will return quickly through natural sediment transport processes. The area affected will also be highly localised, limited to only 2.6m width (worst case) along the cable corridors.

The effect from penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion on sediment habitats (circalittoral sand and coarse sediment communities and shallow-tide-swept coarse sands with burrowing bivalves) has been assessed as negligible.

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.

Additionally, 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.

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 was found at all cable corridors in the Shetland geographical area. Sandeel PMF have been previously identified in the vicinity of Cable Corridor 2.3 Sanday to Shetland and Cable Corridor 2.4 Fair Isle to BU, and sandeel were identified in DDV surveys at Cable Corridor 2.1 Yell to Unst. 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 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 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. 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, which are proposed in Cable Corridor 2.2 Shetland to Yell and Cable Corridor 2.3 Sanday to Shetland (as described in Chapter 2 – Project Description). These are not within the protected sites for habitat features. Rock berms may also be used at cable crossings.

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 5-19.

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

- **Sediment habitats:** including circalittoral sand and coarse sediment communities and shallow-tide-swept coarse sands with burrowing bivalves.
- 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.

Rocky shore habitats occur in intertidal waters. Contingency cable protection will only be used in subtidal areas so there will be no impact to this habitat from the pressure physical change to another seabed type.

Sediment habitats

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, rock berms or concrete mattresses in soft sediment areas will be for a requirement of a crossing agreement.

Therefore, the only potential for physical change to another habitat type in sediment habitats is at the power cable crossings at Cable Corridor 2.2 Shetland to Yell and Cable Corridor 2.3 Sanday to Shetland (as described in Chapter 2 – Project Description). The cable crossings do not occur within the protected sites for habitat features or extent of potential Annex I sandbanks within Cable Corridor 2.3 Sanday to Shetland and there are no protected sediment habitats within Cable Corridor 2.2 Shetland to Yell. Therefore, there will be no impact to these features from the pressure physical change to another seabed type.

No effect.

Potential Annex I reef and related sub-features

In 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 Shetland geographical area, 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, rock berms or concrete mattresses in soft sediment areas will be for a requirement of a crossing agreement.

Therefore, the only potential for physical change to another habitat type in burrowed mud PMF is at the power cable crossings at Cable Corridor 2.2 Shetland to Yell and Cable Corridor 2.3 Sanday to Shetland (as described in Chapter 2 – Project Description). Burrowed mud PMF was not identified in either the Cable Corridor 2.2 Shetland to Yell or Cable Corridor 2.3 Sanday to Shetland. Therefore, 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, rock berms or concrete mattresses in soft sediment areas will be for a requirement of a crossing agreement.

Therefore, the only potential for physical change to another habitat type in sediment habitats is at the power cable crossings at Cable Corridor 2.2 Shetland to Yell and Cable Corridor 2.3 Sanday to Shetland (as described in Chapter 2 – Project Description). The predicted habitat at the Cable Corridor 2.3 Sanday to Shetland crossing is infralittoral rock, which is not suitable for sandeel. The Cable Corridor 2.2 Shetland to Yell crossing is predicted to have circalittoral coarse sediment which could be suitable habitat for sandeel. However, sandeel are typically only found to 70m depth (Wright et al, 2000; McDonald et al, 2019), and the water depth at the cable crossing is approximately 110m. Therefore, there is unlikely to be sandeel at this location.

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

Rocky shore habitats occur in intertidal waters. There will be no ploughing or jet-trenching in the intertidal area, therefore there will be no impact to this habitat from the pressure siltation rate changes including smothering (depth of vertical sediment overburden).

Out with the intertidal area, 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 was found at all cable corridors in the Shetland geographical area. Sandeel PMF have been previously identified in the vicinity of Cable Corridor 2.3 Sanday to Shetland and Cable Corridor 2.4 Fair Isle to BU, and sandeel were identified in DDV surveys at Cable Corridor 2.1 Yell to Unst. 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 Shetland 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 5-22 highlights the periods when marine mammal, marine turtles, European otter and basking shark are most likely to be present within the Shetland geographical area.

Table 5-22 Seasonal summary of marine mammal, fish and reptile presence within the Shetland geographical area

Receptor	Associated	Win	ter		Sumi	mer					Winter		
	protected area* within Shetland	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Harbour porpoise													
White beake dolphin	d												
Atlantic whit sided dolphir													
Bottlenose Dolphin													
Minke whale													
Killer whale													
Risso's dolph	in												
Long-finned pilot whale													
Humpback Whale													
Grey seal													
Harbour seal	Yell Sound Coast SAC, Mousa SAC, Sanday SAC												
Leatherback turtle													
Basking sharl	(
Otter	Yell Sound Coast SAC												
Key	Breeding												
	Present												
	Moulting												
	Unlikely to be	prese	nt in sig	gnifican	t numb	ers							

5.5.2 Fish

There are no protected sites designated for fish species within the search area for the cable corridors in the Shetland geographical area. 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.

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.

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 Special Area of Conservation (SACs) where there exists potential for harbour (common) seal to be impacted by installation activities. No other marine mammals are designated in protected sites within the search area for the cable corridors.

Seal are most sensitive to disturbance during the breeding season, when disturbance can disrupt nursing and compromise growth and survival of pups (Andersen et al., 2012; Jansen et al., 2015). 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 seals 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 Sanday SAC (where harbour seal are also designated under East Sanday Coast SSSI), Mousa SAC and Yell Sound Coast SAC for potential visual and underwater noise disturbance to harbour seal. Information to inform AA concluded that as Cable Corridor 2.3 Sanday landing point is within the Sanday SAC and close to seal-haul outs, should cable installation overlap with the breeding season (typically occurring in June and July inclusive there is the potential for a significant effect. Mitigation has been proposed (project specific mitigation M2) to reduce the significance of effects. With the implementation of the mitigation measures, the proposed installation activities will not have an adverse effect on the integrity of the European site and the conservation objectives for the site will be maintained.

With respect to cable installation activities in Mousa SAC and Yell Sound SAC, information to inform AA concluded that a likely significant effect can be excluded and project specific mitigation is not necessary. There will be no adverse effect on the integrity of the sites either alone or in combination with other plans or projects

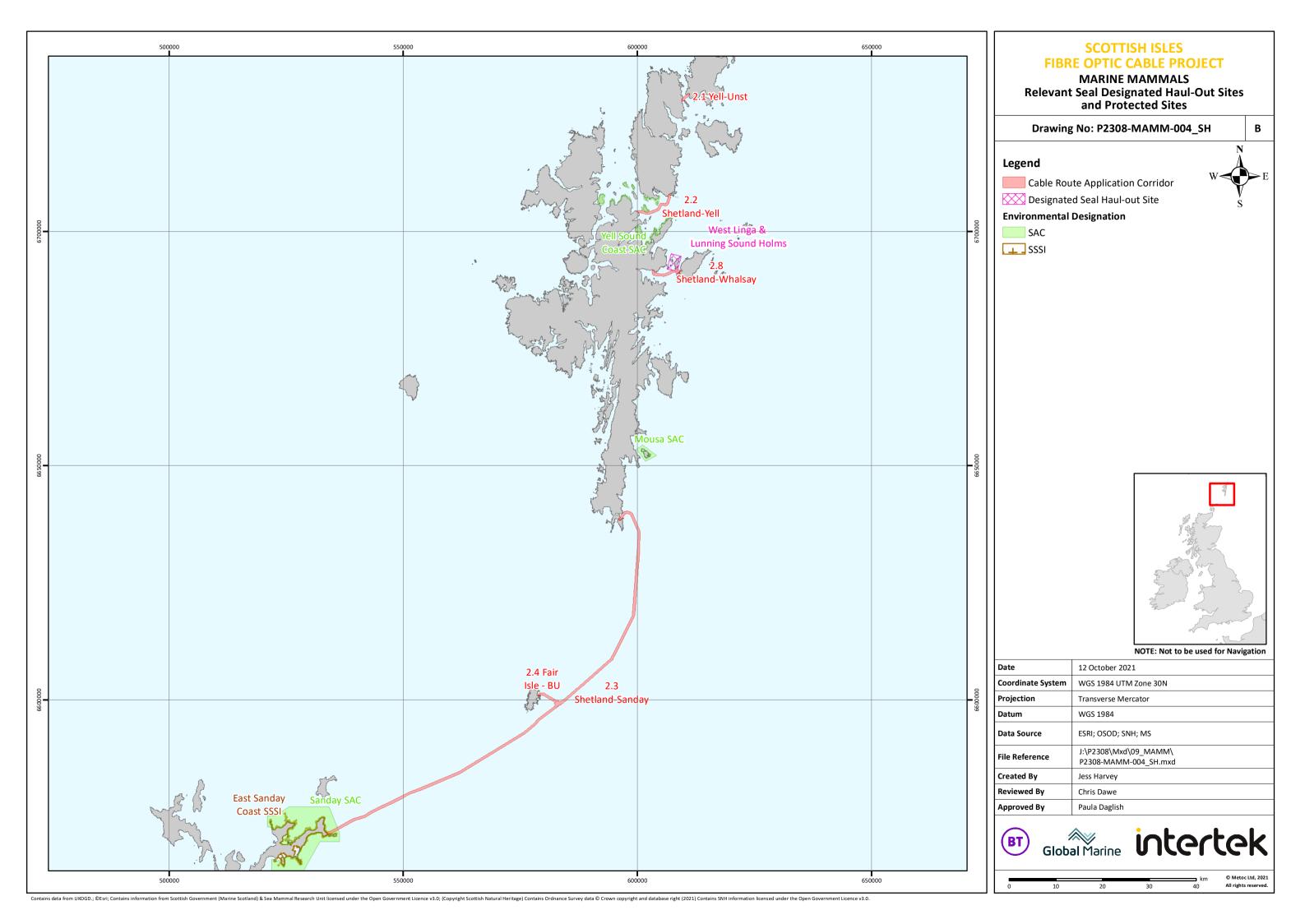
Whilst seals from these European sites could be found foraging within other cable corridors in the Shetland geographical area, as underwater noise from the installation activities is well below the threshold for injury to seal, and the installation activities are temporary there will be no long-lasting, significant impact to seals outside of the protected sites.

In addition to the protected sites which list seal as a Qualifying Interest, there is one designated haul out site (West Linga and Lunning Sound Holm) in the vicinity of the cable corridors. 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).

The haul-out site within 500m of the cable corridors and other protected areas for seals are shown in Figure 5-9 (Drawing Reference: P2308-MAMM-004_SH-B).





The West Linga and Lunning Holm Sound designated haul out intersects with Cable Corridor 2.8 Shetland to Whalsay offshore of Whalsay. The installation vessels will only be within vicinity of the land within the designated haul out area for less than one hour (based on an installation speed of 0.6km/hour for up to 1km within 500m radius for visual disturbance). Therefore, hauled out seals will not be subject to lasting or prolonged periods of disturbance, and there will be no significant disturbance.

5.5.3.2 Project specific mitigation

Project specific mitigation, as proposed in the Protected Site Assessment (Appendix C) and to avoid impacts on breeding seal in the Shetland geographical area is summarised below:

M2 - Works will be scheduled to take place prior to the seal breeding season (June /July) to ensure
works commence before seals arrive to breed and will target completion before the breeding
period. An installation method statement to include timings will be agreed with Nature Scot prior
to installation.

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 were undertaken in Summer 2021 by Aquatera at all 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.

The reports for these surveys are available in Appendix A. Table 5-23 below highlights that otter are present within Shetland and present at most of the cable landing points.



Table 5-23 Otter presence in the vicinity of each Shetland cable

Cable Corridor	Landfall	NBN records in proximity to cable landfalls*	Otters Present? (As determined by otter surveys)	Otter Survey Findings
2.1 Yell to Unst	Unst	0	Yes	 No otters sighted Holt identified outside buffer approximately 240m across bay from BMH.
	Yell	2	Yes	 Spraint sites observed west edge of the Loch of Gutcher. Otter sighted in bay near ferry terminal across bay
2.2 Shetland to Yell	Yell	1	Yes	One spraint identified approximately 80m from BMH
	Shetland	1	Yes	 No otters sighted Holt in stone armouring approximately 200m from BMH Spraint site 80m from BMH
2.3 Sanday to Shetland	Shetland	0	Yes	 Run observed with spraint approximately 180m from BMH
	Sanday	2	Yes	 Three potential otter resting sites, the closest 50m from the BMH.
2.4 Fair Isle to BU	Fair Isle	0		ecords for otter on Fair Isle. Therefore, a undertaken here.
2.8 Shetland to Whalsay	Shetland	0	Yes	 No otters sighted Two holts noted approximately 130m from BMH and 160m from BMH Spraint site 80m from BMH
	Whalsay	0	Yes	 Possible holts at breakwater however area was not surveyable Nine spraint sites identified at breakwater Nearest sprainting area approximately 100m from BMH

^{*} National Biodiversity Network (NBN Atlas, 2021).

