

## BRITISH TELECOMMUNICATION PLC

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### **R100 Scottish Isles Fibre-optic Project**

**Marine Environmental Appraisal - Orkney**

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P2308\_R5931\_Rev0 | October 2021

**Intertek Energy & Water Consultancy Services**

Exchange House, Station Road, Liphook, Hampshire GU30 7DW, United Kingdom

## DOCUMENT RELEASE FORM

### British Telecommunication Plc

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R100 Scottish Isles Fibre-optic Project

Marine Environmental Appraisal - Orkney

Author/s

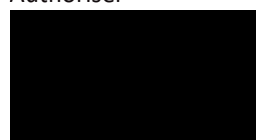
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## GLOSSARY

### AA

Appropriate Assessment

### AEZs

Appropriate archaeological exclusion zone

### AIS

Automatic Identification System

### ALAPR

As Low As Reasonably Practicable

### AP

articulated pipe

### AWAC

armour wire anchor clamp

### BAP

Biodiversity Action Plan

### BGS

British Geological Society

### BMH

Beach Manhole

### BP

Best Practice

### Bq

becquerels

### BT

British Telecommunications plc

### BTO

British Trust for Ornithology

### BU

Branching Unit

### CBA

Cable Burial Assessment

### CCW

Countryside Council for Wales

### CD

Chart Datum

### CES

Crown Estate Scotland

### CHSR

Conservation of Habitats and Species Regulations

### cm

Centimetre

### COHSR

Conservation of Offshore Habitats and Species Regulations

### COLREGs

Convention on the International Regulations for Preventing Collisions at Sea

### DBA

Desk Based Assessment

### DEFRA

Department for Environment, Food and Rural Affairs

### DSE

Direct Shore End

### DTS

Desk-top Study

### EEZ

Exclusive Economic Zone

### EMEC

European Marine Energy Centre

### EMODnet

European Marine Observation Data Network

### EPA

Environmental Protection Agency

### EPS

European Protected Species

### EU

European Union

### EUNIS

European Nature Information System

### FAS

Fishing Activity Study

### FCS

Favourable Conservation Status

### FEAST

Feature Activity Sensitivity Tool

### FLMAP

Fishing Liaison Mitigation Action Plan

### FLO

Fishing Liaison Officer

### FPO

Fish Producers Organisation

### GeMS

Geodatabase of Marine Features adjacent to Scotland

### GES

Good Environmental Status

### GIS

Geographical Information System

### Global Marine

Global Marine Systems Ltd

### GM

Global Marine Systems Ltd

### GMG

Global Marine Group

### HDPE

High Density Polyethylene

### HES

Historic Environment Scotland

### HF

High frequency

### HM

Her Majesty

### HRA

Habitats Regulations Assessment

### ICES

International Council for the Exploration of the Sea

### ICG-C

Intercessional Correspondence Group on Cumulative Effects

### ICG

Intercessional Correspondence Group

### ICPC

International Cable Protection Committee

### INIS

Invasive Non-indigenous Species

### Intertek

Intertek Energy & Water Consultancy Services

### IoM

Isle of Man

### IRL

Ireland

### iSPM

Inorganic suspended particulate material

### IUCN

International Union for Conservation of Nature

### JNCC

Joint Nature Conservation Committee

### KM

Kilometre

### LAT

Lowest Astronomical Tide

### LF

low frequency

### Long Term Effect

Effects lasting fifteen to sixty years

### LSE

Likely Significant Effect

### LWM

Low Water Mark

### M

Metre

### MAIB

Marine Accident Investigation Branch



### MarLIN

Marine Life Information Network

### MARPOL

The International Convention for the Prevention of Pollution from Ships

### Mbps

Megabits per second

### MCAA

Marine and Coastal Access Act

### MCA

Maritime and Coastguard Agency

### MEA

Marine Environmental Appraisal

### Medium Term Effect

Effects lasting seven to fifteen years

### MHWS

Mean High-Water Spring

### mm

Millimetre

### MOD

Ministry of Defence

### MLV

Main lay vessel

### MMMP

Marine Mammal Mitigation Plan

### MMO

Marine Management Organisation

### MPA

Marine Protected Areas

### MS

Marine Scotland

### MSFD

Marine Strategy Framework Directive

### MSI

Maritime Safety Information

### MS-LOT

Marine Scotland Licensing Operations Team

### MSLOT

Marine Scotland Licensing Operations Team

### mSv/y

millisievert per year

### MU

Management Unit

### NCMPA

Nature Conservation Marine Protected Area

### NM

Nautical Mile

### NMP

National Marine Plan

### NMPi

National Marine Plan interactive

### NRA

Navigational Risk assessment

### NtM

Notice to Mariners

### OFA

Orkney Fisheries Association

### OOS

out-of-service

### ORJIP

Offshore Renewables Joint Industry Programme

### OREI

Offshore Renewable Energy Installation

### ORS

Old Red Sandstone

### PAC

Pre-Application Consultation

### PAD

Pressures-Activity Database

### PAIH

Potential Annex I habitat

### PCE

potential cumulative effect

## PLB

Post Lay Burial

## PLIB

Post lay inspection and burial

## PLGR

pre-lay grapnel run

## PLN

Port Letter Number

## PLSE

Pre-Lay Shore End

## PMF

Priority Marine Features

## PSA

Projects Protected Sites Screening Assessment

## pSPA

proposed Special Protection Areas

## PTS

permanent threshold shift

## R100

Reaching 100%

## R100 Project Area

Orkney, Shetland and Inner Hebrides

## RBMP

River Basin Management Plans

## RC

Route Clearance

## RIFG

Regional Inshore Fisheries Group

## RNLI

Royal National Lifeboat Institution

## ROV

Remotely Operated Vehicle

## RPL

Route Position List

## RYA

Royal Yachting Association

## SAC

Special Areas of Conservation

## SEA

Strategic Environmental Assessment

## SEL

exposure to sound

## SEPA

Scottish Environment Protection Agency

## Short Term Effect

Effects lasting one to seven years

## SMWWC

Scottish Marine Wildlife Watching Code

## SNCB

Statutory Nature Conservation Body

## SOLAS

Safety of Life at Sea

## SPA

Special Protection Areas

## SPL

sound pressure level

## SSPO

Scottish Salmon Producers Organisation

## SSSIs

Sites of Special Scientific Interest

## SWFPA

Scottish White Fish Producers Association

## TAC

Total Allowable Catch

## TTS

temporary threshold shift

## UK

United Kingdom

## UKHO

United Kingdom Hydrographic Office

## USBL

Ultra Short Baseline

**VHF**

very high frequency

---

**VHPM**

Vessel Hours Per Month

---

**VMS**

Vessel Monitoring System

---

**WFD**

Water Framework Directive

---

**ZOI**

zone of influence

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# 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 R100 Project, in accordance with the requirements of the MS Act 2010 for installation of seven cables within the Orkney geographical area.

## 1.2 Overview of the Project

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

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

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

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

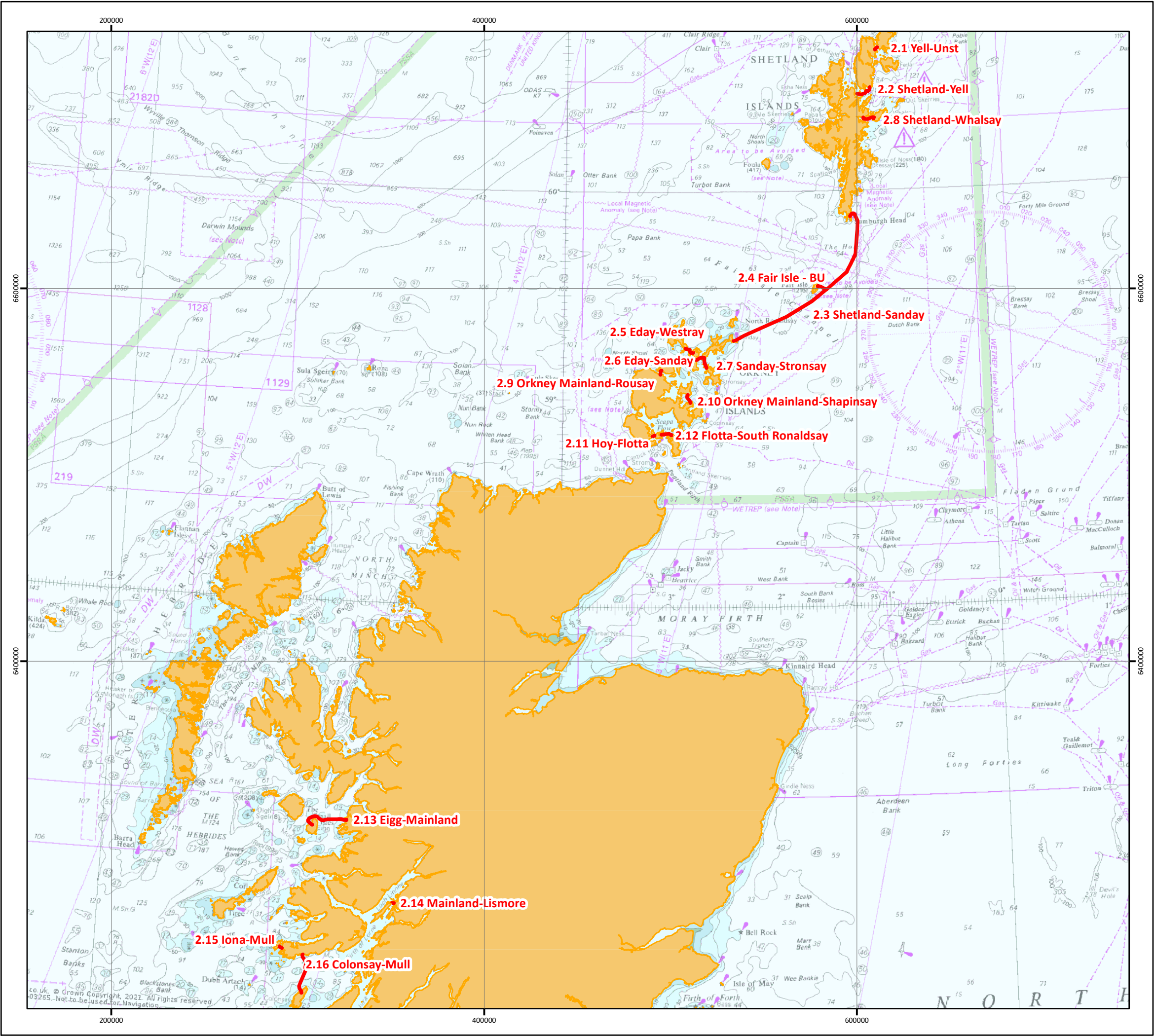
- Cable 2.5 – Eday to Westray
- Cable 2.6 – Eday to Sanday
- Cable 2.7 – Sanday to Stronsay
- Cable 2.9 – Orkney mainland to Rousay
- Cable 2.10 – Orkney mainland to Shapinsay
- Cable 2.11 – Hoy to Flotta
- Cable 2.12 – Flotta to South Ronaldsay

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.

An additional 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 report (Ref: P2308\_R5367\_Rev0). As such, any assessment findings regarding this route in Orkney waters can be found in the Shetland MEA report.

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




SCOTTISH ISLES  
FIBRE OPTIC CABLE PROJECT

LOCATION OVERVIEW  
Cable Application Corridors

Drawing No: P2308-LOC-001

C

Legend

 Cable Route Application Corridor



NOTE: Not to be used for Navigation

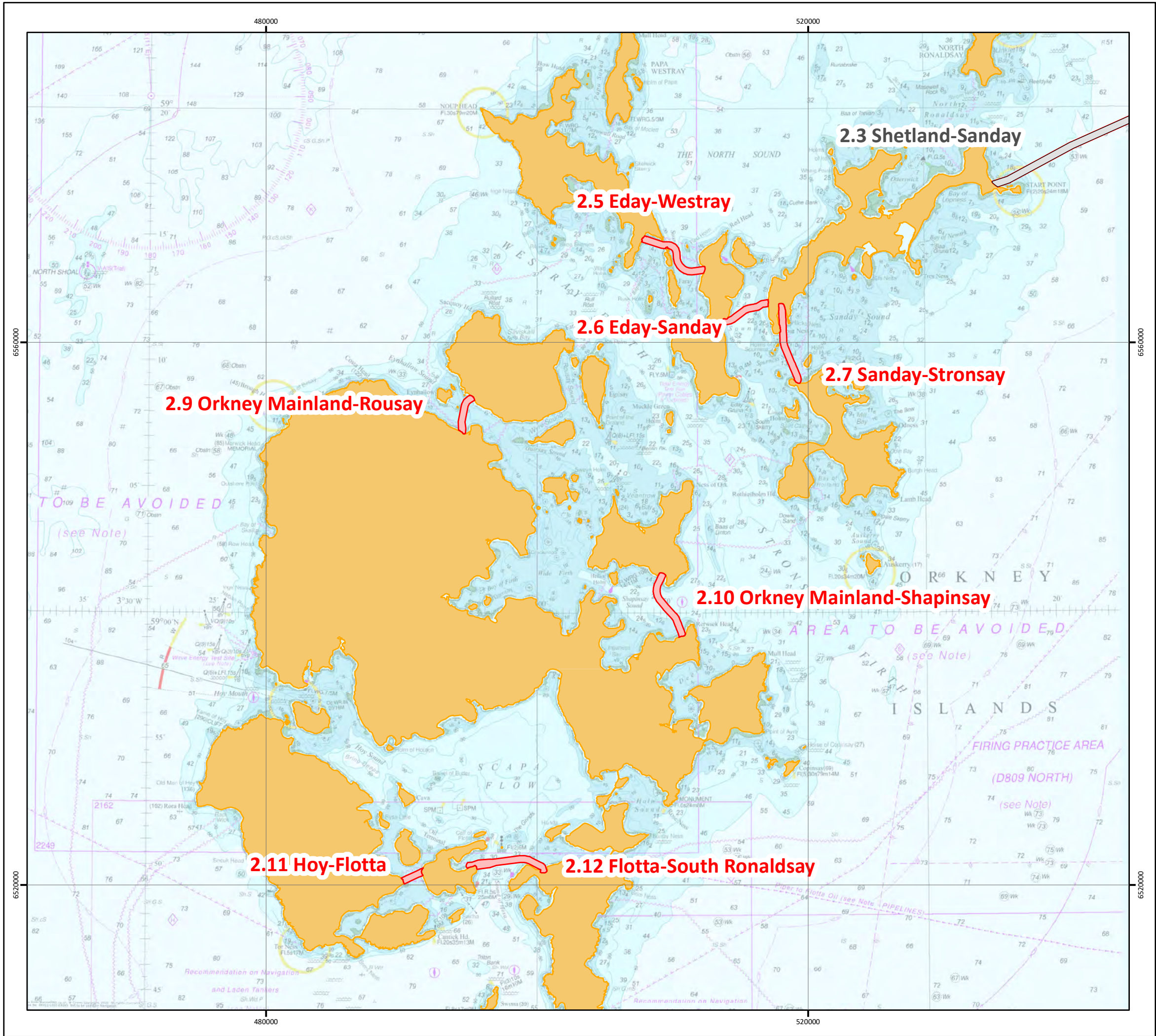
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Created By	Chris Dawe
Reviewed By	Abigale Nelson
Approved By	Paula Daglish



0 25 50 75 100 km

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SCOTTISH ISLES  
FIBRE OPTIC CABLE PROJECT

LOCATION OVERVIEW  
Cable Corridors - Orkney

Drawing No: P2308-LOC-002\_OR

A

Legend

- Cable Corridor
- Not Assessed



NOTE: Not to be used for Navigation

Date	29 September 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ONS; MarineFind; ESRI;
File Reference	J:\P2308\Mxd\01_LOC\ P2308-LOC-002_OR.mxd
Created By	Jessica Harvey
Reviewed By	Emma Langley
Approved By	Paula Daglish



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## 1.3 Project Need

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

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

## 1.4 Consent Requirements and Relevant Legislation

### 1.4.1 Marine (Scotland) Act 2010

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

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

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

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

### 1.4.3 Scottish Crown Estate Act 2019

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

### 1.4.4 Submarine Telegraph Act 1885

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

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

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



## 1.4.6 Scottish National Marine Plan

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

### 1.4.6.1 Sea fisheries

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

### 1.4.6.2 Shipping Ports, Harbours and Ferries

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

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

### 1.4.6.3 Submarine Cables

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

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

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

## 1.4.7 Scottish marine regions

After multiple years of public consultation and specialist studies establishing the support for, and potential areas of marine regions in Scottish waters (Scottish Government, 2015), the Scottish Marine Regions Order 2015 came into force on the 13th May 2015 and details the boundaries of the final eleven Scottish marine regions (Scottish Parliament, 2015). All Cables within Orkney (Cables 2.5 to 2.7 and 2.9 to 2.12) are within the Orkney Islands Marine Region. Within these marine regions, Regional Marine Plans will be developed by Marine Planning Partnerships. These partnerships are comprised of groups of local marine stakeholders, allowing for more focused decision making by the local community to target the issues specific to each marine region.

#### **1.4.8 Orkney Local Development Plan**

Cables 2.3 (Sanday landing point) and cables outlined in section 1.2 above fall within the area of the Orkney Local Development (LDP), which was adopted in 2017. For coastal developments, the LDP ensures that developments are in line with the National Marine Plan (NMP) and protects areas outside of largely developed areas of coast unless there is a specific locational requirement. The plan details four policies in relation to the coastal area (Policies 8, 9, 10 and 11), against which any planning application will be assessed (Orkney Island Council, 2021). The effects to these are considered in the physical and biological chapters of this MEA.