As discussed in the Protected Sites Assessment (Appendix C), there is one European site for otter in the vicinity of installation activities within the Shetland geographical area. Yell Sound Coast SAC is designated for otters which are genetically distinct from those found on the mainland, and which utilise the islands in Yell Sound.

The HRA, presented in the Protected Sites Assessment, concluded that Appropriate Assessment (AA) should be undertaken for the Yell Sound Coast SAC for potential visual and underwater noise disturbance to otter. Cable Corridor 2.2 Shetland to Yell overlaps with the SAC south of Samphrey island, but the landing points are not within the SAC so there will be no impact to otter holts within the SAC. Information to inform AA concluded that the effects to otters will be short-term and temporary, a likely significant effect can be excluded, and no project-specific mitigation measures are required.



5.5.5 Birds

5.5.5.1 Assessment summary

The Protected Sites Assessment (Appendix C), identified nine Special Protection Areas (SPA), 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.

The NCMPA assessment demonstrated that although Cable Corridor 2.1 Yell to Unst overlaps with the Fetlar and Haroldswick NCMPA, no black guillemot nor the kelp habitat used by the birds for foraging has been identified in the cable corridor. The assessment concluded that 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 SSSI assessment concluded that due to the short-term and temporary nature of the installation activities, there will be no adverse effects to ringed plover and sanderling within the East Sanday Coast SSSI, and the integrity of the protected features of the site will be maintained.

The HRA concluded that AA is required for nine SPAs. Sites which require AA, and the qualifying bird species that have been screened through to AA, are summarised in Table 5-24. 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 5-25.

The assessment concluded that of the nine SPAs, in the absence of mitigation, LSE could occur to the qualifying interests of Fair Isle SPA and Sumburgh Head SPA. As a result, project specific mitigation measures (project specific mitigation M3) have been proposed to prevent LSE from occurring to nesting Arctic tern.

Without prejudice to the conclusion of no LSE on red-throated diver for the East Mainland Coast, Shetland SPA and Bluemull and Colgrave Sounds SPA, as best practice the Applicant has also proposed project specific mitigation (project specific mitigation M4).

In addition, information to inform AA was provided for one SPA (Sumburgh Head SPA) in relation to changes in supporting habitat and prey availability. The HRA concluded that due to the small footprint of the installation activities within the protected site LSE can be excluded and there will be no adverse effect on the integrity of the site either alone or in combination with other plans or projects.

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 5-24 A summary of screening decisions for birds in protected sites within Shetland geographical area

Qualifying Feature	Bluemull and Colgrave Sounds SPA	East Mainland Coast, Shetland SPA	Fair Isle SPA and SSSI	Fetlar SPA	Hermaness Saxa Vord and Valla Field SPA	Lochs of Spiggie and Brow SPA	Mousa SPA	Otterswick and Graveland SPA	Sumburgh Head SPA	East Sanday Coast Ramsar and SPA	Fetlar to Haroldswic k NCMPA	East Sanday Coast SSSI
Guillemot (<i>Uria aalge</i>)			В		В				В			
Black guillemot (Cepphus stella)							В				В	
Bar tailed godwit (Limosa lapponica)										NB		
Red-throated diver (Gavia stellata)	В	В			В			В				
Red-necked phalarope (Phalaropus lobatus)				В								
Puffin (Fratercula arctica)			В		В							
Arctic tern (Sterna paradisaea)			В	В			В		В			
Razorbill (<i>Alca torda</i>)			В									
European shag (Phalacrocorax aristotelis)			В		В							
Great northern diver (Gavia immer)		NB										
Slavonian grebe (Podiceps auratus)		NB										
Whimbrel (Numenius phaeopus)				NB								
Dunlin (Calidris alpina schinzii)				NB								
Whooper Swan (Cygnus cygnus)						NB						
Fair Isle wren (Troglodytes troglodytes fridariensis)			В									
Great skua (Stercorarius skua)			В	NB	В							
Arctic skua (Stercorarius parasiticus)			В	В								
Fulmar (Fulmarus glacialis)			В	В	В				В			
Gannet (Morus bassanus)			В		В							
Kittiwake (<i>Rissa tridactyla</i>)			В		В				В			
Purple sandpiper (Calidris maritima)										NB		
Ringed plover (Charadrius hiaticula)												NB
Sanderling (Calidris alba)												NB
Turnstone (Arenaria interpres)										NB		
Storm Petrel (Hydrobates pelagicus)							В					
Key:	Scree	ened In		B = Bre	eeding							
	Scree	ned Out	N	IB = Non	-Breeding	-						



Table 5-25 Summary of birds screened in for AA

Receptor	Woodward et al., 2019	Joint SNCB, 2017		Sugge	sted sea	asonal d	definitio	ns for bire	ds in the	Scottis	h Marin	Environ	ment (N	latureSco	t, 2020
	Mean-Max		Habitat	Winte	r		Summ	er					Winte	er	
	Foraging Range (km)		Specialisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Auks							'	'	_		_	_	_		
Puffin (<i>Fratercula arctica</i>)	137.1	2	3												
Black guillemot (Cepphus stella)	4.8	3	4												
Guillemot (<i>Uria aalge</i>)	73.2	3	3												
Razorbill (<i>Alca torda</i>)	88.7	3	3												
Shags															
European shag (Phalacrocorax aristotelis)	13.2	3	3												
Divers															
Great northern diver (Gavia immer)	Unknown	5	3												
Red-throated diver (Gavia stellata)	9.0	5	4												
Sea Ducks and Grebes															
Slavonian grebe (Podiceps auratus)	Unknown	3	4												
Gulls and Terns															
Arctic tern (Sterna paradisaea)	25.7	2	3												Т
Kittiwake (Rissa tridactyla)	156.1	2	2												
Petrels															
Northern fulmar (Fulmarus glacialis)	542.3	1	1												
Skuas															
Arctic skua (Stercorarius parasiticus)	62.5	1	2												
Great skua (Stercorarius skua)	443.3	1	2												
Gannets															
Northern gannet (Morus bassanas)	315.2	2	1												
Waders															
Bar-tailed godwit (Limosa lapponica)	Unknown	Unknown	Unknown												
Dunlin (Calidris alpina schinzii)	Unknown	Unknown	Unknown												
Purple sandpiper (Calidris maritima)	Unknown	Unknown	Unknown												
Red-necked phalarope (Phalaropus lobatus)	Unknown	1	2												
Ringed plover (Charadrius hiaticula)	Unknown	Unknown	Unknown												
Ruddy Turnstone (Arenaria interpres interpres)	Unknown	Unknown	Unknown												
Sanderling (Calidris alba)	Unknown	Unknown	Unknown												
Whimbrel (Numenius phaeopus)	Unknown	Unknown	Unknown												
Terrestrial															
Fair Isle wren (<i>Troglodytes troglodytes fridariensis</i>)	Unknown	Unknown	Unknown												
Marine Mammals															



Harbour seal (Phoca vitulina)	21 (DECC, 2016).	N/A	N/A						
Key	Bird breeding season	/ Seal pupping season	1						
	Present								
	Unlikely to be present	t in significant numbei	rs						



5.5.5.2 Project specific mitigation

Project specific mitigation, as proposed in the Protected Site Assessment (Appendix C) to avoid impact on nesting Artic tern in the Fair Isle SPA and Sumburgh Head SPA is summarised below:

• M3 - Following licence submission and confirmation by NatureScot Ornithology expert on the use of Cable Corridor 2.4 Fair Isle to BU (North Haven landing point) and Cable Corridor 2.3 Sanday to Shetland (Sumburgh landing point) by nesting Artic Tern, appropriate local mitigation will be agreed.Sanday to Shetland.

In addition, and without prejudice to the conclusion of no LSE on red-throated diver for the East Mainland Coast, Shetland SPA and Bluemull and Colgrave Sounds SPA, as best practice the Applicant proposes that the following mitigation be implemented:

M4 - All vessels associated with the cable installation operations within Cable Corridor 2.1 Yell to
Unst 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 Fair Isle Demonstration and Research MPA (drMPA)

The Fair Isle DR MPA was designated in November 2016 with a focus to establish robust research focused on migratory sea bird populations and to demonstrate the effectiveness of a community-led partnership approach in achieving a long-term programme of sustainable management of Fair Isle's waters. The site extends 5km from the coastline, covering an area of 157km² (Fauna and Flora International, 2020). The objectives of the drMPA include the following (The Scottish Government, 2016):

- the environmental monitoring of seabirds and of other mobile marine species;
- the environmental monitoring of the factors which influence the populations of seabirds and of other mobile species;
- the development and implementation of a local sustainable shellfish fishery;
- the development of a research programme into local fisheries which includes research on species composition, size, distribution and temporal and spatial changes in fish stocks;
- the development of a sustainable-use management programme for local fisheries.

The Fair Isle landing point of Cable Corridor 2.4 Fair Isle to BU is within the drMPA and Cable Corridor 2.3 Sanday to Shetland crosses the southeast edge of the site. There is potential for installation activities to impact surveys of seabirds and other mobile marine species during the installation activities. However, the installation activities within the drMPA will be short-term (approximately 6 days at the Cable Corridor 2.4 Fair Isle landing point, approximately 4 days at the BU to Cable Corridor 2.3 Sanday to Shetland). Therefore, any impact to the research of the drMPA will be short term.

Two of the project design measures that are included in the project description as a best practice measure are 'early consultation with relevant contacts to notify of impending activity' (BP1) and publication of Notice to Mariners (BP2). This early communication will aid the planning and management of the drMPA research surveys.

5.7 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 5-26 provides details of the project specific mitigation measures proposed for each of the Cable Corridors relating to biological features.





Table 5-26 Project Specific mitigation measures for the Shetland geographical area

ID	Aspect	Project specific mitigation	2.1	2.2	2.3	2.4	2.8
M1	Rocky shore habitat	Micro-routeing will be undertaken to minimise effects to rocky shores identified within the Cable Corridor 2.3 Sanday landing point area.Sanday to Shetland					
M2	Harbour seal	Works will be scheduled to take place prior to the seal breeding season (June /July) to ensure works commence before seals arrive to breed and will target completion before the breeding period. An installation method statement to include timings will be agreed with Nature Scot prior to installation.					
M3	Arctic tern	Following licence submission and confirmation by NatureScot Ornithology expert on the use of Cable Corridor 2.4 Fair Isle to BU (North Haven landing point) and Cable Corridor 2.3 Sanday to Shetland (Sumburgh landing point) by nesting Artic Tern, appropriate local mitigation will be agreed.Sanday to Shetland					
M4	Red-throated diver	All vessels associated with the cable installation operations within Cable Corridor 2.1 Yell to Unst 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).

5.8 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 rocky shore habitat, harbour seal and Arctic tern. 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 Shetland 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 and presented along with the mitigation and management measures that will be utilised to remove or reduce these impacts.

6.2 Baseline Conditions

6.2.1 Marine Archaeology

6.2.1.1 Submerged prehistory

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 Shetland Islands 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 data indicates that there are 13 known locations of historical interest within the Shetland geographical area. The known charted historical assets within 500m of the Shetland cable corridors are outlined within Table 6-1. Table 6-1 identifies that two of the cable corridors, Cable Corridor 2.1 Yell to Unst and Cable Corridor 2.8 Shetland to Whalsay contain ahistorical interest.

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

Corridor	Distance form corridor (m)	Description of archaeological asset	Туре
2.1 Yell-Unst	70	Hoga Ness, broch, Unst	Scheduled Monument
	252	Belmont, Norse house and field system ESE of, Unst	Scheduled Monument
2.2 Shetland-Yell	4	Burra Voe, broch 70m SSE of Wester Ayre	Scheduled Monument
2.3 Shetland-Sanday	437	Brough Head, broch and settlement 295m SE of Skitpow, Eastshore	Scheduled Monument
	497	Jarlshof, broch & settlement	Scheduled Monument
	708	Mount Misery chambered cairn	Prehistoric ritual and funerary
2.4 Fair Isle - BU	164	Landberg, fort, South Haven, Fair Isle	Scheduled Monument
2.4 Fair Isle - BU	380	Burn of Furse to Homis Dale, settlement and burnt mounds, Fair Isle	Scheduled Monument
2.8 Shetland-Whalsay	307	Ward of Symbisterness, chambered cairn 400m SW of Symbister Bay	Scheduled Monument





Corridor	Distance form corridor (m)	Description of archaeological asset	Туре
2.1 Yell-Unst	0	Belmont House	Garden and Designed Landscape
2.2 Shetland-Yell	303	Dangerous wreck	Wrecks and Obstructions
	363	Dangerous wreck	Wrecks and Obstructions
2.3 Shetland-Sanday	113	Dangerous wreck, HMS GOLDFINCH	Wrecks and Obstructions
2.8 Shetland-Whalsay	0	Dangerous wreck, VERDANT	Wrecks and Obstructions

Marine sediments can be indicative of the potential for archaeology. In addition to the known archaeological interest features included 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 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 E: Navigation Risk Assessment (NRA) (Document Ref: P2308_R5367 Rev 3) and summarised to provide pertinent information associated with potential shipping and navigation risks in the Shetland geographical area.