#### **1.4.9 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.

#### **1.4.10 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.

#### **1.4.11 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.

#### **1.4.12 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.

#### **1.4.13 Water Framework Directive**

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

## 1.5 Work Undertaken to Date

### 1.5.1 Cable Route Design

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

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

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

### 1.5.2 Desk-top Study

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

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

### 1.5.3 Marine and Intertidal Surveys

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

The following surveys have been undertaken:

- Geophysical survey
- Geotechnical survey
- UXO survey for route 2.7 Sanday-Stronsay, 2.11 Hoy-Flotta and 2.12 Flotta-South Ronaldsay
- Benthic survey – route 2.10: Orkney Mainland-Shapinsay -
- Intertidal survey – all proposed landing points
- Phase 1 Habitat Surveys
- Otter Surveys
- Archaeological walkover survey (geophysical)

### 1.5.4 Consultation and Stakeholder Engagement

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

#### 1.5.4.1 NatureScot

Consultation 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 is easily reviewed by the regulators and advisors. This has included early sight of the Projects approach and decision-making process for the screening to be included in the Projects Protected Sites Screening Assessment (PSA). Consultation responses are provided in Appendix B.

#### 1.5.4.2 Pre-Application Consultation (PAC)

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

#### 1.5.4.3 Fishing Liaison Mitigation Action Plan (FLMAP)

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

### 1.5.5 European Protected Sites and Species Risk Assessment

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

### 1.5.6 Navigational Risk assessment (NRA)

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

## 2. PROJECT DESCRIPTION

### 2.1 Section overview

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

The key activities to be undertaken during installation are:

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

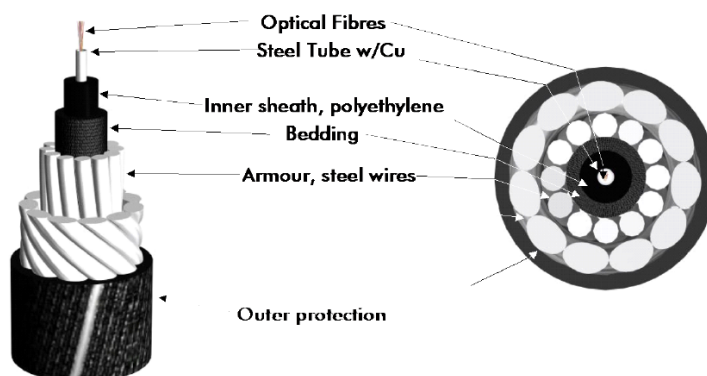
All products, equipment and/or vessel specifications detailed in this section are indicative. In the event that the Project does not/cannot use the specified equipment similar products will be selected.

### 2.2 Submarine cable description

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

The cable types to be used for the R100 project are armoured fibre optic cables, which are a resilient cable type suitable for installation within Scottish waters (Figure 2-1). The cable system will be unrepeaters (an 'unrepeated 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 points

The R100 installations are additional cable connections where new BMH will be constructed for all landing points except for Route 2.9 where the existing BMH will be utilised. Details of the landing points are provided in Table 2-1.

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

Cable Route	Landing Point	Estimated BMH Latitude	Estimated BMH Longitude	Approximate Cable length (km)
2.5	Eday	59°13.5900'N	2°46.9900'W	6.5km
	Westray	59°14.8610'N	2°51.8690'W	
2.6	Eday	59°11.4940'N	2°45.9870'W	4.0km
	Sanday	59°12.2855'N	2°42.0630'W	
2.7	Sanday	59°12.2736'N	2°41.0532'W	6.8km
	Stronsay	59°09.1180'N	2°39.9500'W	
2.9	Orkney Mainland	59°07.1888'N	3°05.9688'W	3.2km
	Rousay	59°08.5680'N	3°04.9180'W	
2.10	Orkney Mainland	58°59.0555'N	2°48.8139'W	5.75km
	Shapinsay	59°01.5710'N	2°50.2840'W	
2.11	Hoy	58°49.3478'N	3°10.2975'W	1.75km
	Flotta	58°49.6980'N	3°08.8460'W	
2.12	Flotta	58°49.9549'N	3°04.7492'W	6.7km
	South Ronaldsay	58°49.6660'N	2°59.4650'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.

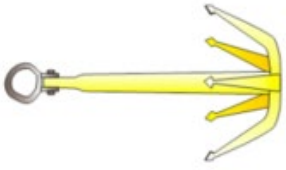




A range of cable recovery tools will be available for use, typically a 'Flatfish' cutting grapnel, de-trenching grapnel, and 'Rennie and Gifford' grapnel (see Figure 2-2), together with the necessary rigging equipment. In summary, route clearance operations shall include:

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

#### 2.4.2 Pre-lay grapnel run

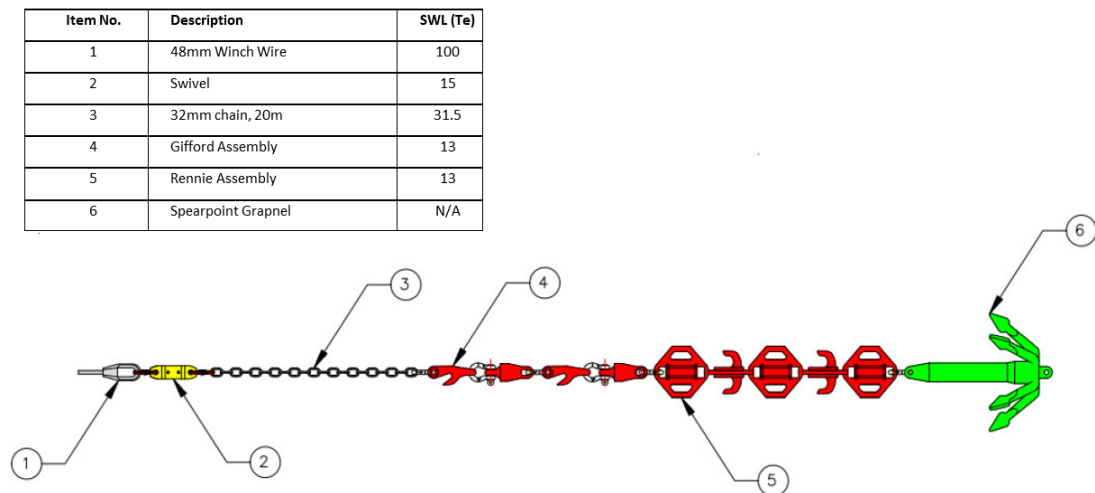
PLGR will be conducted following route clearance works. Typical tools are shown in Figure 2-2 below, which will generally penetrate 0.4m - 1m into the seabed under suitable conditions. The specific grapnel rigging may vary depending on the seabed conditions identified on site.

**Figure 2-2 Typical PLGR Equipment**

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

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

**Figure 2-3 Typical PLGR Chain**



## 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 (Figure 2.6). 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

No rock protection has been proposed for the Project, however it has been included as a contingency measure should it be required. Therefore, a rock placement vessel is included as a potential contingency for crossing agreements, stability or additional protection as required. If rock is required along the cable corridor, a rock-placement vessel will be deployed. This 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 Orkney Geographical Area, the first shore end will be landed. At the time of writing is it not known which cable within Orkney 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.

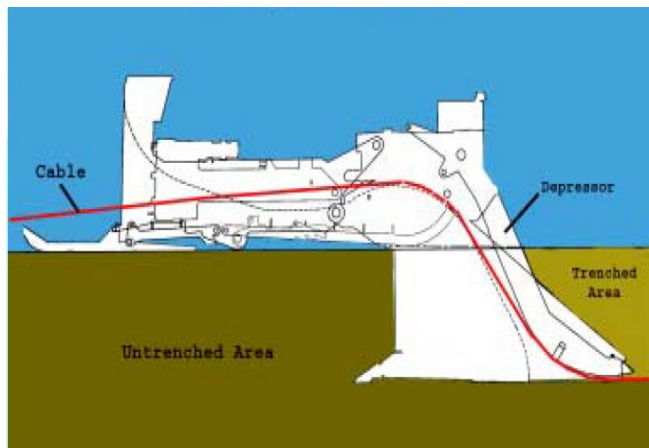
The key steps associated with the cable lay and burial are outlined below.

### 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).

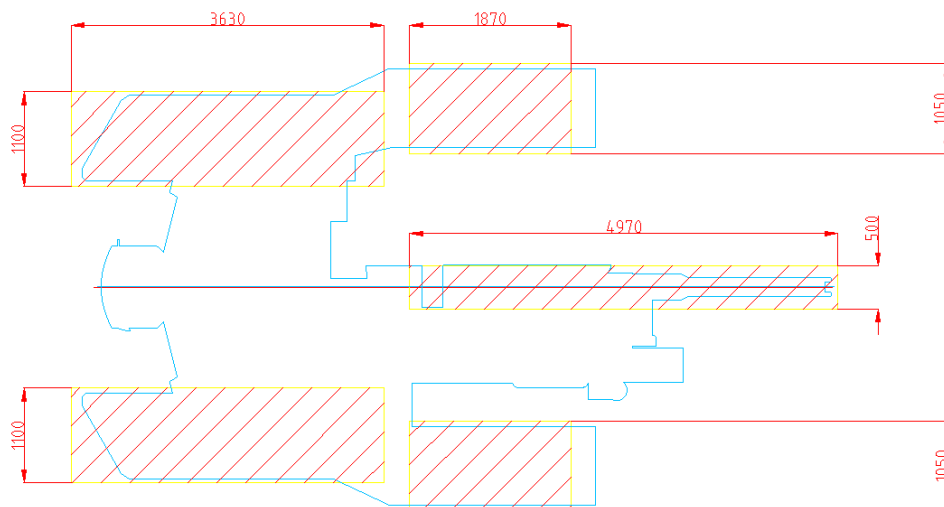
Hydraulically adjustable skids are used to provide steering on the plough and the share is used to vary the burial depth. On-board sensors ensure the cable passes through the plough in a safe manner before being buried. The sensors also record the burial depth achieved, for this Project the target burial 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 7m<sup>2</sup> per skid and the share footprint is approximately 2.45m<sup>2</sup>. The plough share width is approximately 0.5m. The dimensions 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 minimum rate 600m/ hour.

**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 conforms to the seabed topography. The approximate speed of surface lay installation is 2000m p/h which is approximately 1 knot.

## 2.6 Cable Landing

### 2.6.1 Shore end installation

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

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

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

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

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

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

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

Under the control of the Beach Master, the second excavator will commence the pull in of the cable ashore which will be supported in the water by buoys attached to the cable on the MLV/PLSE as it is paid out (Figure 2.11). The excavator will slowly move along the beach while monitoring the cable tension under the control of the Beach Master.

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

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

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

**Figure 2-11 Typical DSE landing from MLV**



### **2.6.2 Beach Works**

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

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

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

### **2.6.3 Rock cutting**

In the event that there is little sediment or rock outcropping between the proposed BMH location to LWM, limited and targeted rock cutting may be conducted if no other practical technique exists to provide acceptable cable protection. Rock cutting is not currently planned however may be a requirement for a short section (50m) for example Route 2.5 Eday cable landing point and Route 2.6 Sanday landing point within the Orkney Geographical Area.

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

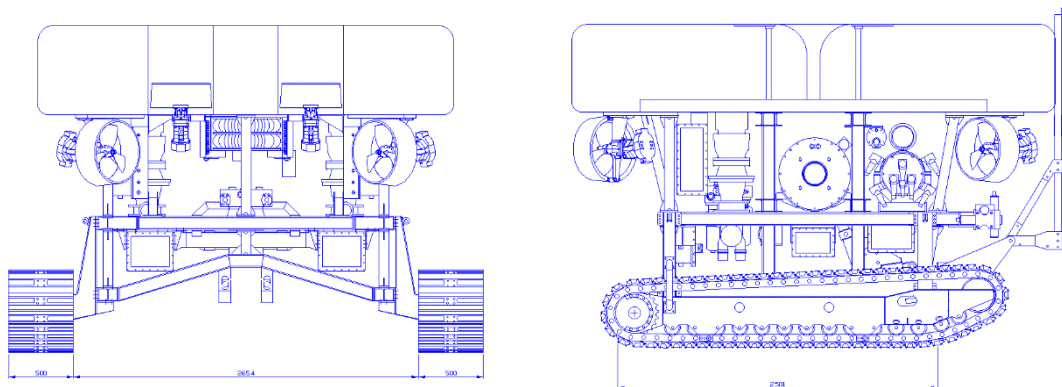
## 2.7 Post lay inspection and burial

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

**Figure 2-12 Typical ROV jetting trencher**



**Figure 2-13 Typical ROV Schematic**



### 2.7.2 Inshore/ Shallow Water Post Lay Burial (PLB)

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

**Figure 2-14 Typical diver assisted jet burial tool**



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

### **2.7.3 Diver swim survey/ Mini ROV survey**

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

### **2.7.4 Cable jointing**

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

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

## **2.8 Cable crossings**

There are no known engineered crossings required within the cable corridors within the Orkney Geographical Area. It is possible that some OOS cables are within the Orkney cable corridors, however these will be removed prior to installation where possible (during route preparation works described in Section 2.4). Should any crossings subsequently be required, the engineering of 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.



## 2.9 Proposed integral cable protection

### 2.9.1 High Density Polyethylene (HDPE) Protection (Uraduct<sup>®</sup>)

High Density Polyethylene (HDPE) Protection, Uraduct<sup>®</sup> (or similar), is currently the only planned cable protection method for all of R100 cable crossings (Figure 2.15). Uraduct<sup>®</sup> (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<sup>®</sup> (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**

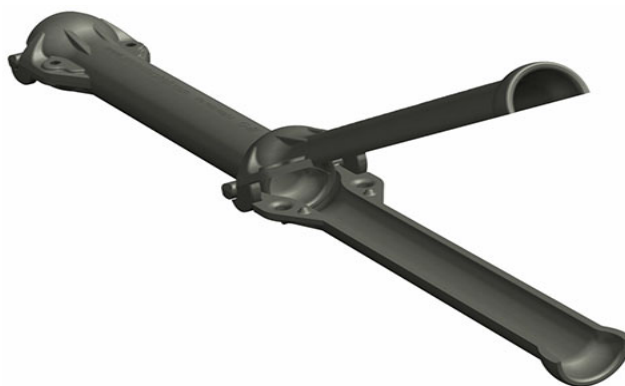


### 2.9.2 Articulated pipe

For this Project, articulated pipe (AP) is planned to be fitted from the end of the BMH duct to the LWM or 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 2-2 Articulated Pipe lengths required for each landfall within the Orkney Geographical Area**

Cable Route	Landfall	Length of Articulated Pipe (BMH to 10m depth contour)*
2.5	Eday	662m
	Westray	1716m
2.6	Eday	616m
	Sanday	207m
2.7	Sanday	2095m
	Stronsay	1236m
2.9	Orkney Mainland	1876m
	Rousay	487m
2.10	Orkney Mainland	695m
	Shapinsay	728m
2.11	Hoy	407m
	Flotta	209m
2.12	Flotta	218m
	South Ronaldsay	764m

\*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.

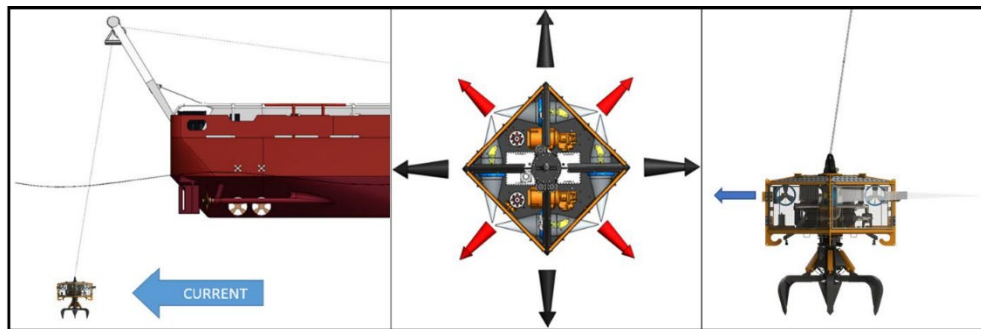
Conservation bodies on past projects have also noted that any additional or external protection should be included in any initial application to avoid subsequent applications being made post-installation. Therefore, whilst additional external protection such as rock bags are not expected or planned,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



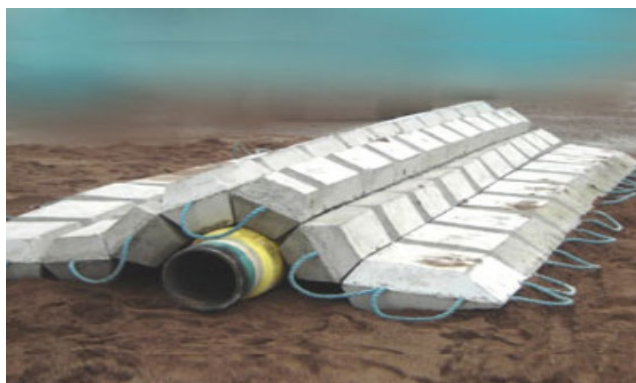
### 2.10.2 Concrete mattresses

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.

**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. This will not be known until after the cable has been installed. Typical dimensions of the rock bags likely to be used for R100 are shown in Table 2-3 below.