6.2.2.1 Shipping

As detailed in Appendix E - NRA, the study areas for each cable corridor have been defined using a minimum distance of 2km (5km for route 2.3) 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 E- NRA, 12 months of AIS data between January to December 2019 were analysed within the 4.5km/10.5km search area from each cable corridor in Shetland. Average monthly vessel density across the region of Shetland is shown in Figure 6-1 (P2308-SHIP-014_SH) 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 Shetland geographical area ranges from high to very low. 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 Shetland geographical area are presented within Appendix E- NRA and are summarised below:

• Cable Corridor 2.4 - Fair Isle to BU – A small vessel anchorage is present within the quay at North Haven, Fair Isle, in around 4m of water. This area has been avoided by Cable Corridor 2.4.





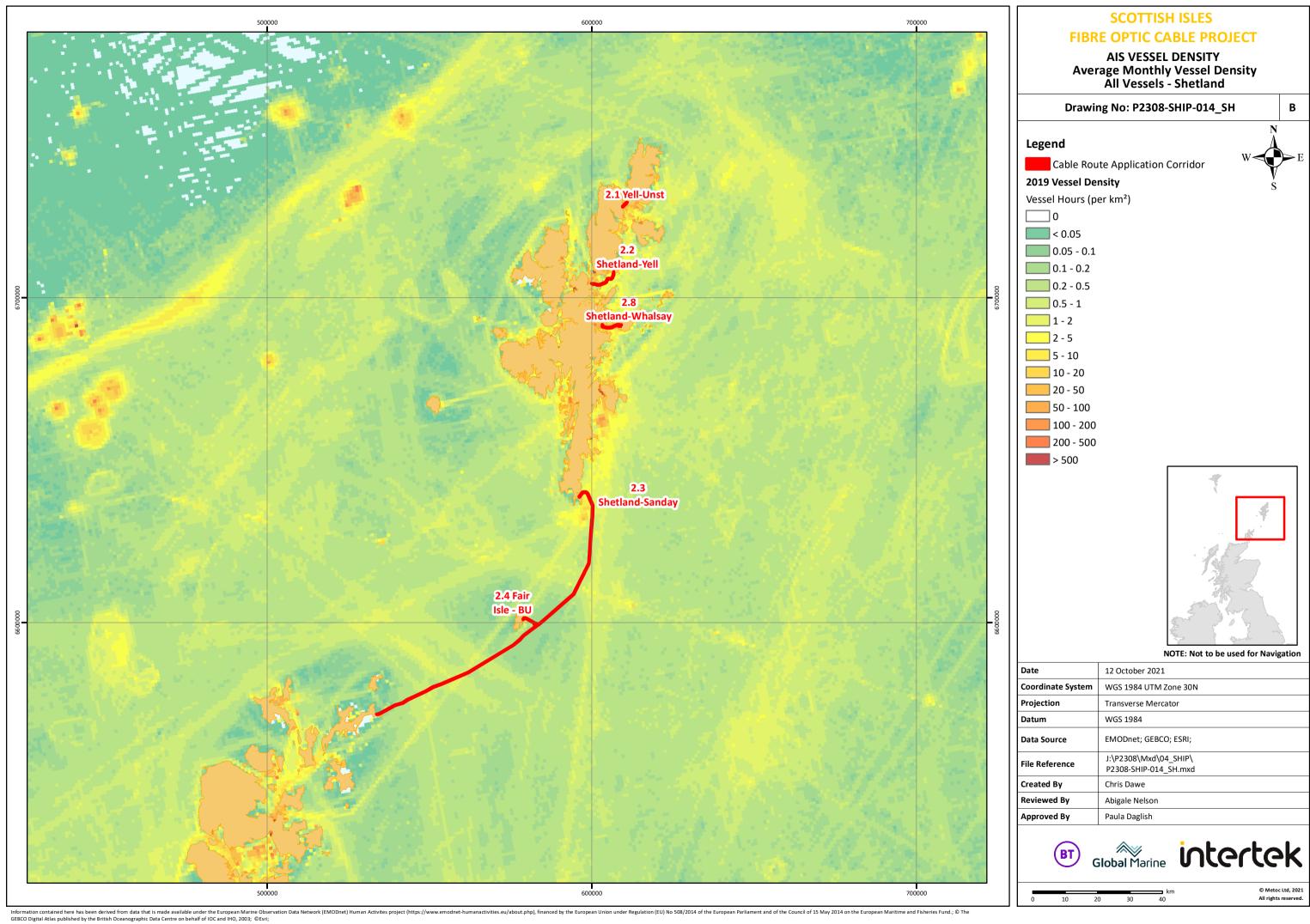
 Cable Corridor 2.8 – Shetland to Whalsay – An undesignated anchorage is present within port limits of Symbister Bay, as well as a designated and unchartered anchorage nearby in North Voe. Cable Corridor 2.8 avoids this area.

There are two Traffic Separation Schemes (TSS) areas within the open waters of route Cable Corridor 2.3 Shetland to Whalsay. They are located is the Fair Isle channel between Orkney and Fair Isle and between Fair Isle and Shetland. They both contain low vessel traffic (2-5 vhpm).

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 Shetland

ID	Segment	Corridor length (km)	General AIS Intensity (vhpy)	No of Ferry Routes intersected	No of Ports within vicinity of Study Area
2.1	Yell-Unst	2.5	High (100-200)	3 (transect the cable corridor) Yell Unst Fetlar – Yell Unst - Feltar	2 - Cullivoe Port - Bellmont Port
2.2	Shetland-Yell	9.65	Very Low (1-2)	1 (does not transect cable corridor) Toft-Yell	Ulsta and Toft portDaggri Port
2.3	Shetland-Sanday	109.87	Very Low (1-2)	2 (does not transect cable corridor) Lerwick – Fair Isle Grutness – Fair Isle 2(transect the cable corridor) Kirkwell - Lerwick Aberdeen – Lerwick	4 North Ronaldsay Fair Isle Sumburgh Lerwick Anch
2.4	Fair Isle-BU	5.29	Very Low (0-5)	3(transect the cable corridor) Grutnessk – Fair Isle Lerwick – Fair Isle Kirkwell – Lerwick	1 • Fair Isle
2.8	Shetland - Whalsay	7.27	Medium to High (20-50	2(transect the cable corridor) Vidlin – Whalsay Laxo – Whalsay	2 Vidlin – Whalsay Laxo - Whalsay





6.2.2.2 Recreation

Appendix E (Document Ref: P2308_R5367 Rev 3) 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 Shetland geographical area is generally low-medium, with the exception of Cable Corridor 2.1 Yell to Unst which has no recorded recreational vessel density.

There are no other general boating areas, clubs, marinas, or training centres within the cable corridors of the Shetland 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 of the proposed Shetland 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 Shetland cable corridors (Appendix E). During this period, a total of 21 lifeboat launches to unique incidents across the Shetland cable corridors were recorded by the RNLI (excluding hoaxes and false alarms). This corresponds to an average of less than one incident per year. Table 6-3 below summarises the incidents per cable corridor in the Shetland geographical area.

Table 6-3 RNLI Accident within 500m of Shetland Cable Corridors

Cable Corridor	No of RNLI Accidents within 500m of corridor
2.3 Shetland - Sanday	17
2.4 Fair Isle - BU	2
2.8 Shetland - Whalsay	2

All UK-flagged commercial vessels are required by law to report accidents to the Marine Accident Investigation Branch (MAIB). A total of four marine incidents were reported within the Shetland region over a period of five years. In terms of yearly variations, this corresponds to less than one incidence per year and in 2018 and 2020 there were no incidents or accidents reported by MAIB (Appendix E). 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 F – Fishing Activity Study (FAS). The FAS has reviewed publicly available fisheries data and has identified the fishing activity across the Shetland 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 Shetland geographical area is presented in Table 6-4.





 Table 6-4
 Summary of fisheries activity by cable corridor

	ICES		Don	ninant Fishing	type	
Cable Route	rectangle	Target Species	Shellfish	Demersal	Pelagic	Peak season
2.1 Yell-Unst	50E9	Mackerel, hake, cod, monks or anglers, whiting, saithe		✓		November
2.2 Shetland-Yell	49E8	Mackerel, cod, scallop, haddock, whiting			√	November
2.3 Shetland- Sanday	47E7	Herring, mackerel, scallops, crabs, lobster			√	September
	47E8	Mackerel, herring, cod, haddock, whiting			✓	September - November
		Mackerel, herring, cod,			✓	August and October
	48E8	haddock, whiting			✓	August and October
2.4 Fair Isle - BU	1050	Mackerel, herring, cod,			✓	August and October
	48E8	haddock, whiting			✓	
2.8 Shetland - Whalsay	49E8	Mackerel, cod, scallop, haddock, whiting			✓	November

There are a number of fishing ports in the Shetland geographical area (Figure 6-2: Drawing reference: P2308-FISH-002_SH), all associated with the Shetland District and the Fishery Office located in Lerwick.



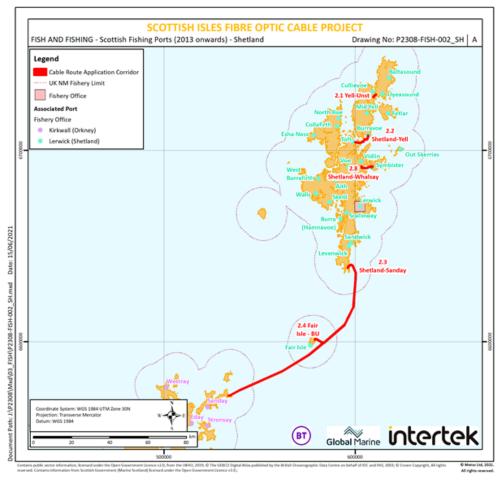


Figure 6-2 Scottish Fishing Ports (2013 onwards) – Shetland (P2308-FISH-002 SH)

The Scottish fishing fleet is largely comprised of vessels of 10m and under (74% of the fleet). These vessels are not required to record their landings or be traced using VMS, therefore may be under-represented within fishing statistics. From the information available, key fishing activities within the Shetland geographical area in relation to the proposed cable corridors are pelagic, demersal (24,000 tonnes of pelagic fish, worth £23 million, were landed in Shetland during 2019) and aquaculture fishing, with some shellfish (2,100 tonnes of shellfish, worth £6 million, were landed in Shetland during 2019). Mackerel and herring are the key target species.

Fishing techniques used within the geographical area include trawling, potting, dredging, diving and aquaculture. Pelagic fisheries is the key fishing activity for all routes (with the exception of Yell and Unst), with mackerel, herring, cod, haddock, scallop and whiting forming the key target species. Demersal fishing is the key fishing activity in Cable Corridor 2.1 Yell to Unst, with mackerel, hake, cod, monks or anglers, whiting and saithe being the key target species.

Landing tonnage and their respective value provide a good indication of the importance of commercial fishing in an area. The proposed cables in Shetland are located within ICES rectangles 47E7, 47E8, 48E8, 49E8, and 50E9. The data highlights the importance of the Pelagic fishery to the region particularly within ICES rectangles 49E8, however demersal fishing is are more important in terms of value within ICES rectangle 50E9.