**Table 2-3 Typical rock bag dimensions**

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

**Figure 2-19 Rock bag deployment**



#### 2.10.4 Rock placement

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

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

## 2.11 Summary of Cable installation per cable corridor

### 2.11.1 Installation footprint

The R100 project within the Orkney Geographical Area consists of seven 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 2-4 Summary of installation methods and footprints per licence application**

Cable Route	PLGR / RC Note 1	Installation method Note 2 Approximate footprint of installation (width of tool x length of installation)					Contingency measures (worst case deposits) *Contingencies will be carefully engineered in water depths less than 10m so that they will not reduce the water depth by more than 5%			
		Surface lay Note 3	Plough Note 4 2.6m wide x length of cable corridor (worst case)	Trenching 2m deep x width of excavator bucket (assumed to be 2m)	Rock cutting Note 5 (50m Length x 0.5 burial x 0.3 width)	ROV Note 6	Boulder relocation Note 7	No. Rock Bags Note 8 3m diameter = 7m <sup>2</sup> per rock bag (8T bag)	No. Concrete Mattress Note 9 6m x 3m = 18m <sup>2</sup> per mattress	Bentonite Cement (m <sup>3</sup> ) Note 10 (0.3m x 0.5m) x length of rock
Cable 2.5 – Eday to Westray	✓	✓	0.017km <sup>2</sup>	✓	✓ 7.5m <sup>3</sup>	✓	✓	25 bags 175m <sup>2</sup>	3 mattress 54 m <sup>2</sup>	<7.5m <sup>3</sup>
Cable 2.6 – Eday to Sanday	✓	✓	0.01km <sup>2</sup>	✓	✓ 7.5m <sup>3</sup>	✓	✓	25 bags 175m <sup>2</sup>	3 mattress 54 m <sup>2</sup>	<7.5m <sup>3</sup>
Cable 2.7 – Sanday to Stronsay	✓	✓	0.017km <sup>2</sup>	✓		✓	✓	40 bags 280m <sup>2</sup>	3 mattress 54 m <sup>2</sup>	
Cable 2.9 – Orkney mainland to Rousay	✓	✓	0km <sup>2</sup>	✓		✓	✓	52 bags 364m <sup>2</sup>	3 mattress 54 m <sup>2</sup>	
Cable 2.10 – Orkney mainland to Shapinsay	✓	✓	0.014km <sup>2</sup>	✓		✓	✓	18 bags 126m <sup>2</sup>	3 mattress 54 m <sup>2</sup>	
Cable 2.11 – Hoy to Flotta	✓	✓	0.004km <sup>2</sup>	✓		✓	✓	10 bags 70m <sup>2</sup>	3 mattress 54 m <sup>2</sup>	
Cable 2.12 – Flotta to South Ronaldsay	✓	✓	0.017km <sup>2</sup>	✓		✓		10 bags 70m <sup>2</sup>	3 mattress 54 m <sup>2</sup>	

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

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 worst case as plough installation will not be used for the entire length of the installation route – see note 3.

Note 5: Rock cutting dimensions are for a wheel attachment to an excavator (Section 2.9.3) – applicable to Route 2.5 and 2.6 only.

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 used, 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 % of no burial within the cable corridor: Route 2.5 – 68%; Route 2.6 – 43%; Route 2.7 – 46%; Route 2.9 – 100%; Route 2.10 – 28% Route 2.11 – 0%; Route 2.12 – 0%.

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

Note 10: A marine grade cement such as Bentonite or similar will be used to backfill any areas where rock cutting has taken place.

## 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 are outlined in Table 2-5 below. Cable installation for the routes within the Orkney Application Area will take approximately 20 days per route with the exception of Route 2.9 which will take longer due to shallow water depths and more time required for diver and ROV pre-installation survey.

**Table 2-5 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/ Mattressing/ rock placement)	No MLV installation
Cable 2.5 – Eday to Westray	0.5	1.5	0.5	2	14	2	N/A
Cable 2.6 – Eday to Sanday	2	1.5	1	2	14	2	N/A
Cable 2.7 – Sanday to Stronsay	1	1.5	1	2	14	2	N/A
Cable 2.9 – Orkney mainland to Rousay	Included in Diver/ROV during pre- installation survey at Shore ends (if required)	Included in NO MLV solution	Included in Diver/ROV post installation survey and Shore End Burial	10	16	2	2.5

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)	No MLV installation
Cable 2.10 – Orkney mainland to Shapinsay	4	2	1	2	14	2	N/A
2CN/Ale 2.11 – Hoy to Flotta	1.5	2.5	0.5	2	14	2	N/A
Cable 2.12 – Flotta to South Ronaldsay	1	2	1	2	14	2	N/A

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

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

**Table 2-6 Project design measures**

ID	Aspect	Design Measure	Source
COMP 1	Human Environment: Commercial Fishing; Shipping and Navigation; Other sea users	Project vessels will comply with the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs) – as amended, particularly with respect to the display of lights, shapes and signals.	International Maritime Organisation



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



ID	Aspect	Design Measure	Source
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 the 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 Environment; Biological Environment, Environment 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 survey and installation vessels will be moving at a speeds of 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

ID	Aspect	Design Measure	Source
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 on birds will be followed where practicable.	Global Marine installation requirement

## 3. APPROACH TO ASSESSMENT

### 3.1 Introduction

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

### 3.2 Assessment methodology

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

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

#### 3.2.1 Characterisation of baseline environment

Data was gathered to inform the R100 application corridors through a review of relevant publicly available literature and where applicable supplemented by survey data. In addition to this, consultation with relevant stakeholders and consultees was undertaken. This information has been used to establish the baseline conditions within the 7 Orkney 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-Activity Database (PAD) (JNCC 2020); and
- Feature Activity Sensitivity Tool (FEAST) for identifying the sensitivity of marine habitats and features to the effects of cable installation (MS 2020).

##### 3.2.2.2 Zone of influence

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

### 3.2.3 Evaluation of Significance

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

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

### 3.2.4 Significance of the Effect

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

In assessing the significance of the effect, the magnitude (the spatial extent of the impact, the duration and frequency) and sensitivity, recoverability and importance of the receptor are considered. The following definitions<sup>1</sup> of significance have been used in the assessment, derived from EPA guidance<sup>2</sup> as outlined in Table 3.1 below.

**Table 3-1 Definition of significance**

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

<sup>1</sup> Adapted from EPA (2017)

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

### **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 Orkney 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 Orkney 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 Orkney geographical area and cable corridors. The section identifies potential effects associated with the cable installation and presents the findings of the environmental appraisal. To avoid repetition, the baseline for the Orkney 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, seabed sediments and features;
- Water and sediment quality;
- Seabed quality; and
- Suspended sediments.

### 4.2 Baseline Conditions

This Section describes the physical conditions within the Project 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 Orkney geographical area and to enable the identification of areas that may be sensitive to pressures from cable installation. The baseline includes an overview of the metocean conditions, sediments and seabed features within the proposed cable corridors. The assessment considers the effects of sea level rise on the proposed installation in addition to the effects of cable installation on water quality.

#### 4.2.2 Metocean Conditions

##### 4.2.2.1 Water Levels and Currents

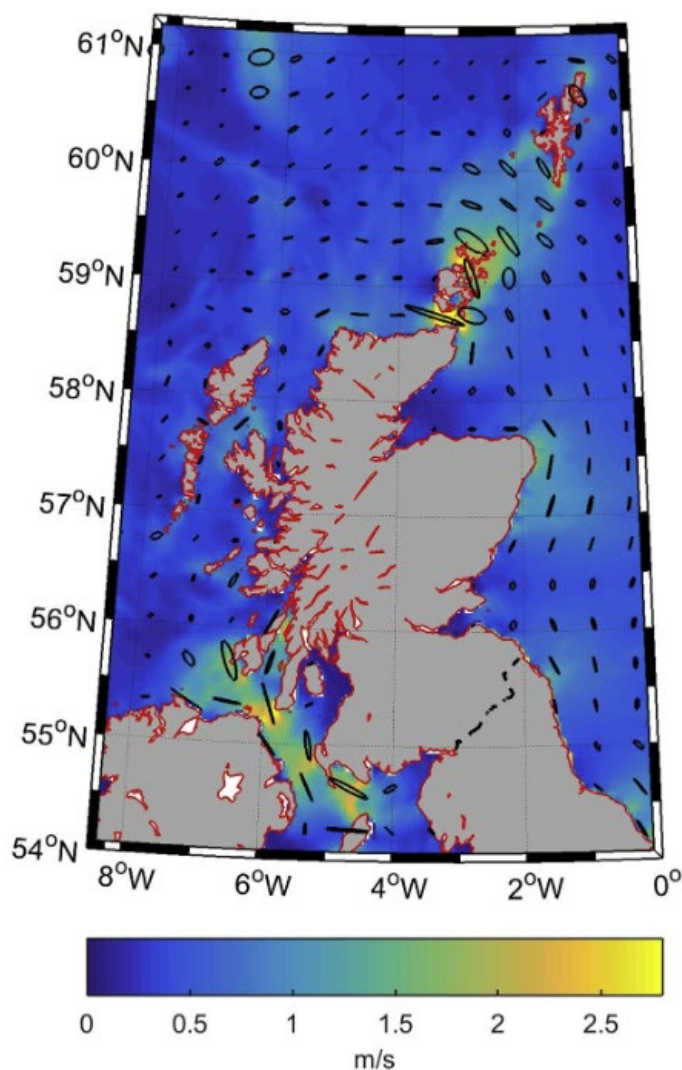
Scotland is separated from the North Atlantic by relatively narrow (approx. 100m) shelf seas to the north and west, connected by the Pentland Firth and the Fair Isle Gap, as well as channels through the Orkney and Shetland island groups (Neill et al., 2017).

The Orkney Isles are 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.

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 Orkney archipelago contain numerous narrow inter-island tidal channels with strong

tidal flows, including the Fall of Warness between Eday and the islands of Muckle Greenholm and Little Greenholm, and Lashy Sound between Eday and Sanday. The tidal currents within the Orkney Isles are some of the strongest in the world, which has attracted interest from a number of tidal energy developers over the years and is home to the European Marine Energy Centre (EMEC). Figure 4-1 shows the simulated spring tidal current amplitude around Scotland taken from Hashemi et al. (2015). Tidal currents within the Orkney Isles are generally  $< 1\text{ms}^{-1}$  with the exception of flow around headlands and within channels where spring tidal currents can exceed  $2.5\text{ms}^{-1}$ .

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



#### **Cable Corridor 2.5 – Eday – Westray**

Rapness, Westray has a spring and neap tidal range of 2.9m and 1.3m, respectively (TotalTide, 2021).

Current speeds along the proposed cable corridor peak at approximately  $1.0\text{ms}^{-1}$  and  $0.75\text{ms}^{-1}$  during a spring and neap tide, respectively between Westray and the Holm of Foray Island. However, in the vicinity of the proposed cable landfalls, currents peak at approximately  $0.1\text{ms}^{-1}$  during both a spring and neap tide (ABPmer, 2017).

#### **Cable Corridor 2.6 – Eday – Sanday**

Loth, Sanday has a spring and neap tidal range of 2.2m and 1.0m, respectively (TotalTide, 2021).

In Lashy Sound, to the immediate north of the proposed cable corridor, current speeds peak at approximately  $3.5\text{ms}^{-1}$  between the Calf of Eday and Sanday (ABPmer, 2017). Current speeds along the proposed cable corridor peak at approximately  $1.5\text{ms}^{-1}$  and  $1.0\text{ms}^{-1}$  during a spring and neap tide, respectively between Eday and Sanday. However, in the vicinity of the proposed cable landfalls, currents peak at approximately  $0.25\text{ms}^{-1}$  and  $0.75\text{ms}^{-1}$  during a spring tide and  $0.1\text{ms}^{-1}$  and  $0.5\text{ms}^{-1}$  during a neap tide at the Eday and Sanday landfalls, respectively (ABPmer, 2017).

#### **Cable Corridor 2.7 – Sanday – Stronsay**

The tidal range in the vicinity of Sanday – Stronsay is as per the Loth tidal range above.

Whitehall, Sanday has a spring and neap tidal range of 2.5m and 1.2m, respectively (TotalTide, 2021).

Current speeds along the proposed cable corridor peak at approximately  $1.5\text{ms}^{-1}$  and  $1.0\text{ms}^{-1}$  during a spring and neap tide, respectively between Sanday and Stronsay. However, in the vicinity of the proposed cable landfalls, currents peak at approximately  $0.5\text{ms}^{-1}$  and  $0.1\text{ms}^{-1}$  during a spring tide and  $0.25\text{ms}^{-1}$  and  $0.1\text{ms}^{-1}$  during a neap tide at the Sanday and Stronsay landfalls, respectively (ABPmer, 2017).

#### **Cable Corridor 2.9 – Orkney Mainland – Rousay**

Tingwall, Orkney Mainland has a spring and neap tidal range of 2.5m and 1.1m, respectively (TotalTide, 2021).

Current speeds along the proposed cable corridor peak at approximately  $1.5\text{ms}^{-1}$  and  $1.0\text{ms}^{-1}$  during a spring and neap tide, respectively between Orkney Mainland and Rousay. However, in the vicinity of the proposed cable landfalls, currents peak at approximately  $0.5\text{ms}^{-1}$  and  $1.0\text{ms}^{-1}$  during a spring tide and  $0.25\text{ms}^{-1}$  and  $0.75\text{ms}^{-1}$  during a neap tide at the Orkney Mainland and Rousay landfalls, respectively (ABPmer, 2017).

#### **Cable Corridor 2.10 – Orkney Mainland – Shapinsay**

Kirkwall, Orkney Mainland has a spring and neap tidal range of 2.5m and 1.1m, respectively (TotalTide, 2021).

Current speeds along the proposed cable corridor peak at approximately  $0.5\text{ms}^{-1}$  and  $0.25\text{ms}^{-1}$  during a spring and neap tide, respectively between Orkney Mainland and Shapinsay. However, in the vicinity of the proposed cable landfalls, currents peak at approximately  $0.1\text{ms}^{-1}$  during a spring and neap tide at the Orkney Mainland and Shapinsay landfalls (ABPmer, 2017).

#### **Cable Corridor 2.11 – Hoy – Flotta**

Widewall Bay, South Ronaldsay has a spring and neap tidal range of 3.2m and 1.4m, respectively (TotalTide, 2021).

Current speeds along the proposed cable corridor (including the proposed landfalls) peak at approximately  $0.25\text{ms}^{-1}$  and  $0.10\text{ms}^{-1}$  during a spring and neap tide, respectively between Hoy and Flotta (ABPmer, 2017).



### Cable Corridor 2.12 – Flotta – South Ronaldsay

The tidal range in the vicinity of Flotta – South Ronaldsay is as per the Widewall Bay tidal range above.

Current speeds along the proposed cable corridor peak at approximately  $0.25\text{ms}^{-1}$  and  $0.1\text{ms}^{-1}$  during a spring and neap tide, respectively between Flotta and South Ronaldsay. However, in the vicinity of the proposed cable landfalls, currents peak at approximately  $0.1\text{ms}^{-1}$  during a spring and neap tide (ABPmer, 2017).

Table 4-1 provides a summary of the tidal levels and ranges in the vicinity of each proposed cable landfalls.

**Table 4-1 Tidal levels and ranges in the vicinity of the proposed cable landfalls (TotalTide, 2021)**

Location	MHWS (m CD)	MLWS (m CD)	Spring range (m)	MHWN (m CD)	MLWN (m CD)	Neap range (m)
2.5 Rapness, Westray	3.6	0.7	2.9	2.9	1.6	1.3
2.6 Loth, Sanday	3.1	0.9	2.2	2.5	1.5	1.0
2.7 Whitehall, Stronsay	3.4	0.9	2.5	2.8	1.6	1.2
2.9 Tingwall, Orkney Mainland	3.1	0.6	2.5	2.4	1.3	1.1
2.10 Kirkwall, Orkney Mainland	3.0	0.6	2.5	2.4	1.3	1.1
2.11 Widewall Bay, South Ronaldsay*	3.6	0.4	3.2	2.7	1.3	1.4

Note: Cable Corridor 2.12, Flotta – South Ronaldsay is as per the Widewall Bay tidal range (Cable Corridor 2.11)

#### 4.2.2.2 Waves

Waves are directly driven by winds, modified by currents and shallow sea-floor topography. 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). Wave conditions within Orkney vary over very short distances due to changes in coastline orientation, rapidly varying fetch lengths, irregular bathymetry, complex refraction and diffraction wave patterns and the influence of the strong tidal currents (Ramsay and Brampton, 2000).

The offshore wave climate to the east of Orkney is not dominated by any particular direction sector, however, there is a marginally greater percentage from the NNE, which is also the direction from which the most severe wave conditions occur (Ramsay and Brampton, 2000). Swell waves are generally most frequent from the north-easterly sector, some of which is generated within the Norwegian Sea, however, swell waves from the north and west diffracting around both the northern coastlines of Orkney and Shetland also contribute a significant proportion of swell energy off the eastern coast of Orkney (Ramsay and Brampton, 2000). The total wave energy in this region is dominated by the swell component.

The total sea wave climate off the west coast of Orkney is generally more extreme and frequent than the eastern coastline and is dominated by a narrow window between  $240^{\circ}\text{N}$  and  $300^{\circ}\text{N}$  with over 50% of conditions experienced from this sector. However, extreme wave conditions (i.e.  $> 8\text{m}$ ) can occur from any direction between southwest and north (Ramsay and Brampton, 2000). The swell climate is

also dominated from a narrow sector with over 70% of conditions experienced from between 260°N and 320°N (Ramsay and Brampton, 2000).

The wave conditions along the north coast of Orkney Mainland tend to be locally generated wind-waves due to restricted fetch lengths and shallow water influences to the north-east, with the exception of the eastern portion between Mull Head and Head of Work (Ramsay and Brampton, 2000).

Much of the offshore wave energy will be dissipated by the entrances to Scapa Flow preventing little propagation of waves generated around the Orkney Isles into Scapa Flow (Ramsay and Brampton, 2000). Instead wave conditions within Scapa Flow will be dominated by locally generated wind-waves.

Table 4-2 and Table 4-3 below show the total sea and swell extreme significant wave heights east and west of Orkney respectively.

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

Return Period (Years)	Total sea extreme significant wave height (m)	Total swell extreme significant wave height (m)
1	7.39	4.29
10	8.72	5.41
100	9.94	6.49

**Table 4-3 Offshore total sea and swell extreme significant wave heights west of Orkney (Ramsay and Brampton, 2000)**

Return Period (Years)	Total sea extreme significant wave height (m)	Total swell extreme significant wave height (m)
1	10.65	4.82
10	12.79	5.94
100	14.82	7.01

The maximum annual wave height along each of the proposed cable corridors within the Orkney Isles is < 0.8m (ABPmer, 2017).

#### 4.2.2.3 Wind

At Kirkwall, Orkney, winds are generally consistent, prevailing from the south and west (Global Marine, 2021). Winds speeds lie between  $6\text{ms}^{-1}$  and  $18\text{ms}^{-1}$  65% of the time and reach gale force on only around 16% of occasions. Due to their greater exposure, the Northern Orkney Isles (Westray, Eday and Sanday) are likely to experience stronger winds more frequently.

#### 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  $12.5^{\circ}\text{C}$  –  $13^{\circ}\text{C}$  in the summer and  $6.5^{\circ}\text{C}$  –  $7.0^{\circ}\text{C}$  in winter (Xodus Group, 2019).

Salinity in this region is approximately 34.85ppt, which is marginally lower than the salinity of normal sea water (35ppt) due to the mixing of Atlantic water with lower salinity coastal waters (Barne et al., 1997).

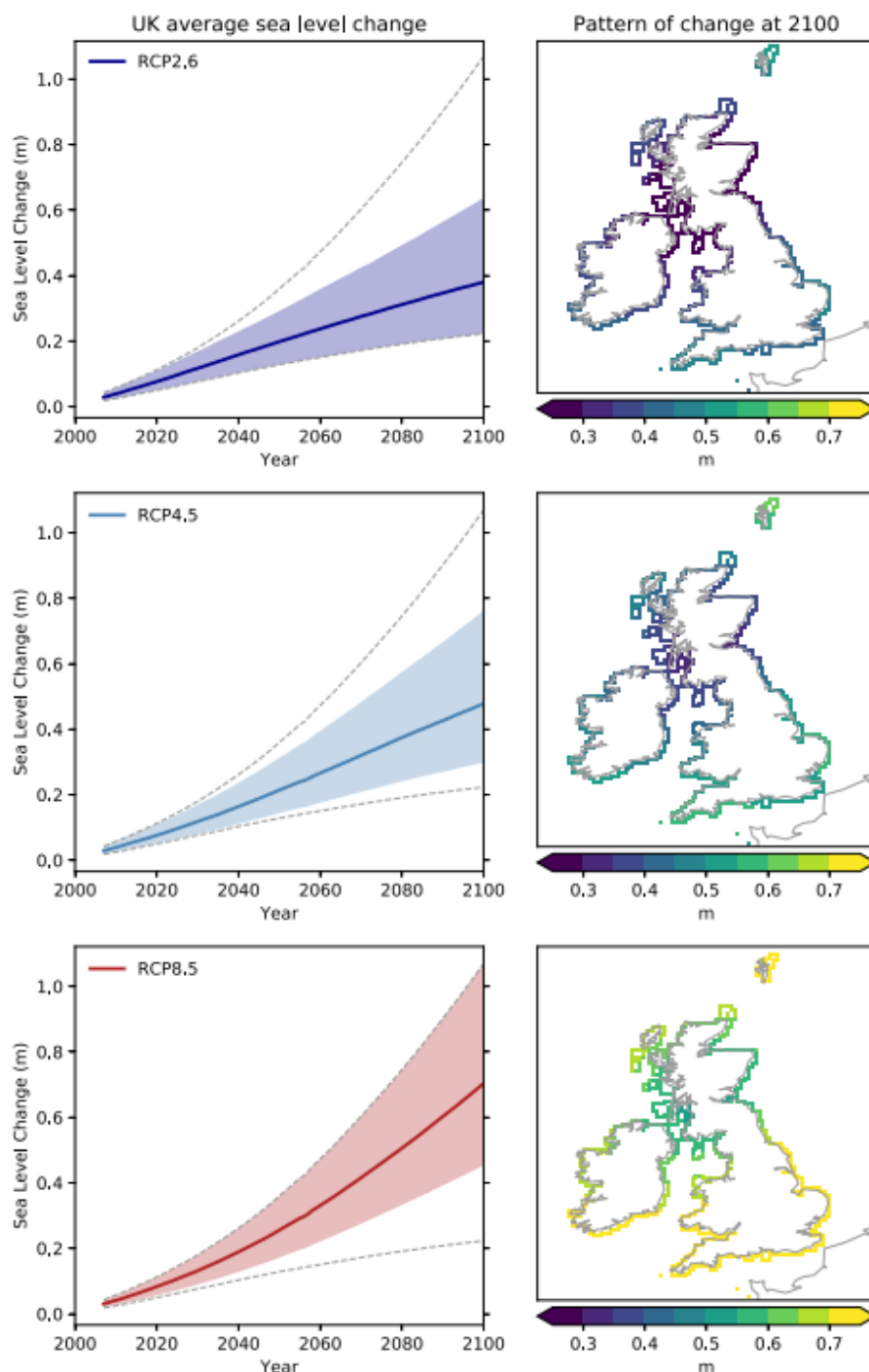
### 4.2.3 Climate Change Implications

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

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

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

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



The implications of future sea level rise on the Orkney landfalls have 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.

#### 4.2.3.2 Cable Corridor 2.5 – Eday – Westray

For a low emissions scenario (Representative Concentration Pathway (RCP) 2.6), a medium emission scenario (RCP 4.5) and a high emissions scenario (RCP 8.5), sea levels in the vicinity of the proposed Eday-Westray cable corridor are predicted to rise by up to 0.19m, 0.20m and 0.23m, respectively

(UKCP, 2018), in 2046 for the central estimate (50th %ile). The Mean High-Water Spring (MHWS) level at Rapness, Westray is 3.6m above Chart Datum (CD) (UKHO, 2021). In this respect, the MHWS level in the vicinity of the proposed Eday-Westray cable corridor could increase to 3.79m CD, 3.80m CD and 3.83m CD under the low, medium, and high scenarios respectively in 2046 for the central estimate (50th %ile).

#### 4.2.3.3 Cable Corridor 2.6 – Eday – Sanday; Cable Corridor 2.7 – Sanday – Stronsay

For a low emissions scenario (RCP 2.6), a medium emission scenario (RCP 4.5) and a high emissions scenario (RCP 8.5), sea levels in the vicinity of the proposed Eday-Sanday and Sanday-Stronsay cable corridors are predicted to rise by up to 0.19m, 0.20m and 0.23m, respectively (UKCP, 2018), in 2046 for the central estimate (50th %ile). The MHWS level at Loth, Sanday is 3.1m above CD (UKHO, 2021). In this respect, the MHWS level in the vicinity of the proposed Eday-Sanday and Sanday-Stronsay cable corridors could increase to 3.29m CD, 3.30m CD and 3.33m CD under the low, medium, and high scenarios respectively in 2046 for the central estimate (50th %ile).

#### 4.2.3.4 Cable Corridor 2.9 – Orkney Mainland – Rousay

For a low emissions scenario (RCP 2.6), a medium emission scenario (RCP 4.5) and a high emissions scenario (RCP 8.5), sea levels in the vicinity of the proposed Orkney Mainland-Rousay cable corridor are predicted to rise by up to 0.19m, 0.20m and 0.24m, respectively (UKCP, 2018), in 2046 for the central estimate (50th %ile). The MHWS level at Tingwall, Orkney Mainland is 3.1m above CD (UKHO, 2021). In this respect, the MHWS level in the vicinity of the proposed Orkney Mainland-Rousay cable corridor could increase to 3.29m CD, 3.30m CD and 3.34m CD under the low, medium, and high scenarios respectively in 2046 for the central estimate (50th %ile).

#### 4.2.3.5 Cable Corridor 2.10 – Orkney Mainland – Shapinsay

For a low emissions scenario (RCP 2.6), a medium emission scenario (RCP 4.5) and a high emissions scenario (RCP 8.5), sea levels in the vicinity of the proposed Orkney Mainland-Shapinsay cable corridor are predicted to rise by up to 0.19m, 0.20m and 0.24m, respectively (UKCP, 2018), in 2046 for the central estimate (50th %ile). The MHWS level at Kirkwall, Orkney Mainland is 3.0m above CD (UKHO, 2021). In this respect, the MHWS level in the vicinity of the proposed Orkney Mainland-Shapinsay cable corridor could increase to 3.19m CD, 3.20m CD and 3.24m CD under the low, medium, and high scenarios respectively in 2046 for the central estimate (50th %ile).

#### 4.2.3.6 Cable Corridor 2.11 – Hoy – Flotta; Cable Corridor 2.12 – Flotta – South Ronaldsay

For a low emissions scenario (RCP 2.6), a medium emission scenario (RCP 4.5) and a high emissions scenario (RCP 8.5), sea levels in the vicinity of the proposed Hoy-Flotta and Flotta-South Ronaldsay cable corridors are predicted to rise by up to 0.18m, 0.19m and 0.22m, respectively (UKCP, 2018), in 2046 for the central estimate (50th %ile). The MHWS level at Widewall Bay, South Ronaldsay is 3.6m above CD (UKHO, 2021). In this respect, the MHWS level in the vicinity of the proposed Hoy-Flotta and Flotta-South Ronaldsay cable corridors could increase to 3.78m CD, 3.79m CD and 3.82m CD under the low, medium, and high scenarios respectively in 2046 for the central estimate (50th %ile).

### 4.2.4 Coastal Processes

#### 4.2.4.1 The Northern Islands (Westray, Rousay, Eday, Sanday, Stronsay and Shapinsay)

A large number of beaches exist on the Northern Islands of Orkney, the majority of which are derived from shell debris – it is understood that a fresh input from this source no longer exists (Ramsay and Brampton, 2000). The majority of the beaches on the Northern Islands have an exposed shingle upper or storm beach derived either from erosion of till deposits by wave action, which overlie Old Red Sandstone, or possibly glacial deposits on the seabed (Ramsay and Brampton, 2000).

The majority of the beaches within the Orkney Isles are now thought to be relatively stable in terms of coastal processes, with few significant changes to beach plan shapes occurring and no net losses or

gains of beach sediment (Ramsay and Brampton, 2000). The shingle ridge that backs the majority of the beaches provides stability as they dissipate wave energy and afford protection to the coastal edge from erosion during storm conditions.

#### 4.2.4.2 The Southern Islands (Orkney Mainland, Hoy and South Ronaldsay)

The majority of the coastline along the north coast of Orkney Mainland is backed by glacial till deposits overlaying Old Red Sandstone, erosion of which has produced the majority of the beach material (Ramsay and Brampton, 2000).

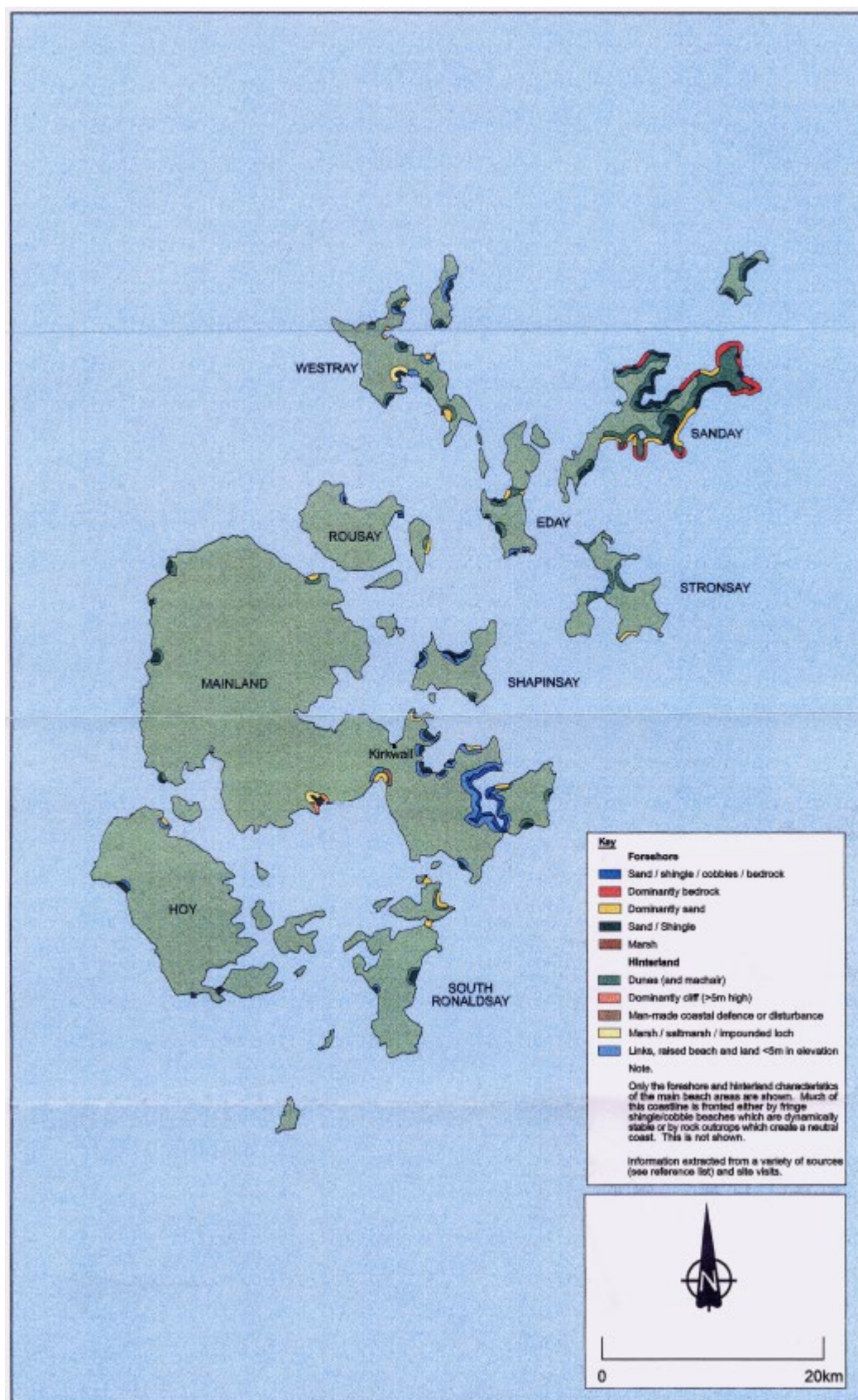
Rock platforms with fringe cobble/shingle and sandy beaches front the majority of the coastline to the west of Kirkwall with little littoral transport occurring other than occasional erosion of till material during severe storm events.

At the Cable Corridor 2.9 Mainland landfall, the sand material on the Sands of Evie is largely derived from shell debris, which is largely carried onshore via swell wave action propagating into Eynhallow Sound in conjunction with strong tidal currents (Ramsay and Brampton, 2000). Nett gain of material is therefore likely at this beach.

Figure 4-3 shows the main foreshore and hinterland characteristics of the Orkney Isles.



**Figure 4-3** Foreshore and hinterland characteristics of the Orkney Isles (Ramsay and Brampton, 2000)





## 4.2.5 Bathymetry, Geology and Seabed Sediments

### 4.2.5.1 Bathymetry

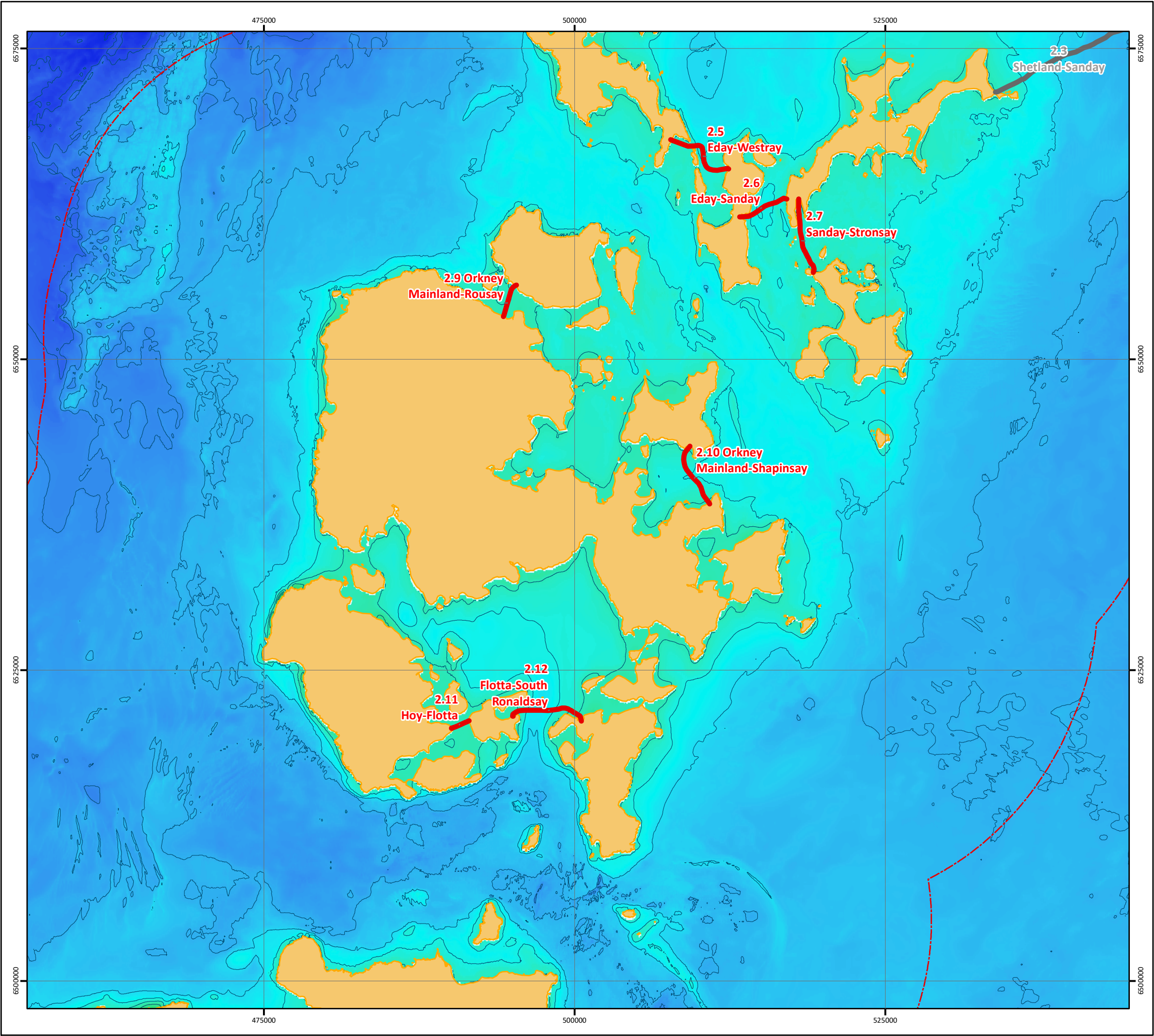
The bathymetry within the Orkney geographical area is characterised by relatively shallow depths within the internal waters of the archipelago with increasing depths in the peripheral offshore areas (Orkney Islands Council, 2020). The maximum water depths are given in Table 4-4 and an overview of bathymetry within the cable corridors is presented in Figure 4-4 (Drawing Reference: P2308-BATH-001\_OR).