Figure 6-3 (Drawing reference: P2308-FISH-003_SH), Figure 6-4 (Drawing reference: P2308-FISH-004_SH) and Figure 6-5 (Drawing reference: P2308-FISH-005_SH) show the spatial patterns of fishing





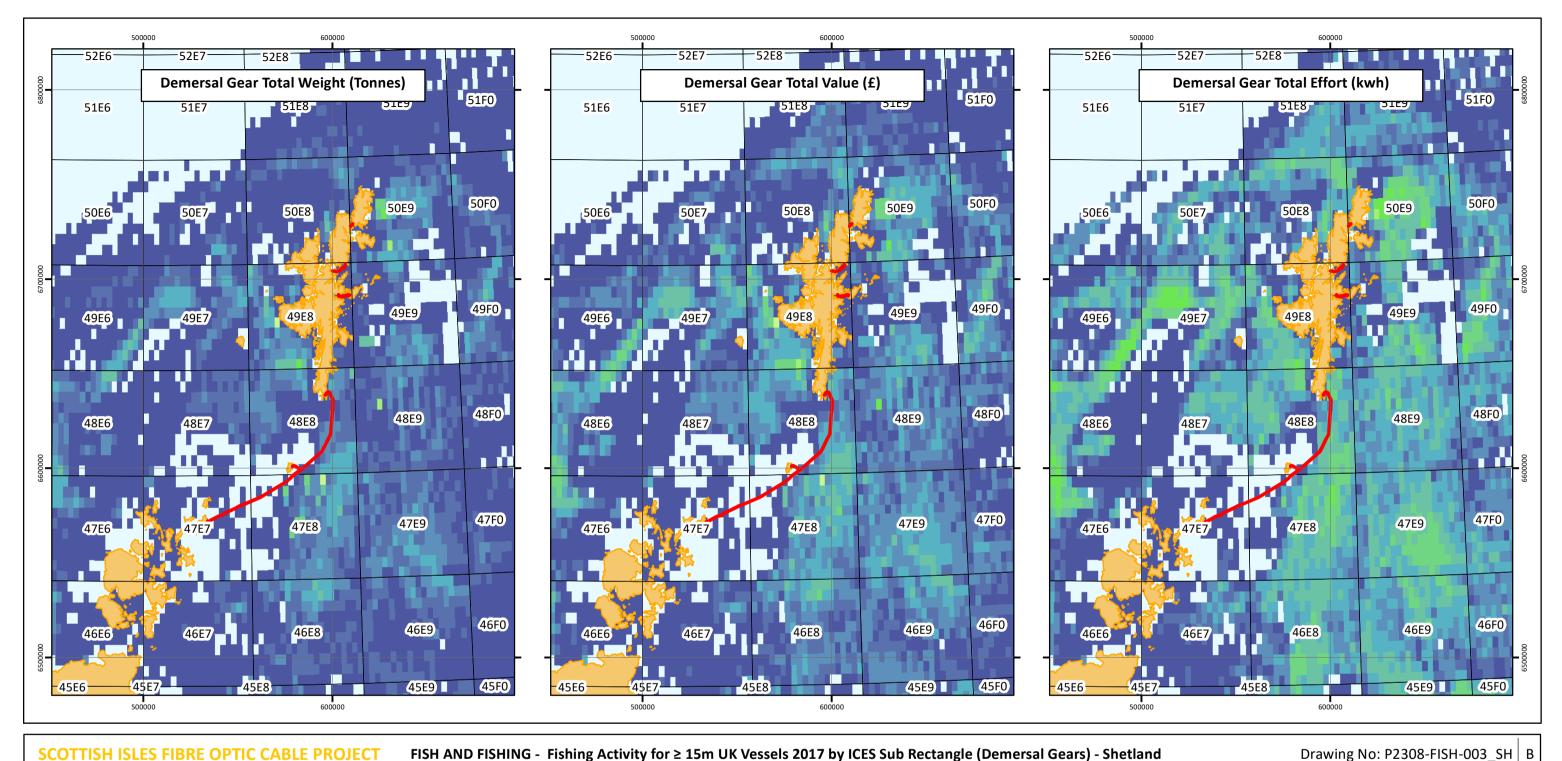
activities within the Shetland geographical area per gear type in terms of weight, value, and fishing effort, at a resolution of ICES sub-rectangles (20x10 per ICES rectangle). Based on the figures below, demersal fishing effort is high, particularly in waters offshore to the east, of Shetland within ICES rectangle 50E9 for demersal fishing. Pelagic fishing effort within the Shetland geographical area is also higher within ICES rectangles 50E9. In comparison shellfish effort is relatively low but also focuses effort within 50E9 and 49E6 to the west of Shetland reflecting the data is limited to vessels over 15m in length and not representative of the Scottish fleet with 81% of vessels under 10m and not represented in these figures.

The seasonality of fishing activity within the vicinity of the proposed cable corridors varies between across the Shetland geographic area. The peak seasonality for each route is summarised in Table 6-4 above.

The Project Fishing Liaison Officer is in regular communication with the Shetland and Fair Isle fishing interests and has held pre-application meetings and workshops to seek the opinion of fishing community. 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) has been developed which considers the fishing interest opinions. The mitigation measures proposed will seek to minimise displacement and disturbance to commercial fishers within the Shetland geographical area as far as possible. The mitigation measures proposed in the FLMAP, are summarised in Section 8 - Schedule of Mitigation).

There are numerous aquaculture sites around Shetland. One active aquaculture site (Wick of Belmont) is located within Cable Corridor 2.1 Yell to Unst. Of the sites outside the cable corridors, the closest is the active North Voe site which is 49m from Cable Corridor 2.8 Shetland to Whalsay, and the Ness of Copister site which is 223m from Cable Corridor 2.2 Shetland to Yell. All other sites are over 500m from the cable corridors.





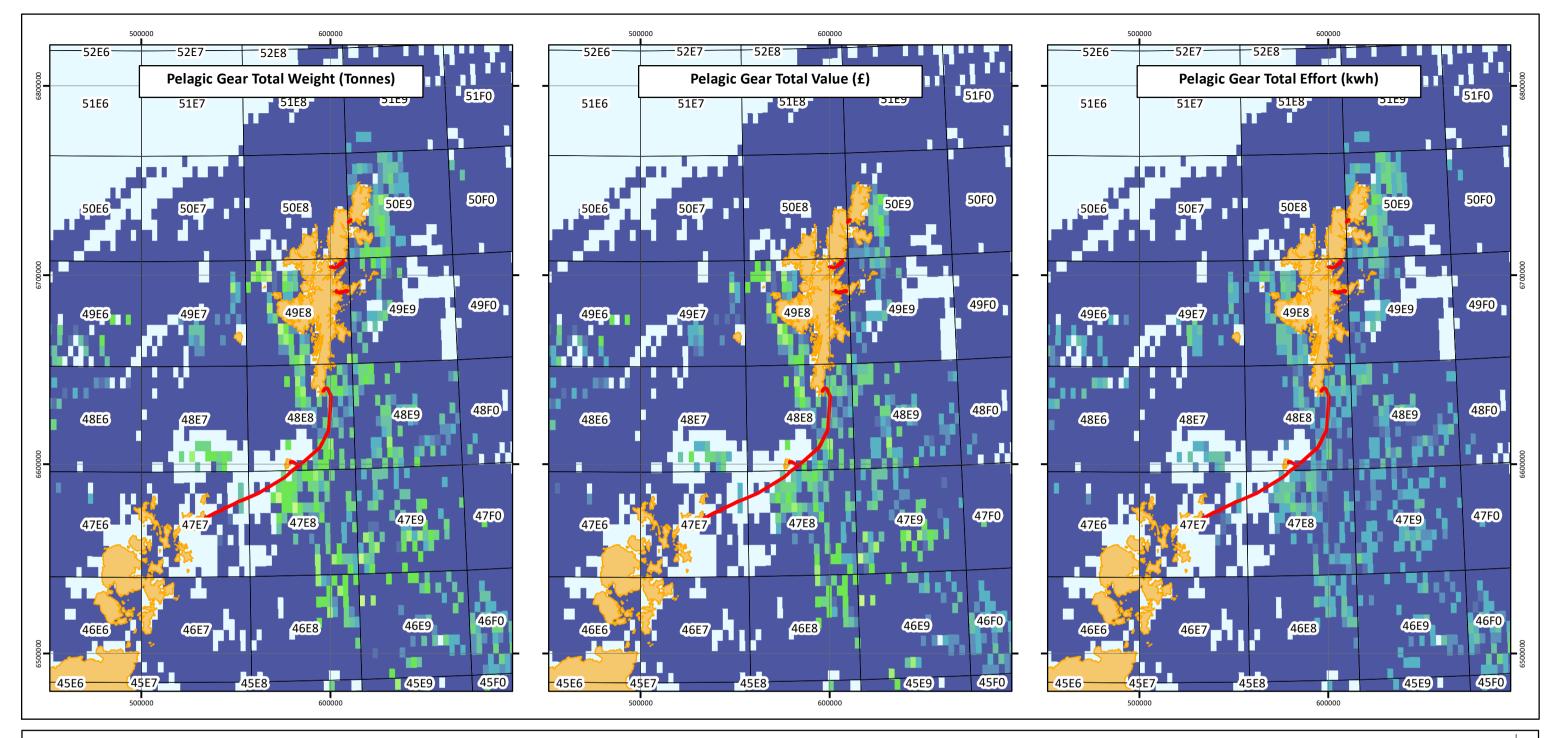
SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

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

Legend Cable Route Application Corridor **Total Fishing Effort Total Weight Total Value** ICES Rectangle (Tonnes) (£ Sterling) (kilowatt/hours) > 0 - 10 (Tonnes) > £0 - £10,000 > 0 - 2,500 (kilowatt/hours) > 10 - 20 > £10,000 - £20,000 > 2,500 - 5,000 > 5,000 - 10,000 > 20 - 40 > £20,000 - £40,000 > 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	12 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-003_SH.mxd
Created By	Chris Dawe
Reviewed By	Chris Carroll
Approved By	Nick Archibald
BT Globa	intertek

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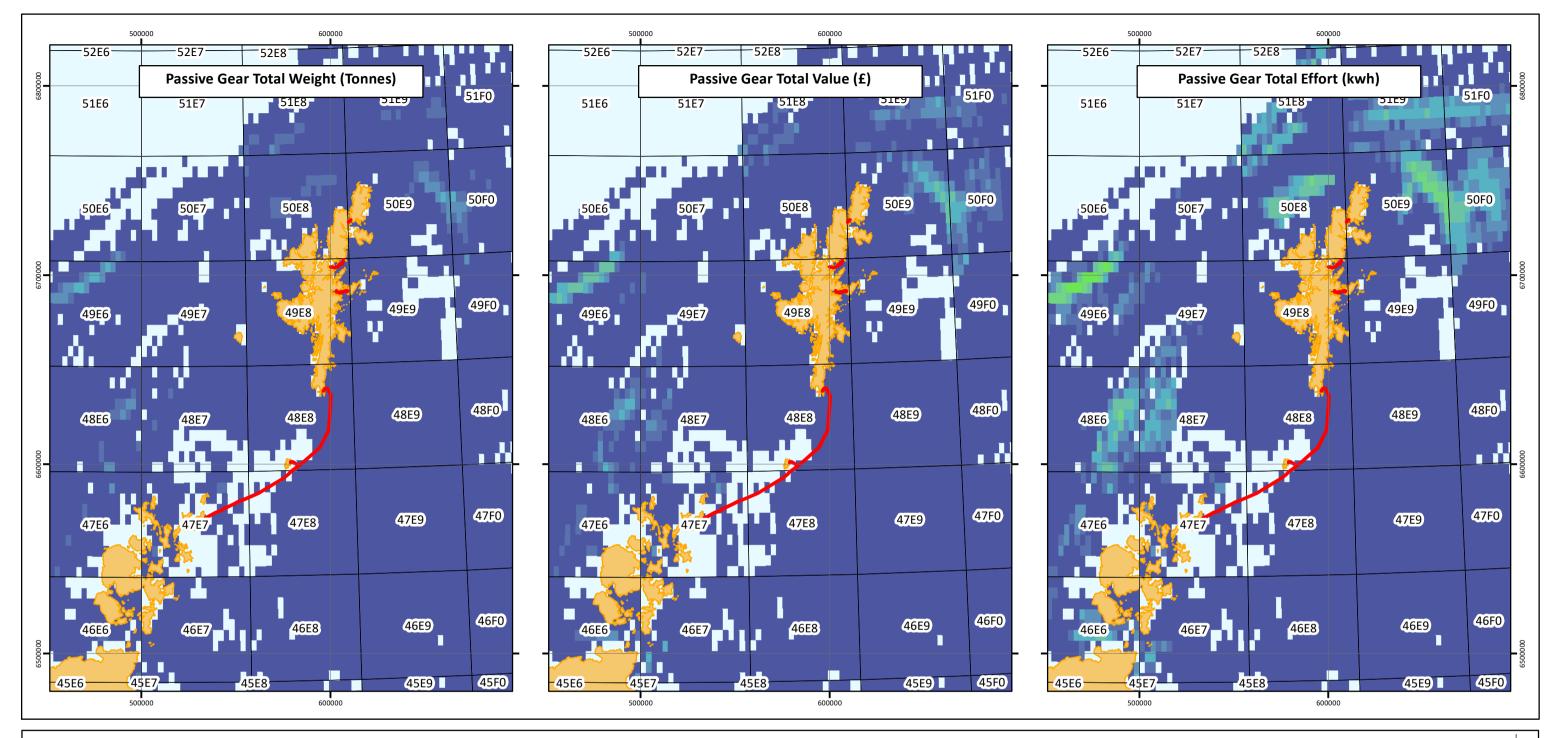


SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

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

Legend Cable Route Application Corridor **Total Value Total Fishing Effort** Total Weight ICES Rectangle (Tonnes) (£ Sterling) (kilowatt/hours) > 0 - 10 (Tonnes) > £0 - £10,000 > 0 - 2,500 (kilowatt/hours) > 10 - 20 > £10,000 - £20,000 > 2,500 - 5,000 > £20,000 - £40,000 > 20 - 40 > 5,000 - 10,000 > 40 - 80 > £40,000 - £80,000 > 10,000 - 20,000 > £80,000 - £160,000 > 20,000 - 40,000 > 80 - 160 > 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

	Drawing No: P2308-FISH-004_SH B		
Date	12 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_SH.mxd		
Created By	Chris Dawe		
Reviewed By	Chris Carroll		
Approved By	Nick Archibald		
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SCOTTISH ISLES FIBRE OPTIC CABLE PROJECT

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

Legend Cable Route Application Corridor **Total Fishing Effort Total Weight** Total Value ICES Rectangle (£ Sterling) (kilowatt/hours) (Tonnes) > £0 - £10,000 > 0 - 10 (Tonnes) > 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

	Drawing No: P2308-FISH-005_SH B		
Date	12 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_SH.mxd		
Created By	Chris Dawe		
Reviewed By	Chris Carroll		
Approved By	Nick Archibald		
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6.2.4 Other Sea Users

6.2.4.1 Military Practice Areas

Cable Corridor 2.3 Shetland to Sanday is located within the Moray Firth Air Force Department Military Practice area, (Figure 6-6, Drawing reference:P2308-INFR-002_SH). There are no other military practice areas located within 5km of the other Shetland cable corridors. Given that this is an aerial practice area the installation activities will not affect this area.