**Table 4-4 Cable Corridor depths**

Corridor	2.5 Eday - Westay	2.6 Eday - Sanday	2.7 Sanday - Stronsay	2.9 Orkney - Rousay	2.10 Orkney - Shapinsay	2.11 Hoy - Flotta	2.12 Flotta – South Ronaldsay
Maximum depth (m below MSL)	-36m	-33m	-22m	-5m	-27m	-18.9m *	-44m

Source: EMODnet 2021 and UKHO 2021

\*Chart Datum (CD) – data not available as MSL



SCOTTISH ISLES  
FIBRE OPTIC CABLE PROJECT

BATHYMETRY  
EMODnet Bathymetry

Drawing No: P2308-BATH-001\_OR

B

Legend

Cable Route Centreline

Cable Route Centreline

Not Assessed

Territorial Sea Limit

Contour (25 m Interval)

Bathymetry (-m MSL)

Value

High : 106.917

Low : -181.87

NOTE: Not to be used for Navigation

Date	08 September 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ESRI; EMODnet, ONS, UKHO
File Reference	J:\P2308\Mxd\12_BATH\ P2308-BATH-001_OR.mxd
Created By	Emma Langley
Reviewed By	Chris Dawe
Approved By	Paul Evans

BT

Global Marine

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#### 4.2.5.2 Underlying Geology

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

The basement geology of Orkney is Old Red Sandstone (ORS), which is a Devonian sedimentary rock that underlies the region from Caithness to southwest Shetland, the sequence of which is approximately 3,000-5,000m thick across most of this area and is relatively resistant to erosion (Global Marine, 2021).

##### **The Northern Islands (Westray, Rousay, Eday, Sanday, Stronsay and Shapinsay)**

The solid geology of the Orkney Isles is composed almost entirely of sedimentary rocks of Middle and Upper ORS Age (i.e. formed between 387Ma and 360Ma) (Ramsay and Brampton, 2000). The ORS with both low and upper groups (Rousay Flags and Eday Beds) dominate the solid geology in the Northern Islands (Ramsay and Brampton, 2000). The ORS outcrops as cliff around much of the coastline of these islands, however, their elevation is not as high as those found on Hoy and the western coastline of the mainland. Much of the coastal edge is fronted by a low rock platform, which has considerable influence on the softer sections of the coastline and tends to act as a hinge points upon which the bay type beach plan shapes develop – this is evident in number of coastal features such as tombolos, spits and salients (Ramsay and Brampton, 2000).

Boulder clay is patchy over most of the Northern Islands; however, it is more prevalent on Stronsay and Shapinsay with no evidence of former sea levels higher than today's in the Orkney Isles (Ramsay and Brampton, 2000). Therefore, the only postglacial coastal deposits which occur are shingle ridges and wind-blown sands with extensive dune systems composed mainly of fine shell sand. The landings on Eday, Sanday and Stronsay land in areas of the Eday Beds, which is a fine- to coarse-grained cross-bedded sandstone unit with few pebbles and rare pebble or conglomerate lenses (Global Marine, 2021).

##### **The Southern Islands (Orkney Mainland, Hoy and South Ronaldsay)**

The Southern Islands are also dominated by ORS deposits, which generally fall into two major groups: the lower group, which comprises Stromness Flags and Rousay Flags, and the upper group, the Eday Bed (Ramsay and Brampton, 2000). The Stromness Flags outcrop as high sea cliffs along the entire western seaboard of Orkney Mainland, principally consisting of flagstones with sequences of marine deposits of siltstones, mudstones and sandstones.

The sandstone that outcrops at the majority of the proposed landfalls on Orkney is the Rousay Flags strata, part of the Middle ORS, which is predominantly composed of fine-grained sandstones with pebbly layers, particularly on Rousay itself (Global Marine, 2021). The landings on South Ronaldsay, also land within the Eday Beds, which is described above (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).

The seabed in the Orkney Isles is dominated by coarse sediment and high energy infralittoral rock around most of the islands, out towards and beyond the 12NM limit (Orkney Islands Council, 2020). An overview of seabed sediments within the Orkney geographical area is presented in Figure 4-5 (Drawing Reference: P2308-SED-001\_OR).

##### **Cable Corridor 2.5 – Eday – Westray**

The Eday-Westray cable corridor is not covered by British Geological Society (BGS) data, however, UKHO charts suggest a mix of sand and rock in the Sound of Faray becoming progressively rockier to

the north – the amount of sand coverage is expected to increase significantly in Rapness Sound adjacent to Westray with rock outcrops noted on the charts (Global Marine, 2021).

#### **Cable Corridor 2.6 – Eday – Sanday**

The Eday-Sanday cable corridor is not covered by BGS data, however, UKHO charts suggest bare rock with several patches of sediment (Global Marine, 2021). A survey of the existing SSE power cable in 2018 indicated that the seabed is composed predominantly of shingle over gravelly sand with areas of cobbles and sand patches and boulders (Global Marine, 2021).

#### **Cable Corridor 2.7 – Sanday – Stronsay**

The Sanday-Stronsay cable corridor is not covered by BGS data, however, UKHO charts suggest the sand is present close to the landing at the Sands of Odie on Sanday with bare rock within the centre of Spurness Sound and areas of sand and gravel – sand comprises the majority of the seabed within the sheltered area of the Bay of Stove on Sanday (Global Marine, 2021).

#### **Cable Corridor 2.9 – Orkney Mainland – Rousay**

The Orkney-Mainland cable corridor is not covered by BGS data, however, UKHO charts suggest that the beach at the Evie landing is predominantly composed of rock (Global Marine, 2021).

#### **Cable Corridor 2.10 – Orkney Mainland – Shapinsay**

The southern half of the Orkney Mainland to Shapinsay cable is covered by BGS data, which shows the seabed to be sandy gravel (Global Marine, 2021). The UKHO charts suggest gravel and stones to the north and seabed video analysis from Marine Scotland show a sandy substrate with a gravel and shell upper layer over large stretches (Marine Scotland, 2021). EMODnet bathymetry survey data indicates that sediment cover is extensive across the corridor with the exception of rocky areas within the Bay of Sandgarth on Shapinsay (Global Marine, 2021).

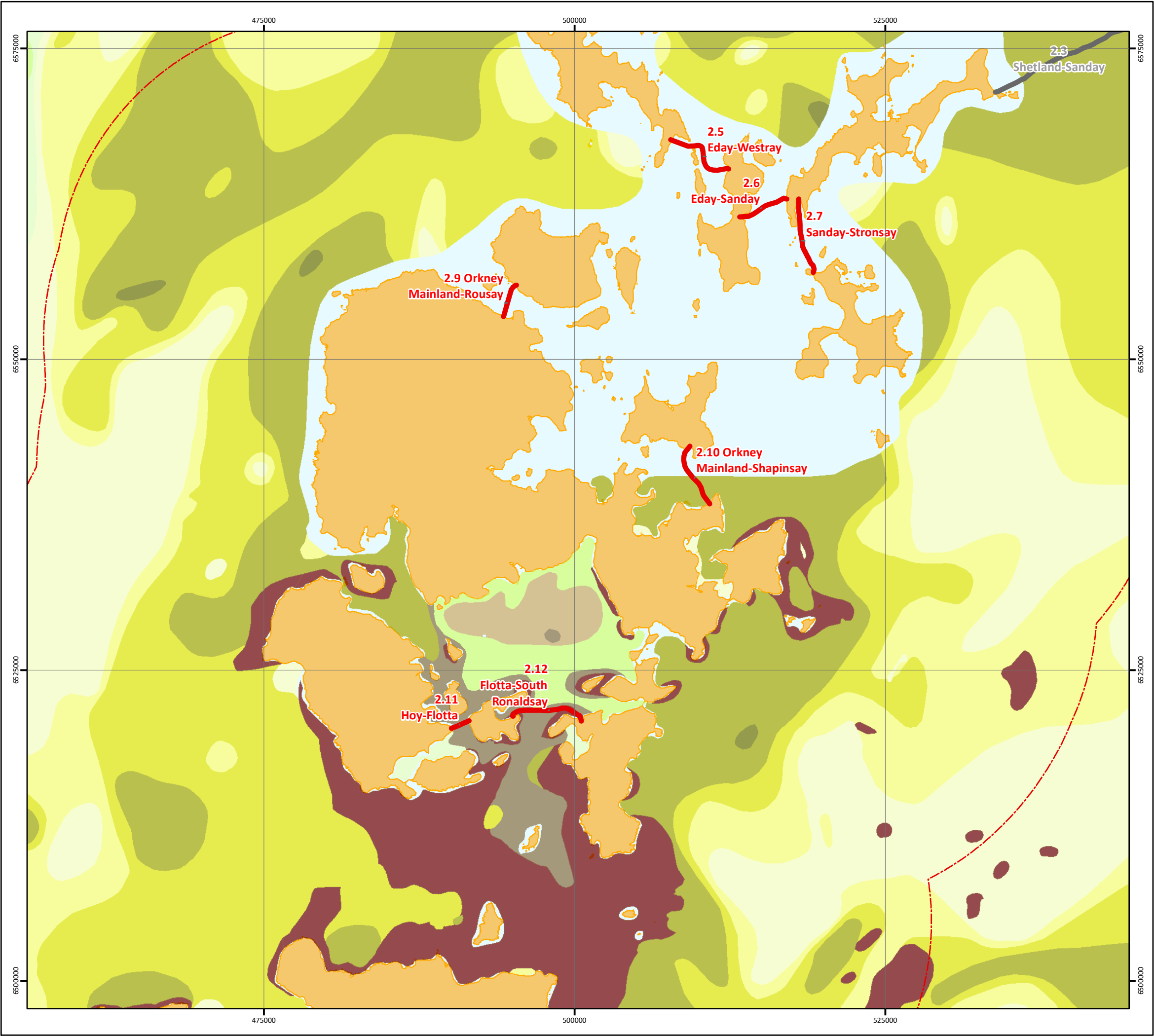
#### **Cable Corridor 2.11 – Hoy – Flotta**

The cable between Hoy and Flotta is covered by BGS data, which shows this area to be muddy sandy gravel (Global Marine, 2021). Exposed bedrock is evident from satellite imagery in the vicinity of the proposed cable landfalls.

#### **Cable Corridor 2.12 – Flotta – South Ronaldsay**

The BGS data indicates rock at Flotta and muddy sandy gravel in the channel with a large rock outcrop from Hoxa Head on South Ronaldsay (Global Marine, 2021).





SCOTTISH ISLES  
FIBRE OPTIC CABLE PROJECT

SEABED SEDIMENTS  
EMODnet Seabed Substrate

Drawing No: P2308-SEDS-001\_OR

B

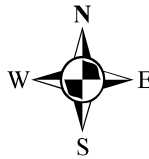
Legend

Cable Route Centreline

- Cable Route Centreline
- Not Assessed
- Territorial Sea Limit

Seabed Substrate - Folk 16 Level

- 1.3.1 muddy Sand
- 1.3.2 (gravelly) muddy Sand
- 2.1.1 Sand
- 2.1.2 (gravelly) Sand
- 3.1.1 gravelly Sand
- 3.2.1 sandy Gravel
- 3.3.1 Gravel
- 4.3.1 gravelly muddy Sand
- 4.4.1 muddy sandy Gravel
- 5. Rock & boulders



NOTE: Not to be used for Navigation

Date	08 September 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ESRI; EMODnet, ONS, UKHO
File Reference	J:\P2308\Mxd\10_SEDS\ P2308-SEDS-001_OR.mxd
Created By	Emma Langley
Reviewed By	Chris Dawe
Approved By	Paul Evans



## 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 Orkney 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 Orkney Isles is Dounreay, which is currently being decommissioned, located on the north coast of Scotland approximately 13km to the west of Thurso. Data collected between 2013 and 2017 suggest that doses from the Dounreay power station are significantly less than the legal dose limit of 1.000mSv/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.

### 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” (GES) 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 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 'GES' and that there is no deterioration in the status. Table 4-5 summarises the WFD status along each proposed cable corridor.

**Table 4-5 WFD status along proposed cable corridors**

Corridor	Waterbody the corridors pass through
2.5 – Eday – Westray; 2.6 – Eday – Sanday; 2.9 – Orkney Mainland	Westray Firth waterbody (ID: 200243) with an overall waterbody status of Good (Atkins Geospatial, 2019)
2.7 – Sanday – Stronsay	Start Point to Burgh Head waterbody (ID: 200242) with an overall waterbody status of Good (Atkins Geospatial, 2019)
2.10 – Orkney Mainland – Shapinsay	Kirkwall waterbody (ID: 200234) with an overall waterbody status of Good (Atkins Geospatial, 2019)
2.11 – Hoy – Flotta; 2.12 – Flotta – South Ronaldsay	Scapa Flow (ID: 200474) with an overall waterbody status of Good (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 no classified Shellfish Harvesting Areas in Orkney, however, there is current one Shellfish Water Protected Area, located in the Bay of Firth (approximately 11km to the west of Cable Corridor 2.10 Orkney Mainland to Shapinsay).

### 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 Orkney Isles, contamination levels are expected to be low. Operations at Dounreay Nuclear Power Development Establishment, approximately 43km south-west of the closest proposed cable corridor (Corridor 2.11 Hoy to Flotta), 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 the Orkney Isles R100 cable system. Average measured iSPM for the period 1998-2015 within the Orkney 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

### 4.3.1 Potential pressures and zone of influence

An assessment of the effects of the installation activities on the physical environment has been undertaken. Table 4-6 summarises the pressures which have been assessed.

**Table 4-6 Pressures considered for proposed cable corridors in Orkney 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	Yes

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

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

The following sub-sections provide the assessment of the effects on the physical environment for each pressure.

### 4.3.2 Compliance and best practice measures

The R100 Project within the Orkney 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 4-7, below. When undertaking the assessment, it has been assumed that these measures will be complied with.

**Table 4-7 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 Orkney 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 0.016km<sup>2</sup> along the length of each cable (worst case).

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

In sections of hard seabed where burial cannot be achieved, the cable may be surface laid and as such, only the seabed within the direct footprint of the cable will be disturbed. The extent of the disturbance

will be confined to a small and linear area. Therefore, the effects of abrasion/disturbance to the substrate on the surface of the seabed will be negligible.

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

Contingency external cable protection measures may be used in such areas such as concrete mattresses 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**

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 are, therefore, considered negligible.

#### **4.3.5 Siltation rate changes including smothering (depth of vertical sediment overburden)**

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

The findings of a separate study on the Environmental Impact of Subsea Trenching Operations (Gooding et al., 2012) suggested that the impacts of subsea trenching operations on sediment disturbance vary depending on the sediment size. For coarser sediments, these are likely to settle back in the very near-field (~ 100m) with finer particles deposited further afield (1-2km). Suspended solid concentrations, although elevated immediately after trenching, have been shown to fall to ambient levels within 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 1 mm for both trenching by jetting and ploughing. No significant impacts on fish populations or migratory species from sediment disturbance are expected to occur.

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

#### **4.3.6 Physical change to another seabed type**

##### **4.3.6.1 Proposed Integral Cable Protection**

The integral cable protection measures which may be required for installation of the proposed cables (if used) could introduce different types of artificial material onto the seabed, which may differ in consistency to the surrounding sediments. The use of integral cable protection may be associated with areas where further cable stability is required or at cable crossing locations. There are no engineered cable crossings within the Orkney geographical area.

Articulated Pipe (AP) protection 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. The estimated length of AP required for each cable landing point is given in Table 2.2 within the project description. 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.

The effects of a physical change to another seabed type from the installation of proposed cable protection for R100 on seabed sediments is negligible. Articulated pipe may also be applied to any sections of surface laid cable if required for additional cable protection. If used this would be in areas of hard ground and is unlikely to constitute a significant change to the seabed in such areas.

##### **4.3.6.2 Contingency External Cable Protection**

There are no engineered crossings requiring cable protection within the Orkney geographical area.

Up to 3 concrete mattresses per route have been included in the marine licence application as a contingency measure within the Orkney geographical area. Each mattress covers an area of 18m<sup>2</sup>. 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 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 route as a worst-case scenario (see Table 2.4 within the Project Description). Rock bags are only likely to be used in sections of the route where cable burial is not possible due to hard ground, glacial till or sub cropping rock and current speeds are high. The addition of rock bags to such areas will not cause a significant change to the seabed physical environment. The area affected is small and based on this, the addition of rock bags is considered negligible.

#### **4.3.7 Local water flow (tidal current) changes**

There are no cable crossings in the Orkney geographical area, therefore external cable protection will only be required offshore where target burial depth is not achievable. This is likely to be areas of exposed rock or hard ground. Scour will only occur in areas of 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. However, a deposit on hard

ground or rock will reduce the potential for scour. The area potentially affected will be very small and localised and the effects will be 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 Orkney 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 Orkney Geographical Area, benthic habitat surveys were undertaken between 1st and 2nd July 2021 for:

- Cable Corridor 2.10 Shapinsay to Orkney Mainland

The survey report is 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)	<p>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.</p> <p>Surveys undertaken by EMODnet and EMODnet partners which informed the EUSM within or adjacent to (&lt;1km) the cable corridor have also been used to inform finer-scale habitats at the corridors.</p>

Data Source	Description
GEMs Priority Marine Features (PMF)	The Scottish PMF list contains 81 habitats and species considered to be of conservation importance in Scottish waters, of which 11 are vulnerable and are currently seen as a conservation priority (NatureScot, 2021a). 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, 2010). 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 <i>et al.</i> , 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 were 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 <i>et al.</i> , 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 Orkney geographical area**

Cable Corridor	Predominant Intertidal habitat	Predominant subtidal habitat	Within Protected Site	Presence of Annex I habitat / PMF / UKBAP habitat	Suitable Sandeel habitat
2.5	<b>Eday landing point:</b> undulating bedrock, backed by large boulders, small area of sand over the bedrock <b>Westray landing point:</b> Central sandy beach flanked by seaweed covered bedrock to the north and south.	Atlantic and Mediterranean moderate energy infralittoral rock (EUNIS habitat 3.2)	No	Potential Annex I Reef	No
2.6	<b>Eday landing point:</b> Rocky shores to the north and south, and backed by low-lying dunes and cliffs, beach has a steep profile of dry barren sand. <b>Sanday landing point:</b> Rocky coastline with a narrow intertidal zone backed by steep cliffs	Atlantic and Mediterranean moderate energy infralittoral rock (EUNIS habitat 3.2) and Atlantic and Mediterranean moderate energy circalittoral rock (EUNIS habitat 4.2)	No	Potential Annex I Reef Potential Annex I Sandbank	No
2.7	<b>Sanday landing point:</b> Large expanses of rippled fine sand bordered by low-lying seaweed covered rocks, sandbar at southern extent <b>Stronsay landing point:</b> Ridged bedrock and backed by cobbles and seaweed covered boulders, western shore high seaweed cover	Atlantic and Mediterranean moderate energy infralittoral rock (EUNIS habitat 3.2) and Atlantic and Mediterranean high energy infralittoral rock (EUNIS habitat 3.1)	No	Potential Annex I Reef Potential Annex I Sandbank	Yes
2.9	<b>Orkney landing point:</b> Bedrock, large boulders and sand <b>Rousay landing point:</b> Bare cobbles, rocky ledge, bedrock, backed by large quantities of dumped rubble	Atlantic and Mediterranean high energy infralittoral rock (EUNIS Habitat A3.1)	No	Potential Annex I Reef	No
2.10	<b>Orkney landing point:</b> Beach flanked by seaweed covered bedrock to the east and west and backed by a small dune system. <b>Shapinsay landing point:</b> Sandy shore, rocky shore, embryonic dunes, small cliff structures	Atlantic and Mediterranean low energy infralittoral rock (EUNIS habitat A3.2) and Infralittoral coarse sediment (EUNIS A5.13)	No	Potential Annex I Reef Kelp Bed PMF Maerl PMF	Yes
2.11	<b>Hoy landing point:</b> Rocky shore, bedrock, backed by gravel cobbles and flat rock <b>Flotta landing point:</b> sublittoral fringed rock backed by a wide zone of cobbles, bedrock by backed cliffs, boulders and mixed sediment	Not covered but identified Infralittoral mixed sediments (EUNIS A5.43) and infralittoral fouling seaweed communities (EUNIS A3.72) adjacent to the cable corridor	No	Potential Annex I Reef Kelp Bed PMF Flame Shell Beds PMF Saltmarsh UK BAP	No
2.12	<b>Flotta landing point:</b> Mixed sediment over bedrock, boulder dominated shore to east, flat shore to north <b>South Ronaldsay landing point:</b> Bedrock backed by cobbles and strandline, small lochans backing the beach	Circalittoral mixed sediments (EUNIS habitat 5.44)	No	Potential Annex I Reef	No

### 5.3.2 Subtidal habitats

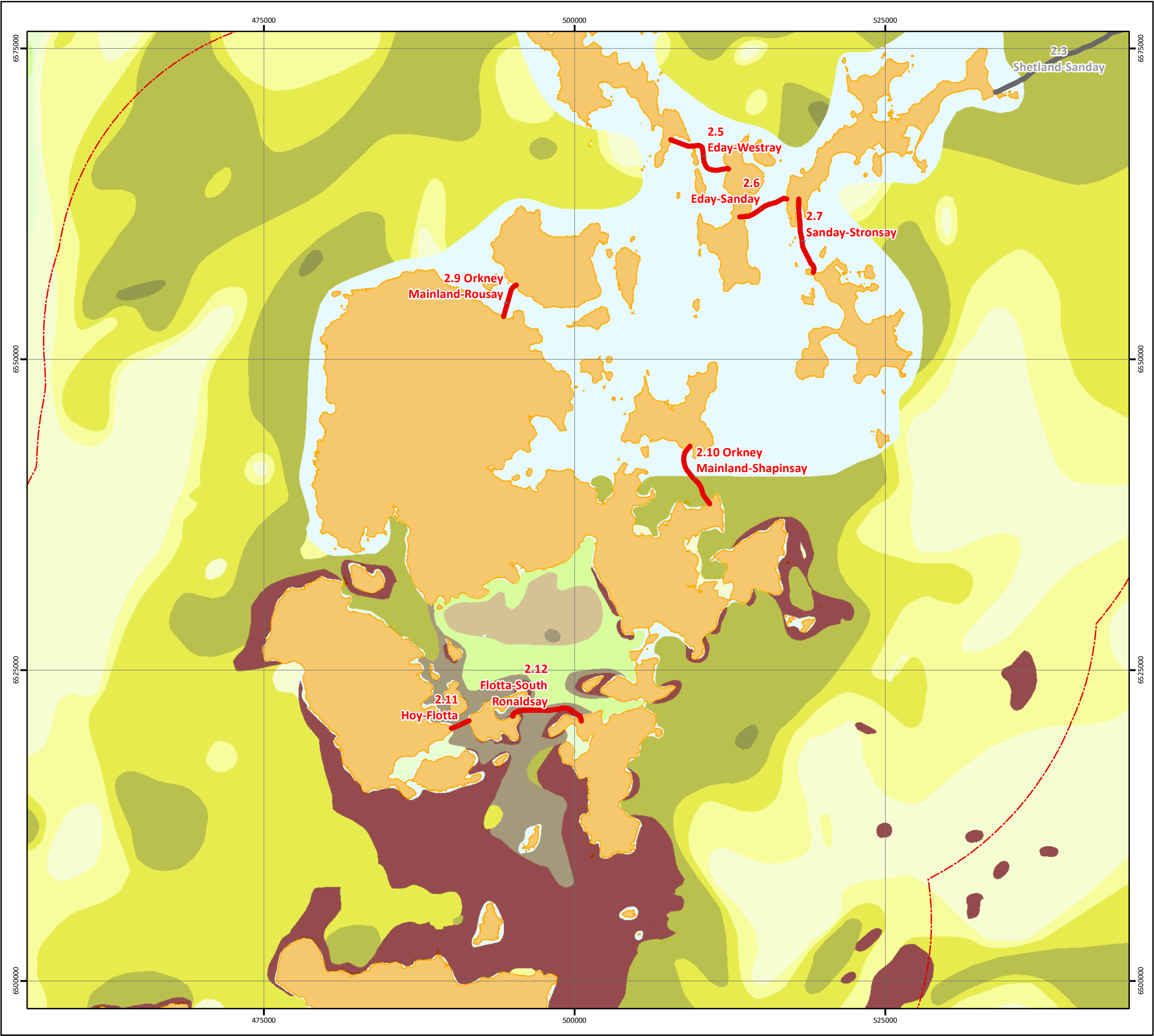
The Orkney geographical area displays predominantly circalittoral tide-swept rocky communities with relatively low diversity. The sediments are predominantly sandy or mixed substrates of sand and stones (Figure 5-1, Drawing Ref: P2308-SEDS-001-OR). Such communities are dominated by fauna such as acorn barnacle *Balanus crenatus* and the Dahlia anemone *Urticina feline* (Moore, 2009). There are also kelp and seaweed communities in the sheltered areas of Orkney (Connor et al., 2014).

Thirteen 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-OR) listed within Table 5-3, below. However, the broad-scale habitat map is not complete, so broad habitat types could not be determined for the full extent of all cable corridors, and no broad scale habitat information was available for cable corridor of Cable Corridor 2.11 Hoy to Flotta.

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

Broad Scale EUNIS Habitat Type and Description		2.5 Eday- Westray	2.6 Eday- Sanday	2.7 Sanday- Stronsay	2.9 Orkney Mainland- Rousay	2.10 Orkney Mainland - Shapinsay	2.11 Eday - Westray	2.12 Flotta- South Ronaldsay
		Percentage of corridor where the habitat is present (%)						
Atlantic and Mediterranean moderate energy circalittoral rock	A3	5.24	1.81	0.45	2.66	0.25	-	0.11
Atlantic and Mediterranean low energy circalittoral rock	A3.1	3.15	-	33.15	30.85	0.16	-	-
Atlantic and Mediterranean moderate energy infralittoral rock	A3.2	42.14	28.93	35.15	-	4.84	-	-
Atlantic and Mediterranean low energy infralittoral rock	A3.3	2.74	5.22	0.86	-	18.94	-	7.02
Atlantic and Mediterranean high energy circalittoral rock	A4.1	-	-	0.47	-	-	-	-
Atlantic and Mediterranean moderate energy circalittoral rock	A4.2	9.98	48.36	0.24	-	-	-	-
Atlantic and Mediterranean low energy circalittoral rock	A4.3	0.52	3.30	-	-	-	-	-
Sublittoral sediment	A5	-	-	-	-	-	-	15.50
Infralittoral coarse sediment	A5.13	-	-	-	-	18.22	-	-
Circalittoral coarse sediment	A5.14	-	-	-	-	13.02	-	-
Circalittoral sandy mud	A5.35	-	-	-	-	-	-	0.57
Infralittoral mixed sediments	A5.43	-	-	-	-	-	-	10.80
Circalittoral mixed sediments	A5.44	-	-	-	-	-	-	41.49

Notes: EUNIS = European Nature Information System. Habitats are based on EMODnet (2019) data.



SCOTTISH ISLES  
FIBRE OPTIC CABLE PROJECT

SEABED SEDIMENTS  
EMODnet Seabed Substrate

Drawing No: P2308-SEDS-001\_OR

B

Legend

Cable Route Centreline

Cable Route Centreline

Not Assessed

Territorial Sea Limit

Seabed Substrate - Folk 16 Level

1.3.1 muddy Sand

1.3.2 (gravelly) muddy Sand

2.1.1 Sand

2.1.2 (gravelly) Sand

3.1.1 gravelly Sand

3.2.1 sandy Gravel

3.3.1 Gravel

4.3.1 gravelly muddy Sand

4.4.1 muddy sandy Gravel

5. Rock & boulders

N

W

E

S

NOTE: Not to be used for Navigation

Date	08 September 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ESRI; EMODnet, ONS, UKHO
File Reference	J:\P2308\Mxd\10_SEDS\ P2308-SEDS-001_OR.mxd
Created By	Emma Langley
Reviewed By	Chris Dawe
Approved By	Paul Evans

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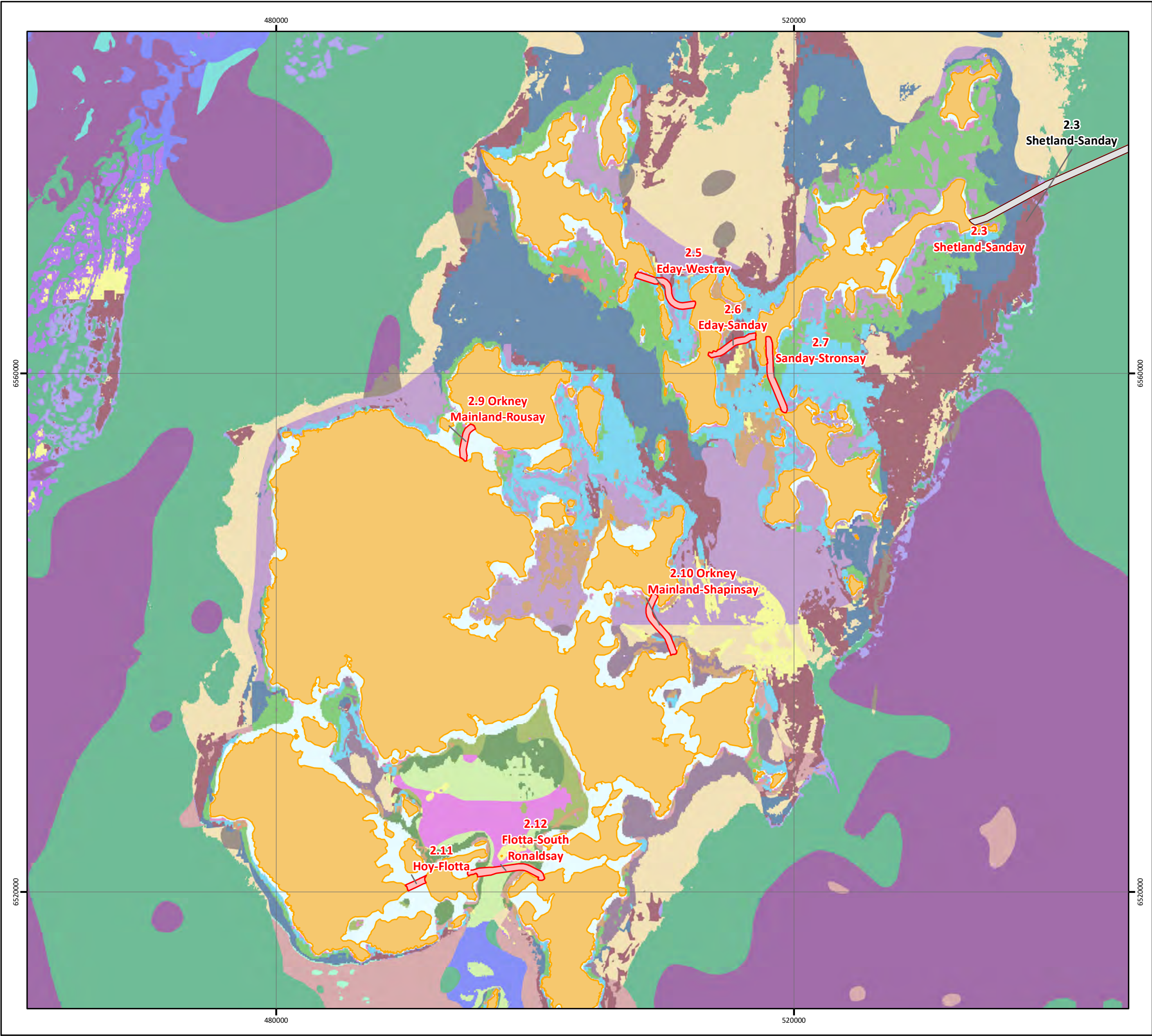
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SCOTTISH ISLES

FIBRE OPTIC CABLE PROJECT

SEABED HABITATS

EMODnet EUSeaMap Predicted Habitats

Orkney

Drawing No: P2308-HAB-001\_OR

A

Legend

Not assessed

Cable corridor

EU Sea Map

EUNIS classification

A3

A3.1

A3.2

A3.3

A4

A4.1

A4.12

A4.12 or A4.27 or A4.33

A4.2

A4.27

A4.3

A4.33

A5

A5.13

A5.14

A5.15

A5.23 or A5.24

A5.25 or A5.26

A5.27

A5.33

A5.35

A5.37

A5.43

A5.44

A5.45

Na

NOTE: Not to be used for Navigation

Date

24 September 2021

Coordinate System

WGS 1984 UTM Zone 30N

Projection

Transverse Mercator

Datum

WGS 1984

Data Source

ONS; EMODnet; ESRI;

File Reference

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Created By

Chris Dawe

Reviewed By

Abigale Nelson

Approved By

Paula Daglish

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



### 5.3.3 Protected features

#### 5.3.3.1 Introduction

Several potential Annex I habitats and PMFs were identified within the cable corridors in the Orkney geographical area. These are outlined in Table 5-4 and described in the sections below. Table 5-2 above summarises which habitat occurs within each cable corridor.