6.2.4.2 Disposal Sites

The following seven closed or disused disposal sites (Figure 6-6, Drawing reference: P2308-INFR-002_SH) are located within 5km of the Shetland cable corridors:

- Cullivoe closed site: located 2.3km from Cable Corridor 2.1 Yell to Unst;
- Toft- disused site: located within Cable Corridor 2.2 Shetland to Yell;
- Ulsta disused site: located 2.3km from Cable Corridor 2.2 Shetland to Yell;
- North Haven

 closed site: located 4.2km from Cable Corridor 2.3 Shetland to Sanday;
- North Haven- closed site: located 1.1km from Cable Corridor 2.4 Fair Isle to BU;
- Symbister closed site: located within Cable Corridor 2.8 Shetland to Whalsay; and
- Symbister A
 – closed site: located within 0.4km from Cable Corridor 2.8 Shetland to Whalsay cable corridor.

6.2.4.3 Renewable Energy

The Bluemull Sound - Nova Innovation Ltd tidal farm agreement is located 1.5km from Cable Corridor 2.1 Yell to Unst (Figure 6-6, Drawing reference: P2308-INFR-002_OR):

6.2.4.4 Pipelines

There are a number of active pipelines located within 5km of the proposed Shetland cable corridors (Figure 6-6, Drawing reference: P2308-INFR-002_SH), two of which intersect Cable Corridor 2.2 Shetland to Yell, as listed below:

- PL2764, GAS EXPORT (SIRGE) FIRTHS VOE TO MCP01, PX Limited; and
- PL4, CORMORANT A TO SULLOM VOE, TAQA.

6.2.4.5 Cable Infrastructure

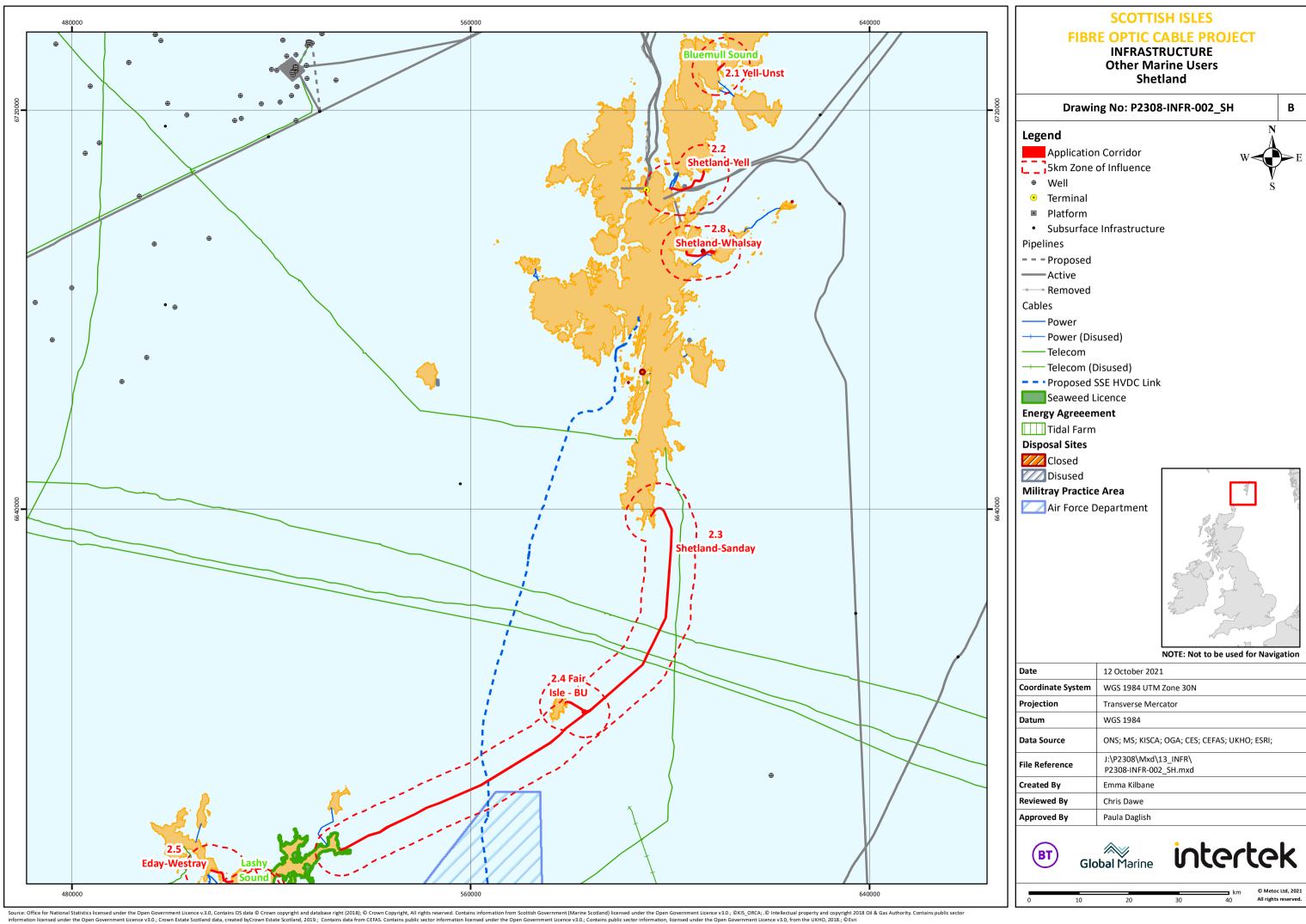
There are a number of existing power and telecommunications cables located within 5km of the Shetland cable corridors, (Figure 6-6, Drawing reference:P2308-INFR-002_SH). Of these cables there are five which are in close proximity (within the Shetland cable corridors).

Table 6-5 Existing cables within the proposed Shetland cable corridors

Proposed Shetland cable corridors	Asset	Owner	Туре	Estimated proximity to proposed installation (approximate km)
2.1 Yell-Unst	Yell-Unst1	Scottish and Southern Electricity Networks (SSEN)	Power	1.4
	Yell-Unst North	SSEN	Power	1.7



Proposed Shetland cable corridors	Asset	Owner	Туре	Estimated proximity to proposed installation (approximate km)
	Yell-Unst Replacement	SSEN	Power	1.5
	Yell-Unst South	SSEN	Power	1.2
	Yell-Fetlar 1	SSEN	Power	2.0
	Yell-Fetlar 2 (Disused)	SSEN	Power	3.8
2.2 Shetland- Yell	MOSSBANK-YELL 1	SSEN	Power	Intersects
	MOSSBANK-YELL 2	SSEN	Power	Intersects
	MOSSBANK-YELL SOUTH 2	SSEN	Power	Intersects
	Proposed power cable Shetland HVDC Link	SSEN	Power	Intersects
2.3 Shetland-	TAT 14	Telia Carrier	Telecoms	Intersects
Sanday	ATLANTIC CROSSING 1	Century Link	Telecoms	Intersects
	HAVFRUE	Aqua Comms	Telecoms	Intersects
	SHEFA-2	Faroese Telecom	Telecoms	1.8
	SANDAY- N.RONALDSAY	SSEN	Power	2.9
2.8 Shetland- Whalsay	SHETLAND- WHALSAY	SSEN	Power	0
	SHETLAND - WEST LINGA	SSEN	Power	1.3
	SHETLAND- WHALSAY 2	SSEN	Power	1.3





6.3 Assessment of Effects

6.3.1 Shipping and Navigation

The Appendix E (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 E are listed in Table 6-6 below.

Table 6-6 Potential effects and zones of influence

Project Phase	Operation	Potential Pressure	Receptor	Zone of Influence
Pre-Installation 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 	Archaeology, Commercial shipping, recreational boating and fishing vessels	Requested Safe working distance and up to 18km in any 12-hour period
	Route Clearance			
	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)	vessels Collision risk Accidental anchoring on		Requested Safe working distance and to 2.4km in any 12-hour period
	Diver/ROV pre installation survey at Shore ends	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		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	 Reduced visibility 		
	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 6-7 below are required to be undertaken to meet environmental and health and safety legislation. The assessment assumes these measures will be implemented.

Table 6-7 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 6-8 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 6-8 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	An onshore Fishing Liaison Officer (FLO) will be provided for the project. The FLO will follow the	Maritime and Coastguard





ID	Aspect	Design Measure	Source
	Fishing; Shipping and Navigation; Other sea users	Fishing Liaison Mitigation Action Plan (FLMAP). The FLO will continue in this role during installation process.	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
BP8	Biological Environment Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Rock berms and, bags and mattresses 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 rock berm 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 E - Section 5) takes into consideration the applied mitigation needed to reduce the hazards to As Low As Reasonably Practicable (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 all hazards have reached a risk level of tolerable through the ALARP process. 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 6-9 below.

Table 6-9 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		Immediate footprint of cable installation
Cable installation -plough burial	Penetration and disturbance below the substratum including abrasion	Historic environment	Immediate footprint of cable installation
Cable protection (at crossing and contingency)	Physical change to another seabed type		Immediate footprint of cable protection
Cable protection (at crossing and contingency)	Local water flow (tidal current) changes		Immediate footprint of cable protection

6.3.2.2 Compliance Mitigation

The Compliance measures outlined in Table 6-10 below will be implemented during the final route design process to further ensure the protection of marine archaeological receptors:

Table 6-10 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 6-8), the Best Practice project mitigation relevant to archaeology are the same as those presented for shipping and navigation (Table 6-8).

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 Shetland 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 6-11 below.

The potential for collision risk has been assessed in Section 6.3.2 – Shipping and Navigation, with the risk expected to be minimal due to the temporary nature of vessel displacement.

Table 6-11 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 6-7).

6.3.3.3 Best Practice Mitigation

With the exception of BP9 (Table 6-8), the Best Practice project mitigation relevant to commercial fishing are the same as those presented for shipping and navigation (Table 6-8).

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 3-7 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 Shetland geographical area are focussed on pelagic, demersal and aquaculture fishing, with herring and mackerel being the key component. As discussed in Section 6.2.3 the





seasonality of fishing activity within the vicinity of the proposed cable corridors varies between routes. However, should installation of the cable coincide with the peak season, the disturbance will be very localised and short term (3-7 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 Shetland geographical area is not significant.

A Fisheries Liaison Mitigation Action Plan (FLMAP) (Appendix F) 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 Shetland 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 (1.852km²) 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 Shetland 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:

- Rock placement (at power cable crossings only).
- Concrete mattresses.
- Rock bags.

There are four known cable crossings required within the cable corridors within the Shetland geographical area. An engineered cable crossing including rock protection, is only likely to be required for crossings with power cables or pipelines. There is one engineered cable crossing within Cable Corridor 2.2 Shetland to Yell and one within Cable Corridor 2.3 Shetland to Sanday. In addition, discrete deposits of rock or concrete mattressing may be required to protect the cable in areas of hard ground where burial cannot be achieved.

All crossings will be designed in accordance with industry best practice (namely ICPC Recommendation No.3.). Crossing designs would also be subject to crossing agreements with the individual cable asset owners. Asset owners would be notified in advance of installation operations in line with the individual crossing agreement conditions.





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.

Where cable protection is required for corridors within the Shetland 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 6-12) 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 6-12 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 6-7).

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 6-8).

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 Shetland cables in the intertidal zone at the landfall sites will be undertaken by trenching across the beach, rock cutting in the landfall area is not currently planned for any landing points within the Shetland geographical area. An excavator will be used to excavate a trench down the beach to the low water mark.

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:

M5 - 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 Shetland 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 Shetland geographical area the following information sources have been reviewed and plotted on to GIS (Figure 7-1, Drawing: P2308 CUMU-001-SH-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 Shetland 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 Shetland 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 (September 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 Shetland 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-SH-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 taking place between 01/04/22 and 31/12/22 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 commencement date moves beyond 01/12/22, 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 Shetland 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.



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

Project Category	Name	MS LOT Reference	Distance to	cable corridor	(km)			Does	Projects to be taken forward to
			Cable 2.1	Cable 2.2	Cable 2.3	Cable 2.4	Cable 2.8	project category induce similar pressures to R100?	assessment?
Cable	BT Cable Removal – Between Fair Isle and Shetland	00009308			0			Yes	Yes – Further assessment is required
Cable	Marine Licence - HVDC Link Installation outside 12 Nautical Miles - Shetland to Caithness	07357			0			Yes	Yes – Further assessment is required
Cable	Marine Licence - HVDC Link Installation outside 12 Nautical Miles - Shetland to Caithness	07203			0			Yes	Yes – Further assessment is required
Chemotherapeutant	Marine Licence - Wellboat Discharge - North Voe, Shetland	07171					0	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Chemotherapeutant	Marine Licence- Wellboat Discharge - Belmont, Shetland	06932	0					No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Chemotherapeutant	Wellboat Discharge – Swarta Skerry, Dury Voe, Shetland	07038					0	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects



Project Category	Name	MS LOT	Distance to	cable corrido	r (km)		Does	Projects to be taken forward to assessment?	
		Reference Number	Cable 2.1	Cable 2.2	Cable 2.3	Cable 2.4	Cable 2.8		project category induce similar pressures to R100?
Chemotherapeutant	Marine Licence - Marine Farm - Bight of Bellister, Shetland	07346/000 08827					0	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Chemotherapeutant	Marine Licence - Wellboat Discharge - Bellister, Dury Voe	07301					0	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Chemotherapeutant	Wellboat Discharge - Copister Salmon Farm, Yell Sound, Shetland	06835		1.2				No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Chemotherapeutant	Marine Licence- Wellboat Discharge - Burkwell, Shetland	06937	2.5					No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Chemotherapeutant	Marine Licence- Wellboat Discharge - North Sandwick, Shetland	06934	2.9					No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Chemotherapeutant	Wellboat Discharge - Winna Ness, Uyeasound, Shetland	06945	3.2					No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Chemotherapeutant	Wellboat Discharge - Vee Taing, Uyeasound, Shetland	06941	3.5					No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects





Project Category	Name	MS LOT Reference	Distance to cable corridor (km)						Projects to be taken forward to
			Cable 2.1	Cable 2.2	Cable 2.3	Cable 2.4	Cable 2.8	project category induce similar pressures to R100?	assessment?
Chemotherapeutant	Marine Licence - Wellboat Discharge - Vidlin Outer, Vidlin Voe	07303/073 04					3.7	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Chemotherapeutant	Marine Licence - Wellboat Discharge - Setterness South, Shetland	07283		3.9				No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Chemotherapeutant	Marine Licence- Wellboat Discharge- Kirkabaster, Shetland	06938	4					No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Construction, alteration or improvement of any works	Marine Licence - Construction of a New Marina - Cullivoe Pier, North Yell	Pre- application (No Ref Number.)	2					Yes	No, project has been deemed as a non EIA project with no significant effects and therefore will not have any potential for inter project effects.
Construction, alteration or improvement of any works	Marine Farm - Mula, Unst, Shetland	00009235	1					No	No, project is for an application to renew an existing licence and no changes or deposits are anticipated.
Fish (including shellfish) farm	Marine Farm (and surrounding moorings)	5862					0	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Fish (including shellfish) farm	Wellboat discharge (Active site)	6029					0	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects





Project Category	Name	MS LOT Reference	Distance to	cable corrido	r (km)			Does	Projects to be taken forward to
			Cable 2.1	Cable 2.2	Cable 2.3	Cable 2.4	Cable 2.8	project category induce similar pressures to R100?	assessment?
Fish (including shellfish) farm	Marine farm (Expired)	5050		1.5				No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Fish (including shellfish) farm	Marine Licence - Marine Farm - Wick of Belmont, Shetland	00009279	0					No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Fish (including shellfish) farm	New Finfish Farm - Dury Voe, Shetland Islands	06786					0	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 - Bellister, Shetland	07270					1	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Fish (including shellfish) farm	Existing fish farm – Fish Holm, Yell Sound, Shetland	06977		1.1				No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Fish (including shellfish) farm	Marine Licence - Marine Farm - Loura Voe, Shetland	07347/000 08828					1.2	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Fish (including shellfish) farm	Marine Farm - Outer Grunna Voe, Dury Voe, Shetland	00008997					1.5	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects



Project Category	Name	MS LOT Reference	Distance to	cable corrido	r (km)		Does project category induce similar pressures to R100?	Projects to be taken forward to assessment?	
			Cable 2.1	Cable 2.2	Cable 2.3	Cable 2.4			Cable 2.8
Fish (including shellfish) farm	Marine Licence - Marine Farm - Vatsetter, Shetland	07257				1.5		No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Fish (including shellfish) farm	Marine Licence - Marine Farm - Copister, Yell Sound	07180		1.5				No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Fish (including shellfish) farm	Marine Licence - Marine Farm - South Holm, Unst	07114	2.3					No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Fish (including shellfish) farm	Marine Licence - Marine Farm - Copister, Yell -	07237		2.4				No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Fish (including shellfish) farm	Marine Farm - Vidlin Ness, Shetland	07348					3.0	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Fish (including shellfish) farm	Marine Licence Variation - Marine Farm - Vidlin Voe, Shetland	00008902					3.4	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Fish (including shellfish) farm	Marine Licence - Marine Farm - Bastavoe, Shetland	07305/000 08805			4.2			No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects





Project Category	Name	MS LOT	Distance to	cable corridor	(km)			Does	Projects to be taken forward to assessment?
		Reference Number	Cable 2.1	Cable 2.2	Cable 2.3	Cable 2.4	Cable 2.8	project category induce similar pressures to R100?	
Fish (including shellfish) farm	Marine Licence- Existing Marine Farm- Basta Voe South, Basta Voe	07185	4.7					No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Fish (including shellfish) farm	Marine Licence- Marine Farm - Turness, Skuda Sound	00009299	4.8					No	No, project category does not induce similar pressures to the Project, therefore there is no potential for interproject effects
Renewables - Tidal	Marine Licence – Shetland Tidal Array (as extended) – Bluemull Sound, Shetland	00009110	1.8					Yes	Yes – Further assessment is required
Renewables - Tidal	Marine Licence – Deposits Tidal Array – Bluemull Sound, Shetland	04859	1.8					Yes	Yes – Further assessment is required



7.4.1 Marine Scotland NMPi

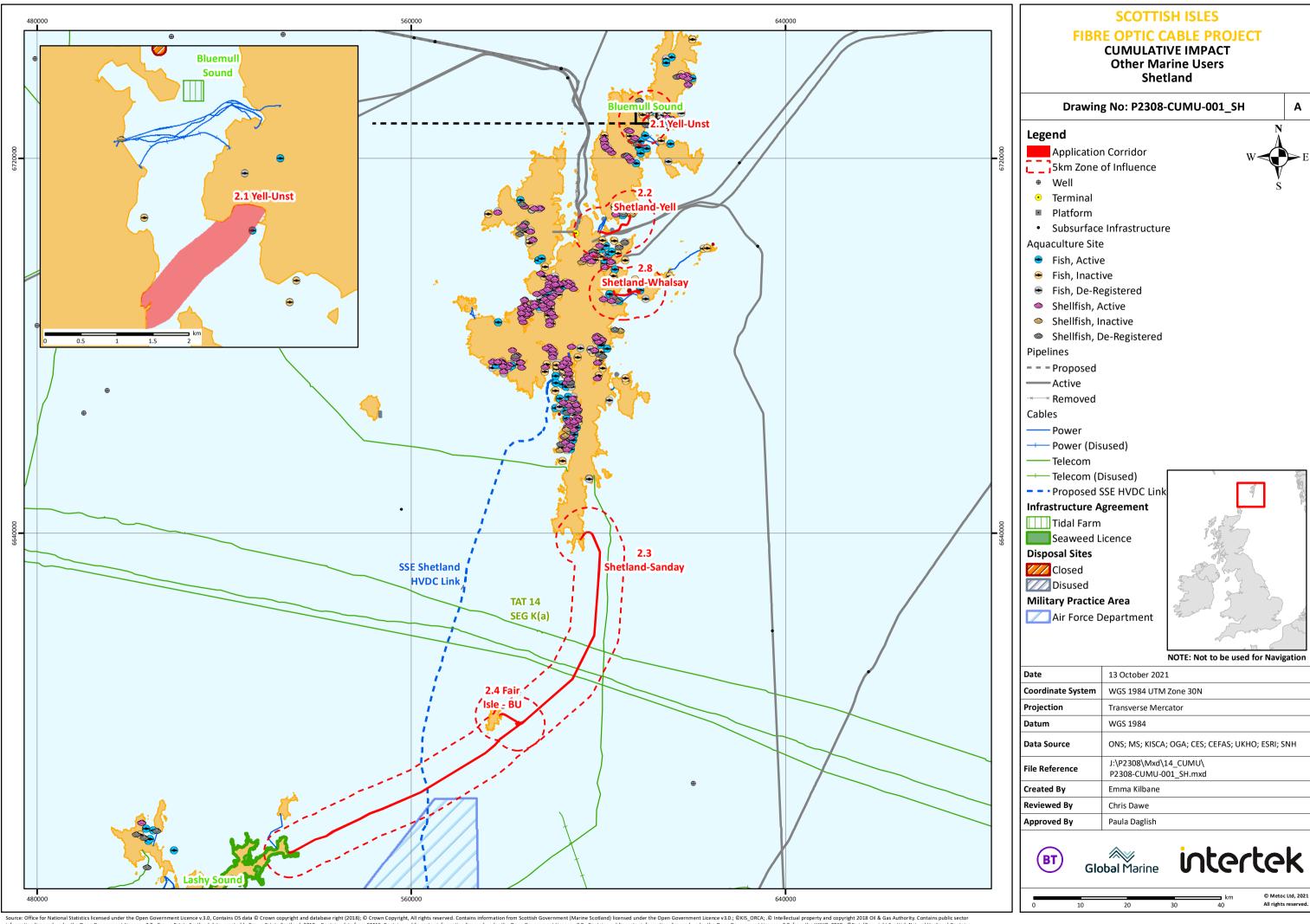
A review of the NMPi tool did not identify any other proposed projects or plans that would induce similar pressures and/or that were located within the assessment search area of the Shetland cable corridors (Marine Scotland 2021b).

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 Shetland 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-SH-A) below.

Table 7-2 Projects identified using GIS analysis within Shetland 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	6	Yes	No – Cables are already installed and there are currently no other applications on MS-LOT to carry out maintenance on the existing cables.		
Cables (Power) – Disused	1	Yes	No – Cables are already installed and have been marked as disused therefore no other maintenance will be carried on the existing cables.		
Cables (Telecom) - Active	4	Yes	No – Cables are already installed and have been marked as disused therefore no other maintenance will be carried on the existing cables.		
Oil Terminal - Active	1	Yes	No - project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects		
Oil Pipe Line – Active	3	Yes	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects		
Fish (including shellfish) farm - Active	29	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	21	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	22	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects		
Macroalgae (including macroalgal farm)	1	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	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) – Disused	2	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects		



7.4.3 Relevant Projects

A total of 38 projects were identified using MS-LOT and 73 projects identified using GIS analysis that were within the assessment search area. Of these, five applications were identified from MS-LOT as having a common pressure-receptor pathway and requiring further assessment for the potential for cumulative impacts. Table 7-3 summarises the relevant projects taken forward for assessment. These are discussed in Section 7.5 below:

Table 7-3 Projects identified which require further assessment within Shetland geographical area assessment search area

Project Category	Project Name	Distance of Cable Corridor from project (km) or intersect (Int) Cable Corridor					
		2.1	2.2	2.3	2.4	2.8	
Cable	BT Cable Removal – Between Fair Isle and Shetland (Ref: 00009308)			Int			
Cable	SSE - Marine Licence - HDVC Link Installation outside 12 Nautical Miles - Shetland to Caithness (Ref: 07357)			Int			
Cable	SSE - Marine Licence - HDVC Link Installation outside 12 Nautical Miles - Shetland to Caithness (Ref: 07203)			Int			
Renewables - Tidal	Nova Innovation - Marine Licence – Shetland Tidal Array (as extended) – Bluemull Sound, Shetland (Ref: 00009110)	1.8					
Renewables - Tidal	Nova Innovation - Marine Licence – Deposits Tidal Array – Bluemull Sound, Shetland (Ref: 4859)	1.8					

7.4.4 Fishing Activity

Key fishing activities within the Shetland geographical area in relation to the proposed cable corridors are pelagic, demersal and aquaculture fishing, with some shellfish. Mackerel and herring are the key target species. Demersal fishing induces 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 Shetland geographical area cable installations to have inter-project effects with demersal fishing activity. Despite this, the Shetland cable installation will be a temporary and one-off disturbance. Furthermore, the installation of the Shetland cables would only induce these pressures on a narrow footprint on the seabed, therefore potential cumulative impacts with demersal fishing activities will be highly limited and are therefore not considered further.