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

Conservation interest	Habitat
<b>Within designated site</b>	
Annex I habitat	Reef - Bedrock and / or stony reef
Sanday Special Area of Conservation (SAC)	Sandbanks slightly covered by seawater all of the time
	Mudflats and sandflats not covered by seawater at low tide
<b>Outside designated site</b>	
Potential Annex I habitat (PAIH)	Reef - Bedrock and / or stony reef
	Sandbanks slightly covered by seawater all of the time
Priority marine features (PMF)	Flame shell beds*
	Maerl beds*
	Horse mussel beds*
	Kelp bed and seaweed communities on sublittoral sediment
* May also be classified as PAIH biogenic reef	

An additional cable route, Cable Corridor 2.3 – Shetland to Sanday, crosses between the Shetland and Orkney geographical regions. As the Cable Corridor lies predominantly in the Shetland region it has been assessed as part of the Shetland MEA. As such, any assessment findings regarding this route in Orkney waters can be found in Shetland MEA Chapter 5 report (Document Reference: P2308\_R5367\_Rev0).

#### 5.3.3.2 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).

#### 5.3.3.3 Sandbanks slightly covered by seawater all of the time

This Annex I habitat consists of sandy sediments that are permanently covered by shallow sea water, typically at water depths of less than 20m. The habitat comprises distinct banks (elongated, rounded, or irregular 'mound' shapes) which may arise from horizontal or sloping plains of sandy sediment.

The sediment type, and metocean conditions determine the diversity of the seabed community within these habitats. Shallow sandy sediments are typically colonised by a burrowing fauna of worms, crustaceans, bivalve molluscs, and echinoderms. Species living on the sandbank may include shrimps, gastropod molluscs, crabs, and fish. Sand banks provide important supporting habitat for marine species. Sandeel (*Ammodytes* spp) live in shallow sandy sediments and are an important food for birds, pinnipeds and cetaceans. Where coarse stable material, such as shells, stones or maerl is present on the sandbank sediment, species of foliose seaweeds, hydroids, bryozoans, and ascidians may form distinctive and diverse communities.

The sensitivity of Sandbanks habitats will be dependent on the diversity of the faunal community and the footprint of the disturbance within the habitat. Cable route design involves avoiding areas of steep slopes and will therefore avoid such areas through engineering design. The recovery of infaunal species within sandy environments is usually rapid. The resulting resilience to sandbank habitats to the pressures of cable installation are medium to high (MarLIN 2021), with a sensitivity of medium to low.

As the habitats are usually of high importance to marine species, the habitat is considered to be of critical value to marine mobile species. Recoverability is 'high' and expected within 1-2 years, dependant on the biotopes present. Recovery is much less to none where sandbanks support maerl and seagrass beds (which are PMFs). The recoverability is much longer if at all in the case of Maerl.

#### 5.3.3.4 Mudflats and sandflats not covered by seawater at low tide

Intertidal mudflats and sandflats are submerged at high tide and exposed at low tide. They are most commonly associated with estuaries and large shallow inlets and bays in the UK but also occur extensively along the open coast and in lagoonal inlets. The physical structure of the intertidal flats ranges from mobile, coarse-sand beaches on wave-exposed coasts to stable, fine-sediment mudflats in estuaries and other marine inlets. This habitat type can be divided into three broad categories (clean sands, muddy sands, and muds), although in practice there is a continuous gradation between them. Within this range the plant and animal communities present vary according to the type of sediment, its stability, and the salinity of the water.

Clean sands commonly occur on open coast beaches and bays around the UK where wave action or strong tidal currents prevent the deposition of finer silt. This habitat is typically characterised by species such as amphipod crustaceans, some polychaete worms and certain bivalve molluscs which tend to be robust and tolerant of disturbance.

Muddy sands occur on more sheltered shores of open coast and at the mouth of estuaries where sediment conditions are relatively stable. A wide range of species, such as lugworm (*Arenicola marina*), and other polychaete worms and bivalve molluscs, can colonise these sediments. Substantial beds of mussels (*Mytilus edulis*) may develop on the lower shore. Intertidal beds of eelgrass (*Zostera* spp.) may also occur.

Mudflats form in the most sheltered areas of the coast, usually where large quantities of silt derived from rivers are deposited in estuaries. The sediment is stable, and communities are typically

dominated by polychaete worms and bivalve molluscs and may support very high densities of the mud-snail (*Hydrobia ulvae*).

When trenching occurs in mudflats and sandflats 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 (assuming no cable repairs are required during the lifetime of the cable). Species will be able to rapidly re-colonise the seabed sediments and MarLIN conclude that species recoverability is 'high' and expected within 1-2 years, with impacts on species minor and short term (MarLIN, 2021).

#### 5.3.3.5 Flame shell bed

Flame shells (*Limaria hians*) live hidden on the seabed in nests, which they build from shells, stones, and other materials. Flame shell beds develop on coarse sand, gravel and shell in locations where there are moderate or strong currents. Hundreds of nests can combine to form a dense bed, which raises and stabilises the seabed and makes it more attractive to many other creatures. The horse mussel (*Modiolus modiolus*) sometimes occurs at the same locations. The byssus threads, coarse sediment, and shell produced by flame shell provides refuge, and substratum for attachment for a wide variety of species. Flame shell beds usually occur at depths of between 5m and 30m, though they can be found from the low-tide mark.

Flame shell can live up to 11 years (MarLIN 2021) and beds are maintained by recruitment from the existing or adjacent bed. The species is slow to grow and are sensitive to pollutants such as Tributyltin (TBT) used in antifoul paint and seabed disturbance, particularly from bottom trawls and dredges. Studies (reported in MarLIN, 2021) have estimated that their slow growth rates mean that they are very slow to recover from disturbance and their resilience is low or very low (up to 25 years) making them highly sensitive to disturbance from the pressures of cable installation (abrasion and penetration of seabed) and routeing through patches of flame shell should be avoided.

#### 5.3.3.6 Maerl bed

Maerl is a collective term for several species of calcified red seaweed. It grows as unattached nodules on the seabed. As a type of 'coralline' algae, maerl deposits lime in its cell walls as it grows, creating a hard, brittle skeleton. Living maerl is a purple-pink hard seaweed that forms spiky underwater 'carpets' on the seabed, known as 'maerl beds'. The beds are comprised of dead coralline algal gravel and a percentage of live maerl which varies in proportion. Maerl beds support diverse communities of burrowing infauna, especially bivalves, and interstitial invertebrates; including suspension feeding polychaetes and echinoderms.

Maerl species are slow growing and long lived (up to 100 years). European species may grow up to 1mm per year and rarely produces reproductive spores making it unlikely to recover following disturbance to the seabed from cable burial (abrasion and penetration of seabed) which would cause a loss of habitat. Maerl prefers coarse clean sediments of gravels and clean sands or muddy mixed sediments on the open coast or within tide swept channels and inlets. It is generally found from the lower shore up to 30m water depth, but more typically up to 20m. The MarLIN consider maerl beds to be ecologically significant even when only dead Maerl is present as they support many other species (150 macroalgae and over 500 faunal species). Maerl is considered particularly significant when identified as a 10m<sup>2</sup> live clump (MarLIN, 2021). Maerl has very low resistance to change, very low resilience and is highly sensitive to the pressures associated with the use of cable installation equipment (MarLIN, 2021).

#### 5.3.3.7 Horse mussel beds

Horse mussel (*Modiolus modiolus*) are large bivalve molluscs, which can grow up to 20cm in length over 50 years. They are predominantly a subtidal species in water depths of 5 – 70m. The mussels live part buried in soft to coarse sediments but can also attach to rock up to 280m water depth (MarLIN, 2021). The mussels can live individually, or form scattered clumps or larger aggregations where densities may be up to 40 individuals / m<sup>2</sup> (Holt et al., 1998).

Where clumps form, the byssus threads which secure them to the seabed create a stable habitat that attracts a very rich infaunal community with a high density of polychaetes (worm). These can constitute a reef when they are distinct from surrounding habitats covering greater than 25m<sup>2</sup> (Morris 2015). Horse mussel beds provide a stable foundation for reef species and provide shelter for a high diversity of fauna (up to 200 species) including brittlestar, crustacean and mollusc.

Horse mussel reproduction and settling of larvae is highly variable and recovery timescales following disturbance are long and dependant on larvae supply from more distant areas. Due to the long lifespan of the species, the effects of decline may not be detected until many years later (Wilcox et al., 2020).

The resilience and the ability for horse mussel reef to recover from human induced pressures is a combination of the environmental conditions of the site, the frequency (repeated disturbances versus a one-off event) and the intensity of the disturbance. The resilience of horse mussel to the pressures associated with cable installation equipment is generally low (10-25 years), however this is dependent on the size of the bed and the footprint of the installation through the bed, therefore resilience may be increased to medium with a recovery of between 2-10 years (MarLIN, 2021).

#### 5.3.3.8 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, 2021b).

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 latissima* 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).

### 5.3.4 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, 2017a). 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).

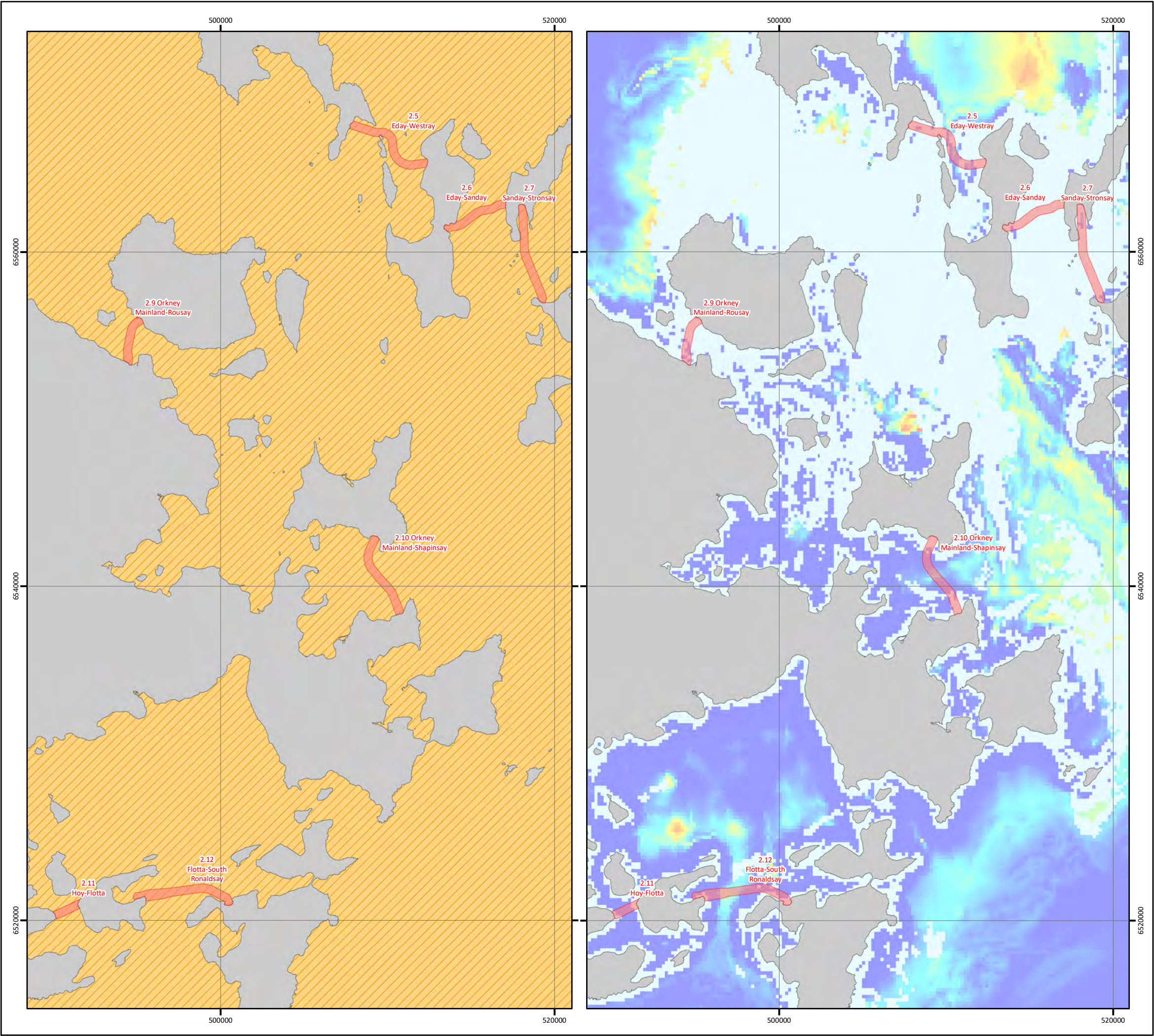
The distribution of sandeel within Scotland's seas is patchy and is generally concentrated on or nearby banks and areas of suitable sediment (NatureScot, 2021b). The Orkney area is considered important as an export ground for sandeel, with sandeel larvae hatched off Orkney travelling on ocean currents to Shetland in the north and the Moray Firth in the south (Lynam et al., 2013).

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 Orkney geographical area. The entire Orkney geographical area has been identified as having potential for low intensity sandeel nursery and spawning grounds following review of larval data from ichthyoplankton surveys (Figure 5-3: Drawing Reference: P2308-FISH-008\_OR-A). However, no areas in Orkney 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).





SCOTTISH ISLES  
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FISH AND FISHING  
Sandeel Distribution in Orkney

Drawing No: P2308-FISH-008\_OR

A

Legend

Cable Route Application Corridor

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

Nursery

Spawning

Lesser Sandeel Probability Presence (North Sea)

High : 0.983799

Low : 0

N

E

S

W

NOTE: Not to be used for Navigation

Date	25 August 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ESRI; OSOD; CEFAS; MS
File Reference	J:\P2308\Mxd\03_FISH\ P2308-FISH-008_OR.mxd
Created By	Jessica Harvey
Reviewed By	Chris Dawe
Approved By	Jill Hobbs

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### 5.3.5 Cable Corridor 2.5 Eday to Westray

Cable Corridor 2.5 is located within the northern area of Rapness Sound and Sound of Faray, and through Weatherness Sound. Rapness Sound is exposed to strong currents from the west which increase the strength of tidal streams and wave action (Global Marine, 2021).

#### 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 2.5 Eday to Westray landing points**

Corridor 2.5	Eday landing point	Westray landing point
<b>Location</b>	Situated at the moderately exposed Cusbay on the north-west coast of the island at the Sound of Faray	On the south-east corner of Westray adjacent to the ferry terminal at Rapness on the Sands of Helzie
<b>Description</b>	The main shore has undulating bedrock, backed by large boulders, with a small area of sand over the bedrock at the south of the survey area.	Central sandy beach flanked by seaweed covered bedrock to the north and south. The beach is backed by eroding cliffs.
<b>No. of biotopes recorded by Phase 1 intertidal survey</b>	14	21
<b>Presence of Annex I habitat or PMF</b>	No	No
<b>Presence of OSPAR Listed Threatened and/or Declining Species</b>	Dog whelk ( <i>Nucella lapillus</i> ) – common across UK and not locally protected	Dog whelk - common across UK and not locally protected
<b>BAP priority marine species or habitats</b>	No	No

#### 5.3.5.2 Subtidal area

A total of six 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 moderate energy infralittoral rock (EUNIS habitat 3.2) with patches of the other habitats across the cable corridor (Figure 5-4, Drawing Reference: P2308-HAB-002\_2.5 Eday-Westray).

The Cable Corridor 2.5 eday to Westray intersects bedrock/stony Annex I reef habitat across the majority of the cable corridor. As discussed in Appendix C – Protected Sites Assessment, Cable Corridor 2.5 does not intersect any protected sites designated for benthic species or features. There are also no known PMFs or protected sandbank features within Cable Corridor 2.5.

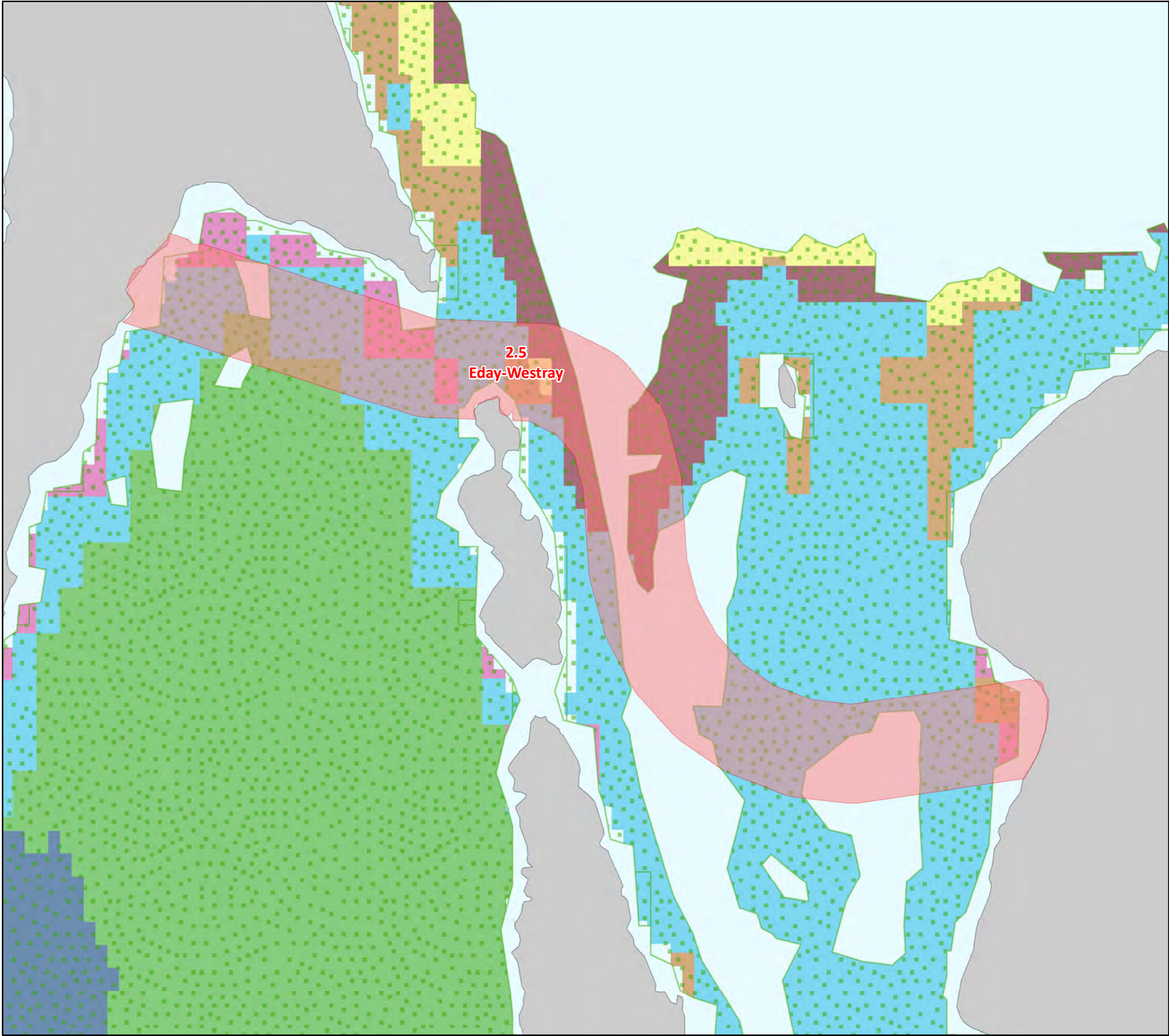
**Table 5-6 EUNIS habitats within Cable Corridor 2.5 Eday to Westray**

Habitat	EUNIS code
Atlantic and Mediterranean moderate energy circalittoral rock	A3
Atlantic and Mediterranean low energy circalittoral rock	A3.1
Atlantic and Mediterranean moderate energy infralittoral rock	A3.2
Atlantic and Mediterranean low energy infralittoral rock	A3.3
Atlantic and Mediterranean moderate energy circalittoral rock	A4.2
Atlantic and Mediterranean low energy circalittoral rock	A4.3

#### 5.3.5.3 Sediment characterisation and sandeel potential

Cable Corridor 2.5 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.