7.5 Assessment of Cumulative Impacts

7.5.1 BT Cable Removal – Between Fair Isle and Shetland (00009308)

BT have applied for a marine licence for the decommissioning and removal of the out of service telecommunications cable TAT14 Segment K (Figure 7-1; Drawing Reference: P2308-CUMU-001-SH-A). The cable is located between Shetland Islands and Fair Isle and intersects perpendicular to the Cable Corridor 2.3 Sanday to Shetland zone of influence for approximately 10km. The method of

removal will be carried out by marine recovery vessels offshore. Grapnels may be required to locate a section of cable outside territorial waters if the cable can't be recovered in one complete section (BT Group PLC, 2021). The works were expected to be completed by December 2021 however, the works are most likely to now take place in April 2022. Therefore, there is the potential for the installation activities within Cable Corridor 2.3 Sanday to Shetland to occur at the same time as the decommissioning of TAT14.

Potential cumulative impacts which are likely to occur from the two projects are pressures to the seabed, visual disturbance to birds and seal, underwater noise impacts to marine mammals and displacement of fishing vessels. In the marine environmental appraisal (MEA) submitted to MS-LOT (BT Group PLC, 2021) it was identified that there would be minimal risk to the seabed. The use of the marine recovery vessel will mean that sediment disturbance is localised and will be resolved in hours. Where it is not possible to use the marine recovery vessel a grapnel will be used. The use of this will widen the impact on the seabed however, again the assessment of the impact was classed as negligible impact to benthic communities in the BT MEA.

The noise output of the Shetland cable installation is expected to have a disturbance radius for marine mammals of 1.1km from the installation activities. The decommissioning, associated with the BT TAT14 cable, that overlaps with Cable Corridor 2.3 Sanday to Shetland, will not require any acoustic equipment therefore, there is no potential cumulative impact.

The cable TAT14 is not within any seal haul out or breeding sites therefore no cumulative impact of visual or noise disturbance will occur on pinnipeds. Additionally, visual and noise impact on birds for the decommissioning works has been assessed as negligible due to the distance of the cable to the habitats that the different species occupy. The TAT14 intersection with Cable Corridor 2.3 Shetland to Sanday is entirely offshore therefore, any breeding or moulting birds will not be affected due to the distance from the shore (crossing approximately 21km from coast).

As identified in the Shetland Fishing Activity Study (FAS) the area within and around Cable Corridor 2.3 Shetland to Sanday has a moderate amount of monthly fishing activity (0-5 hours per km²) (Appendix E – P2308_R5367). There is potential for fishing vessel displacement due to the cable installation within the Shetland geographical area and the decommissioning of TAT14. However, the decommissioning will be short term (proposed 8-10 days) and localised, BT have also specified mitigation to reduce the impact on fishing vessels during the TAT14 works. Alongside the mitigation put in place for the Shetland geographical area and the localised area of interaction it is not likely there will be a significant cumulative impact on fishing activity in the area.

The effects that result from decommissioning of part of the TAT14 Segment K cable will be short term and localised. All effects will be restricted to the zones of influence either side of the proposed works. As the potential similar impacts of the decommissioning works have been assessed as negligible and given the small area of potential cumulative impact there will be no significant cumulative impact.

7.5.2 SSE - Marine Licence - HDVC Link Installation outside 12 Nautical Miles - Shetland to Caithness (07357) / SSE - Marine Licence - HDVC Link Installation outside 12 Nautical Miles - Shetland to Caithness (07203)

SSE have applied to MS-LOT for a licence to install the 'Shetland HVDC Link' cable, a new 254km high voltage direct current (HVDC) transmission cable. This will be installed from Weisdale Voe in Shetland, passing to the east of Fair Isle and Orkney to make landfall at Noss Head in Caithness. The project intersects perpendicular to Cable Corridor 2.3 Sanday to Shetland zone of influence for approximately 10km. The project is expected to be completed in 2025 indicating that there is potential for both spatial and temporal cumulative impacts with the installation of Cable Corridor 2.3 Sandy to Shetland.

The common pressure-receptor pathway with Cable Corridor 2.3 Sandy to Shetland are noise effects on marine mammals and seabirds; visual disturbance to seals and seabirds; disturbance to the seabed; and displacement of fishing vessels.

The two projects intersect offshore between Shetland (approximately 31km away) and Fair Isle (approximately 11km away). The closest seal haul out site is 55km away. These distances ensure that seals at designated haul out sites will not be affected by any cumulative noise impact. The marine environment appraisal submitted by SSE to MS-LOT specifies that the main risk to marine mammals due to underwater noise is by the geophysical survey equipment which will be used during the pre-lay survey works (Xodus Group, 2019). SSE have identified there is the potential for the HVDC cable installation works to cause significant impact, however, there has been introduced several embedded and best practise mitigations to reduce the impacts. The SSE environmental appraisal concluded that due to the addition of only a small number of transient vessels, and the highly spatial and offshore location of survey works where noise absorption is greatest, there would not be a significant impact on marine mammals due to noise. Additionally, it is likely that the greatest noise impacts from equipment of the two projects will not occur at the same time. The SSE cable installation activity plan state that pre-lay survey works would take place in Q2/Q3 of 2021. The noise output of the Shetland cable installation is expected to have a disturbance radius for marine mammals of 1.1km from the installation activities. This has been assessed in the EPS risk assessment (Appendix C, Document ref: P2308-R5283) as minor localised disturbance and no significant effects are expected. Due to the reduced level of impact created by the SSE project, and the timing of the works it is not expected there will be a significant cumulative impact due to noise.

The installation of Cable Corridor 2.3 Sandy to Shetland and the SSE HVDC cable installation interact offshore and do not overlap in any protected sites (Fair Isle SPA is located approximately 11km away). Due to the distance from shore, breeding and nesting sites will not be impacted by any cumulative effect. Offshore there is the potential for loafing or rafting bird groups to be disturbed, however both projects are installing cables where the vessel lay activity will be highly localised and slow moving. Birds show a relatively mild disturbance response to slower moving vessels than faster moving vessels (Ronconi and St. Clair, 2002). This in conjunction with the area having a moderate amount of shipping, fishing and recreational traffic indicates that the addition of vessels from both projects will not have a cumulative impact.

There is potential for an accumulation of fishing vessel disruption due to the two projects. However, the installation works are transient and will be short term and localised. Like BT, SSE have specified mitigation to reduce the impact on fishing vessels. If the two cable installation activities overlap this will reduce the amount of time that vessel displacement will occur. Fisheries liaison officers (FLO) have been appointed for both projects who will manage interactions between fishing vessels and cable installation vessels. In view of the mitigation in place for the Shetland geographical area and the localised area of interaction it is unlikely there will be a significant cumulative impact on fishing activity in the area.

7.5.3 Nova Innovation - Nova Innovation - Marine Licence - Deposits Tidal Array - Bluemull Sound, Shetland (Ref: 4859) / Marine Licence - Shetland Tidal Array (as extended) - Bluemull Sound, Shetland (Ref: 00009110)

Nova Innovation Ltd. have been awarded a marine licence (04859) to operate five tidal turbines at the Shetland Tidal array until 2035 located in Bluemull Sound. The extended application (00009110) is to deploy a sixth turbine at the same site and extend the duration of operation to 2038 including tidal array reconfiguration of three turbines in this time (Nova Innovation Ltd., 2018). This site is located within the 5km zone of influence for Cable Corridor 2.1 Yell to Unst and is located approximately 1.5km distance from the cable corridor. Nova Innovation have five turbines consented under the existing licence which are T1 and T2 deployed in 2016; T3 deployed in 2017; and T4 and T5 which had been

scheduled to be deployed in Q3 2019 and Q1 2020. Under the extended application form Nova Innovation requested to deploy a 6th turbine (T6) alongside T5 in Q1 of 2020. The array operation is scheduled to last from 2018 to 2038, with decommissioning commencing in 2038.

Nova Innovation has specified on their website that there are now four operational turbines and two more are being installed in 2021 and 2022 (Nova Innovation Ltd., 2021). Therefore, there is the potential that installation activities of the final tidal turbines will occur at the same time as the cable installation for Cable Corridor 2.1 Yell to Unst.

The common pressure-receptor pathway with Cable Corridor 2.1 Yell to Unst is noise effects on marine mammals and seabirds. The noise output of the cable installation is expected to have a disturbance radius for marine mammals of 1.1km from the installation activities. This has been assessed in the EPS risk assessment (Appendix C, Document ref: P2308-R5283) as minor localised disturbance and no significant effects are expected. A characterisation study of the acoustic levels of turbines at a similar tidal turbine array, the Fall of Warness site located in Orkney, concluded that it is unlikely that the noise generated by operating tidal energy converters would have a significant impact on marine mammals (Harland, 2013). However, it was stipulated that further detailed studies will be required in order to gain more understanding of this. A study conducted by (Lossent et al., 2018) assessed the acoustic impacts of an operating tidal current turbine on marine fauna. The study concluded that acoustic footprint of the device was a 1.5km disturbance radius and, even in this area of greatest potential impact, physiological injury of marine mammals, fishes and invertebrates is not likely. It was noted that behavioural disturbance occurred for harbour porpoise within 1km of the turbines. The study concludes that the noise impact of one turbine is not significant however concern could be raised for tidal farms with over 100 turbines. Give the distance of the cable corridor from the Bluemull test site it is unlikely that the operating turbines and the Cable Corridor 2.1 Yell to Unst installation activities will have any significant cumulative impact on marine mammals or birds due to noise.

The increased vessel presence during installation of Cable Corridor 2.1 Yell to Unst and the deployment of the final turbines will also not have a cumulative noise impact on marine mammals as it will not increase the current background noise levels that are already present in the area.

Given the short distance between the two projects there is the possibility that the two zones of influence would act as a barrier preventing animals from entering two areas at once as there will be a temporal overlap between the projects. However, mitigation put in place for the Shetland geographical region including the appointment of a Marine Mammal Observer (MMO) will ensure that marine disturbance is reduced for any marine mammals using the area. Nova Innovation has also stipulated that they have set up an ongoing Project Environmental Monitoring Plan (PEMP) which will monitor the area throughout operation of the tidal turbines. Additionally, the report submitted by Nova Innovation for the extension of the tidal array, concluded that the most significant effect would be collision with the turbine blades. This was deemed as not significant upon assessment. Cumulative impact risk will not occur given the localised nature of this impact and the distance between the two projects.

It is possible that visual disturbance could occur from the increased vessel traffic from both projects. A study carried out at the EMEC site identified that there was some disturbance and redistribution of birds during construction however, numbers returned to previous levels once the turbines were operational (Long, 2017). Additionally, the PEMP employed by Nova Innovation and mitigation measures set forth for the Shetland geographical area will reduce any significant cumulative impacts on birds. Due to the short-term and localised nature of both the tidal turbine deployment and cable installation cumulative impact from activities of both these projects will not occur.

7.6 Mitigation

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



7.7 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 Shetland 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 Shetland 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	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
BP8	Physical , Biological, Human Environment:	Rock berms and bags will only be deployed where adequate burial cannot be achieved or as required by	Crossing Agreements



ID	Aspect	Design Measure	Source
	Commercial Fishing; Shipping and Navigation; Other sea users	crossing agreements. The footprint of the deposits will be the minimum required to ensure cable safety and rock berm stability.	
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	Embedded mitigation	Source
M1	Rocky shore habitat	Micro-routeing will be undertaken to minimise effects to rocky shores identified within the Cable Corridor 2.3 Sanday landing point area.	Protected Sites Assessment – Appendix C
M2	Harbour Seal	Works at Cable Corridor 2.3 (Sanday landing point) will be scheduled to take place prior to the seal breeding season (June /July) to ensure works commence before seals arrive to breed and will target completion before the breeding period. An installation method statement to include timings will be agreed with Nature Scot prior to installation.	Protected Sites Assessment – Appendix C
M3	Arctic Tern	Following licence submission and confirmation by NatureScot Ornithology expert on the use of Cable Corridor 2.4 Fair Isle to BU (North Haven landing point) and Cable Corridor 2.3 Shetland to Sanday (Sumburgh landing point) by nesting Artic Tern, appropriate local mitigation will be agreed.	Protected Sites Assessment – Appendix C
M4	Red throated diver	All vessels associated with the cable installation operations within Cable Corridor 2.1 Yell to Unst 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



ID	Aspect	Embedded mitigation	Source
M5	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 Shetland 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 Shetland 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 which includes 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 five complete cables within the Shetland 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.

It is also noted that Cable Corridor 2.3 Shetland to Sanday lands within the Orkney geographical area as part of the R100 project. It has been agreed between Global Marine and MS-LOT (*pers comms*) that the reporting of the appraisal of the Orkney landing should be included within this Shetland marine licence package.

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 Shetland 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 only been proposed for installation where there is potential for significant effects. Project specific short-term disturbance effects have been identified for hauled out seal and bird species and project specific mitigation has been proposed to reduce significance of effects. In addition, project specific mitigation has been proposed to reduce the potential for significant effects on rocky shore habitat.



9.2 Cable Corridor 2.1 Yell to Unst

Cable Corridor 2.1 Yell to Unst is between Gutcher, Yell and Belmont, Unst and is approximately 2.5km long. The corridor 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 minimal requirement for additional cable protection measures (contingency only; 28 rock bags, 3 mattresses [mattresses will only be installed if required by a third party]). 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 at the landing points. The worst-case footprint of the installation is approximately 0.005km².

The corridor passes through two protected site (Bluemull and Colgrave Sound SAC and Fetlar to Haroldswick NCMPA), and there is potential for temporary disturbance to red throated diver during installation operations at the Unst cable landing site. The duration of the installation activities within Cable Corridor 2.1 Yell to Unst may occur over 24 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 6 days within this time scale. Any disturbance will be short term and transient. Vessel traffic within Cable Corridor 2.1 Yell to Unst is low with between 2-5 vessels per day. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.1 Yell to Unst, are given in Section 8 Schedule of Mitigation and are as follows:

- M4 All vessels associated with the cable installation operations within Cable Corridor 2.1 Yell
 to Unst 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.
- M5 The marine archaeological technical report will be provided to MS-LOT ahead of any licensable activities taking place.

It should be noted that the Protected Sites Assessment (Appendix C) concluded no likely significant effect on red-throated diver. Without prejudice to this conclusion, as best practice the Applicant proposed project specific mitigation ID M4 as best practice.

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 2.1 Yell to Unst.

9.3 Cable Corridor 2.2 Shetland to Yell

Cable Corridor 2.2 Shetland to Yell is between Mossbank South, Shetland to Burravoe, Yell and is approximately 9.65km long. 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 external cable protection measures (contingency measures have been included and assessed as a precaution including 66 rock bags, 3 mattresses [mattress will only be installed if requested by a third party as part of a crossing agreement]). There is one cable crossing that may require external cable protection within Cable Corridor 2.2 Shetland to Yell with the Mossbank to Yell SSEN power cable. The crossing location is not within a protected site and no known PMFs are located at the crossing location. Crossing agreements will define the final design of any cable protection required for the crossing and contingency cable protection has been included in the assessment. Within the intertidal area the cable will be buried into a trench using excavators, and rock picking may also be required for a short section at both landing points. The worst case footprint of the installation is approximately 0.028km².

The corridor is within two protected sites for very short distances (Yell Sound Coast SAC – approx. 200m) and East Mainland Coast, Shetland SPA approx. 2km) and has been assessed for temporary



disturbance to harbour seal (Yell Sound SAC), breeding red-throated diver and non breeding / wintering great northern diver and Slavonian grebe (East Mainland Coast, Shetland SPA). The potential for disturbance to protected birds and harbour seal are short term and transient and there is no effect to the protected site integrity. The duration of the installation activities within Cable Corridor 2.2 Shetland to Yell may occur over 23 days 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 6 days within this time scale. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.2 Shetland to Yell, to reduce the effects of cable installation to not significant or ALARP are given in Section 8 Schedule of Mitigation and are as follows:

M5 - 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 Corridor 2.2 Shetland to Yell.

9.4 Cable Corridor 2.3 Shetland to Sanday

Cable Corridor 2.3 Sanday to Shetland is between Grutness, Sanday (Orkney) and Northwall South, Shetland and is approximately 109.87km long. 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 external cable protection measures (contingency measures have been included and assessed as a precaution including 186 rock bags and 12 mattresses [mattresses will only be installed if requested by a third party as part of a crossing agreement]). There is one cable crossing that may require external cable protection measures within Cable Corridor 2.3 Shetland to Sanday with the proposed Shetland HVDC Link SSEN power cable. External protection measures are subject to any crossing agreements negotiated with the third party cable owner. The crossing location is not within a protected site and no known PMFs are located at the crossing location. Crossing agreements will define the final design of any cable protection required for the crossing and contingency cable protection has been included in the assessment. Within the intertidal area the cable will be buried into a trench using excavators. The worst case footprint of the installation is approximately 0.28km².

The cable corridor passes within four protected sites (Sumburgh Head SPA, Fair Isle SPA, East Sanday Coast SSSI and Sanday SAC) and has been assessed for temporary disturbance to breeding seabirds and Arctic tern (Sumburgh Head SPA and Fair Isle SPA), rocky habitats (East Sanday Coast SSSI), and harbour seal (Sanday SAC). The potential for disturbance to protected breeding birds and harbour seal 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 2.3 Shetland to Sanday may occur over 68 days 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 20-26 days within this time scale and are continuously moving along the route. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.3 Shetland to Sanday, 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 Micro-routeing will be undertaken to minimise effects to rocky shores identified within the Cable Corridor 2.3 Sanday landing point area.
- M2 Works at Cable Corridor 2.3 (Sanday landing point) will be scheduled to take place prior to the seal breeding season (June /July) to ensure works commence before seals arrive to breed and will target completion before the breeding period. An installation method statement to include timings will be agreed with Nature Scot prior to installation.





- M3 Following licence submission and confirmation by NatureScot Ornithology expert on the
 use of Cable Corridor 2.4 Fair Isle to BU (North Haven landing point) and Cable Corridor 2.3
 Shetland to Sanday (Sumburgh landing point) by nesting Artic Tern, appropriate local mitigation
 will be agreed.
- M5 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 2.3 Shetland to Sanday.

9.5 Cable Corridor 2.4 Fair Isle to Branching Unit (BU)

Cable Corridor 2.4 Fair Isle – Branching Unit (BU) is between North Haven, Fair Isle and the Branching Unit from Cable 2.3. The corridor length is approximately 5.29km long. The offshore route will be installed using 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 external cable protection measures (contingency measures have been included in the assessment as a precaution (13 rock bags and 3 mattresses [mattress will only be installed if reqestedby a third party as part of a crossing agreement]). Within the intertidal area the cable will be buried into a trench using excavators. The footprint of the surface lay installation is approximately 0.0013km².

The corridor passes through two protected sites (Fair Isle SPA and Fair Isle SAC) and has been assessed for temporary disturbance to breeding seabirds and nesting Arctic tern (Fair Isle SPA). The potential for disturbance to protected breeding sea birds and Arctic tern 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 2.4 Fair Isle to BU may occur over 47 days (including contingency) for the route installation and burial from BMH to BU. However, most of this time is contingency or transit time and cable installation activities will only occur for approximately 9 days within this time scale. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.4 Fair Isle to BU, 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 Following licence submission and confirmation by NatureScot Ornithology expert on the use of Cable Corridor 2.4 Fair Isle to BU (North Haven landing point) and Cable Corridor 2.3 Shetland to Sanday (Sumburgh landing point) by nesting Artic Tern, appropriate local mitigation will be agreed.
- M5 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 2.4 Fair Isle to BU.

9.6 Cable Corridor 2.8 Shetland to Whalsay

Cable Corridor 2.8 Shetland to Whalsay is between Skelberry, Shetland and Symbister, Whalsay and is approximately 7.3km long. 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 external cable protection measures (contingency measures have been included and assessed as a precaution including 32 rock bags and 3 mattresses [mattresses will only be installed if requested by a third party as part of a crossing agreement]). Within the intertidal area the cable will be buried into a trench using excavators. The footprint of the installation is approximately 0.017km².





The cable corridor does not pass through any protected sites however, 14 European protected sites have been considered for potential likely significant effects arising from works within Cable Corridor 2.8 Shetland to Whalsay. The duration of the installation activities within Corridor 2.8 Shetland to Whalsay may occur over 22 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 4-6 days within this time scale. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.8 Shetland to Whalsay, to reduce the effects of cable installation to not significant or ALARP are given in Section 8 Schedule of Mitigation and are as follows:

M5 - 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 2.8 Shetland to Whalsay.

9.7 Summary

In conclusion, the effects from the R100 Project cable installation to the Shetland 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 Shetland geographical area

Section	Potential Pressure	Potential Effect	Residual effect of Cable installation Corridor				
Section	Totellian ressure	Totelluli Ellect	2.1 Yell – Unst	2.2 Shetland – Yell	2.3 Shetland - Sanday	2.4 Fair Isle – BU	2.8 Shetland - Whalsay
Physical Processes	Abrasion/disturbance at the surface of the substratum.		Negligible	Negligible	Negligible	Negligible	Negligible
	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Disturbance to the seabed	Negligible	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	Negligible
	Physical change (to another seabed type)	Reduction in extent of seabed sediments	Not Significant	Not significant	Not Significant	Not significant	Not Significant
	Local water flow (tidal current) changes	Scour and erosion / deposition of sediments to the seabed	Negligible	Not Significant	Not significant	Negligible	Negligible
	Abrasion/disturbance at the surface of the substratum.	Mortality, injury or disturbance to benthic habitats and species	Negligible	Negligible	Negligible	Negligible	Negligible
Benthic and Intertidal Ecology	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	Negligible
	Physical change (to another substratum type)	Reduction in extent of reef habitats and sub habitats – Contingency external cable protection: Rock bags or mattressing	Minor	Minor	Minor	Minor	Minor



	Potential Pressure	Potential Effect	Residual effect o	of Cable installati	on		
Section			Corridor				
			2.1 Yell – Unst	2.2 Shetland - Yell	2.3 Shetland - Sanday	2.4 Fair Isle – BU	2.8 Shetland - Whalsay
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	Negligible
	Underwater noise changes	Basking shark / fish species	Negligible	Negligible	Negligible	Negligible	Negligible
Fish and Shellfish	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	Negligible
	Abrasion/disturbance at the surface of the substratum.	Disturbance to rocky shore habitat	Negligible	Negligible	Not significant* M1	Negligible	Negligible
	Visual and above water noise disturbance	Disturbance to protected birds	Not significant* M3	Not significant	Not significant* M3	Not significant	Not significant
Protected Sites and Species	Visual and above water noise disturbance	Disturbance to pinniped	Negligible	Negligible	Not Significant* M2	Negligible	Negligible
	Underwater noise changes	Injury to pinniped	Negligible	Negligible	Negligible	Negligible	Negligible
	Underwater noise changes	Disturbance to pinniped	Not significant	Not significant	Not significant	Not significant	Not significant
	Underwater noise changes	Injury to cetaceans (EPS)	Negligible	Negligible	Negligible	Negligible	Negligible





			Residual effect of Cable installation					
Section	Potential Pressure	Potential Effect	Corridor					
			2.1 Yell – Unst	2.2 Shetland – Yell	2.3 Shetland - Sanday	2.4 Fair Isle – BU	2.8 Shetland - Whalsay	
		Disturbance to cetaceans (EPS)	Not significant	Not significant	Not significant	Not significant	Not significant	
	Visual and above water noise disturbance	Disturbance to otter	Negligible	Not significant	Negligible	Negligible	Negligible	
Protected Sites and Species	Underwater noise changes	Disturbance to otter	Negligible	Not significant	Negligible	Negligible	Negligible	
Marine	Abrasion/disturbance at the surface of the substratum	Damage to archaeological assets	Not Significant* M5	Not Significant* M5	Not Significant* M5	Not Significant* M5	Not Significant* M5	
Archaeology	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion.	Damage to archaeological assets	Not Significant* M5	Not Significant* M5	Not Significant* M5	Not Significant* M5	Not Significant* M5	
	Displacement of vessels due to avoidance of Project vessels	Temporary displacement due to the avoidance of Project vessels	As Low As Reasonably Practicable					
Shipping and Navigation	Collision Risk	Damage to vessels and injury to personnel	As Low As Reasonably Practicable					
	Accidental anchoring on surface laid cable	Damage to surface laid cable	As Low As Reasonably Practicable					





		Potential Effect	Residual effect of Cable installation				
Section	Potential Pressure		Corridor				
			2.1 Yell – Unst	2.2 Shetland - Yell	2.3 Shetland - Sanday	2.4 Fair Isle – BU	2.8 Shetland - Whalsay
	Project vessels blocking navigational features	Temporary displacement or restricted access	As Low As Reasonably Practicable				
	Extreme weather conditions	Cable installation risk	As Low As Reasonably Practicable				
	Reduced visibility	Cable installation risk	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	Not Significant
Other Sea Users	Temporary displacement / restricted access	Disruption to activities	Negligible	Negligible	Negligible	Negligible	Negligible
outer sea osers	Damage to third-party assets	Physical damage to third-party assets	Negligible	Negligible	Negligible	Negligible	Negligible
	Abrasion/disturbance at the surface of the substratum.		Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
Cumulative Effects	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Disturbance to the seabed, support habitats and species	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
	Physical change (to another seabed type)		Not Significant	Not Significant	Not Significant	Not Significant	Not Significant



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