As sandeel require sediment habitats, there is unlikely to be suitable sandeel habitat present within the cable corridor for Cable Corridor 2.5.



SCOTTISH ISLES  
FIBRE OPTIC CABLE PROJECT  
SEABED HABITATS  
EUSeaMap and Priority Marine Features  
2.5 Eday-Westray

Drawing No: P2308-HAB-002	A
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**Legend**

Cable Route Application Corridor

**Annex I Reef Habitat**

Bedrock and/or Stony

**EUNIS Classification**

A3

A3.1

A3.2

A3.3

A4.1

A4.2

A4.3



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	23 August 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

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### 5.3.6 Cable Corridor 2.6 Eday to Sanday

Cable Corridor 2.6 Eday to Sanday is located within the Eday Sound, which is relatively sheltered with moderate tidal flows up to approximately 1.5m/s along the cable corridor (MEA Chapter 4). 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).

#### 5.3.6.1 Intertidal area

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

**Table 5-7 Characteristics of Cable Corridor 2.6 Eday to Sanday landing points**

Corridor 2.6	Eday landing point	Sanday landing point
<b>Location</b>	The Eday landing point is at the sheltered Bay of London on the eastern side of the island.	The Sanday landing point is off the western side of the island on the Eday Sound at the Gump of Spurness.
<b>Description</b>	The intertidal zone is an enclosed sandy bay flanked by rocky shores to the north and south, and backed by low-lying dunes and cliffs. The beach has a steep profile of dry barren sand before levelling out to a gentle gradient down to low water.	Rocky coastline with a narrow intertidal zone, backed by steep cliffs except for a lower, sloped section at the mid-point where an existing cable has recently been installed.
<b>No. of biotopes recorded by Phase 1 intertidal survey</b>	17	10
<b>Presence of Annex I habitat or PMF</b>	No	No
<b>Presence of OSPAR Listed Threatened and/or Declining Species</b>	Dog whelk - common across UK and not locally protected	Dog whelk - common across UK and not locally protected
<b>BAP priority marine species or habitats</b>	No	No

#### 5.3.6.2 Subtidal area

A total of 5 broad EUNIS habitat types were identified within the Cable corridor (Table 5-8). The subtidal seabed habitat within and surrounding the cable corridor are dominated by Atlantic and Mediterranean moderate energy infralittoral rock (EUNIS habitat 3.2) and Atlantic and Mediterranean moderate energy circalittoral rock (EUNIS habitat 4.2) with patches of other habitats on the western end of the cable (Table 5-8; Figure 5-5, Drawing Reference: P2308-HAB-002\_2.6 Eday to Westray). During previous EMODnet surveys offshore of the Eday landing point, outside the Bay of London, a variety of sub-habitats have also been identified (Table 5-8).

Cable Corridor 2.6 Eday to Sanday intersects bedrock/stony Annex I reef habitat across the majority of the cable corridor. The corridor also intersects several small areas of protected Annex I covered sandbanks on the eastern side, approximately 0.3km<sup>2</sup> from the Sanday landing point. These are described as Sublittoral sandbanks, permanently submerged which can be non-vegetated or with

seagrass vegetation (e.g. *Zosterum marinae*, *Cymodoceion nodosae*) (DG Environment, 2013). Two types of sandbank were identified: Infauna in Fine Sand, and Gravel Sands.

As discussed in Appendix C – Protected Sites Assessment, Cable Corridor 2.6 does not intersect any protected sites designated for benthic species or features, or PMFs. The Cable corridor is 4.77km from Sanday SAC which is designated for bedrock reef habitat, sandbanks which are slightly covered by sea water all the time and mudflats and sandflats not covered by seawater at low tide.

**Table 5-8 EUNIS habitats within Cable Corridor 2.6 Eday to Sanday**

Habitat	EUNIS code	Species/ benthic features identified from previous surveys	Source
<i>Fucus vesiculosus</i> on full salinity moderately exposed to sheltered mid eulittoral rock	A1.3131	<ul style="list-style-type: none"> <li>Large boulders, pebbles and mixed gravel</li> <li><i>Fucoid</i> sp</li> <li>Thongweed</li> <li>Limpets and <i>Idotea</i> sp</li> <li><i>Elysia viridis</i></li> <li><i>Flustrellidra hispida</i></li> </ul>	2
Atlantic and Mediterranean moderate energy circalittoral rock	A3	NA – Broad-scale seabed habitat map only available.	1
Atlantic and Mediterranean moderate energy infralittoral rock	A3.2	NA – Broad-scale seabed habitat map only available.	1
Atlantic and Mediterranean low energy infralittoral rock	A3.3	NA – Broad-scale seabed habitat map only available.	1
<i>Codium</i> spp. with red seaweeds and sparse <i>Laminaria saccharina</i> on shallow, heavily-silted, very sheltered infralittoral rock	A3.321	<ul style="list-style-type: none"> <li>Course shell gravel</li> <li>Sparse <i>Laminaria saccharina</i> kelp park</li> <li>Mixed algae</li> <li>Diverse animal life – mobile and attached to kelp</li> </ul>	2
Infralittoral fouling seaweed communities	A3.72	<ul style="list-style-type: none"> <li>Metal wreckage on sand and gravel</li> <li>Mixed algae</li> <li><i>Laminaria hyperborea</i></li> <li><i>Laminaria saccharina</i></li> <li><i>Alcyonium digitatum</i></li> <li><i>Cnidarians</i></li> </ul>	2
Atlantic and Mediterranean moderate energy circalittoral rock	A4.2	NA – Broad-scale seabed habitat map only available.	1
Atlantic and Mediterranean low energy circalittoral rock	A4.3	NA – Broad-scale seabed habitat map only available.	1
<i>Laminaria saccharina</i> and robust red algae on infralittoral gravel and pebble	A5.5212	<ul style="list-style-type: none"> <li>Stone and shell gravel with some sand</li> <li>Mixed algae</li> <li>Burrowing anemones</li> </ul>	2

Sources:

<sup>1</sup> Habitats are obtained from the EMODnet broad-scale seabed (EUNIS) habitat map (EMODnet, 2019)

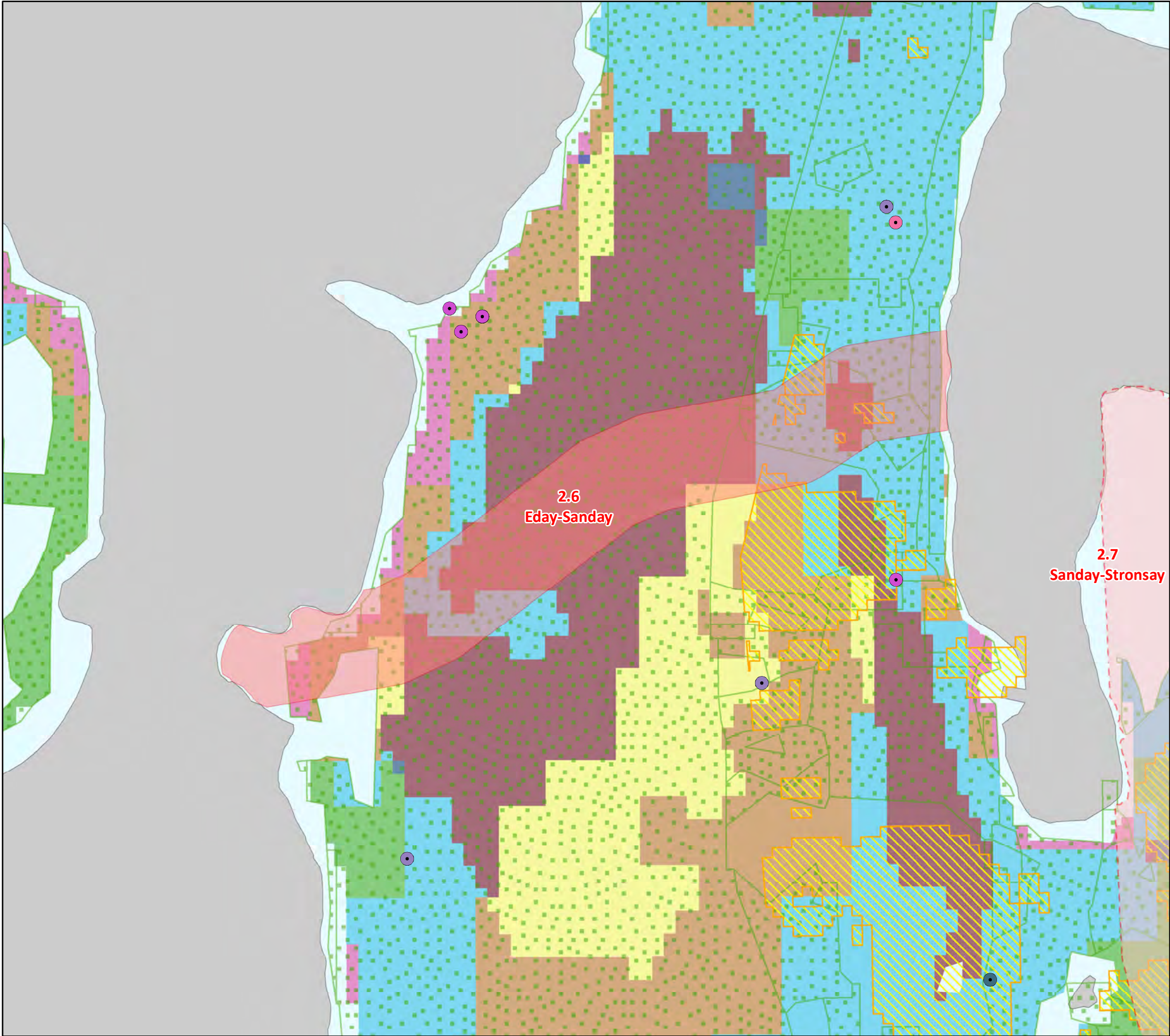
<sup>2</sup> Habitats and species/benthic information are obtained from previous surveys within or adjacent to the Cable corridor by EMODnet Seabed Habitat partners (EMODnet, 2020)



#### Sediment characterisation and sandeel potential

Cable Corridor 2.6 was outside of the extent of data available for BGS sediment and sandeel probability mapping. The EUSM broad habitat types identified across the corridor are types of infralittoral and circalittoral rock. However, a survey of the existing SSE power cable in 2018 indicated that the seabed is composed predominantly of shingle over gravelly sand with areas of cobbles and sand patches and boulders (Global Marine, 2021).

The shingle covering the gravelly sand is likely to restrict sandeel burial, making it unsuitable for sandeel. Therefore, there is unlikely to be suitable sandeel habitat present within Cable Corridor 2.6 Eday to Sanday.



SCOTTISH ISLES

FIBRE OPTIC CABLE PROJECT

SEABED HABITATS

EUSeaMap and Priority Marine Features

2.6 Eday-Sanday

Drawing No: P2308-HAB-002

A

Legend

Cable Route Application Corridor

Other Cable Route Application Corridor

Priority Marine Feature

Kelp and seaweed communities on sublittoral sediment

Kelp beds

Low or variable salinity habitats

Maerl beds

Tide-swept algal communities and Kelp beds

Sandbank Area (High Confidence)

Annex I Reef Habitat

Bedrock and/or Stony

EUNIS Classification

A3

A3.1

A3.2

A3.3

A4

A4.1

A4.2

A4.3

N

W

S

E

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

23 August 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

BT

Global Marine

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km

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### 5.3.7 Cable Corridor 2.7 Sanday to Stronsay

Cable Corridor 2.7 Sanday to Stronsay is located in Spurness Sound, west of Sanday Sound, which has moderate current speeds up to 1.5m/s along the cable corridor (MEA Chapter 4: Physical Processes). 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 5-9 summarises the intertidal information for the intertidal 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 2.7 Sanday to Stronsay landing points**

Corridor 2.7	Sanday landing point	Stronsay landing point
<b>Location</b>	The Sanday landing point is in the sheltered Bay of Stove.	The Stronsay landing point is just offshore of Odie.
<b>Description</b>	Large expanses of rippled fine sand bordered by low-lying seaweed covered rocks. The southern extent of the intertidal zone rises to create a sand bar at low tides.	Small sandy bay flanked by ridged bedrock and backed by cobbles and seaweed covered boulders. The western shore has high seaweed cover, whilst the eastern shore is lower in profile and more heavily influenced by sand scour.
<b>No. of biotopes recorded by Phase 1 intertidal survey</b>	17	10
<b>Presence of Annex I habitat or PMF</b>	No	No
<b>Presence of OSPAR Listed Threatened and/or Declining Species</b>	Dog whelk - common across UK and not locally protected	Dog whelk - common across UK and not locally protected
<b>BAP priority marine species or habitats</b>	No	No

#### 5.3.7.2 Subtidal area

A total of 6 broad EUNIS habitat types were identified within the cable corridor (Table 5-11). The subtidal seabed habitat within and surrounding the cable corridor are dominated by Atlantic and Mediterranean moderate energy infralittoral rock (EUNIS habitat 3.2) and Atlantic and Mediterranean high energy infralittoral rock (EUNIS habitat 3.1) with small patches of other habitats across the subtidal area. Just offshore of the Sanday landing point within the Bay of Stove, EUNIS habitats A2.231 and A5.234 have also been identified (Table 5-10; Figure 5-6, Drawing Reference: P2308-HAB-002\_2.7 Sanday-Stronsay).

The central cable corridor intersects several areas of protected Annex I sandbank habitat. These are described as Sublittoral sandbanks, permanently submerged which can be non-vegetated or with seagrass vegetation (e.g. *Zostera marina*, *Cymodocea nodosa*) (DG Environment, 2013). Two types of sandbank were identified: Infauna in Fine Sand, and Gravel Sands. Potential bedrock/stony reef Annex I habitat is found across most of the remainder of the cable corridor.

As discussed in Appendix B – Protected Sites Assessment, the cable corridor does not intersect any protected sites designated for benthic species or features. No PMFs intersect the cable corridor; however, PMF Tide-swept algal communities and kelp beds has been identified approximately 500m from the cable corridor. The cable corridor is 3.6km from Sanday SAC which is designated for bedrock reef habitat, sandbanks which are slightly covered by sea water all the time and mudflats and sandflats not covered by seawater at low tide.

**Table 5-10 EUNIS habitats within Cable Corridor 2.7 Sanday to Stronsay**

Habitat	EUNIS code	Species/ benthic features identified from previous surveys	Source
Atlantic and Mediterranean moderate energy circalittoral rock	A3	NA – Broad-scale seabed habitat map only available.	1
Atlantic and Mediterranean low energy circalittoral rock	A3.1	NA – Broad-scale seabed habitat map only available.	1
Atlantic and Mediterranean moderate energy infralittoral rock	A3.2	NA – Broad-scale seabed habitat map only available.	1
Polychaetes in littoral fine sand	A2.231	<ul style="list-style-type: none"> <li>Fine sand</li> <li><i>Arenicola marina</i></li> <li><i>Tubicolous</i> polychaetes</li> <li>Green and brown filamentous algae</li> </ul>	2
Atlantic and Mediterranean low energy infralittoral rock	A3.3	NA – Broad-scale seabed habitat map only available.	1
Atlantic and Mediterranean moderate energy circalittoral rock	A4.1	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
Semi-permanent tube-building amphipods and polychaetes in sublittoral sand	A5.234	<ul style="list-style-type: none"> <li>Sheltered infralittoral fine sand</li> <li><i>Ensis</i> sp</li> <li><i>Lanice conchilega</i></li> <li>Polychaetes</li> </ul>	2

Sources:

<sup>1</sup> Habitats are obtained from the EMODnet broad-scale seabed (EUNIS) habitat map (EMODnet, 2019)

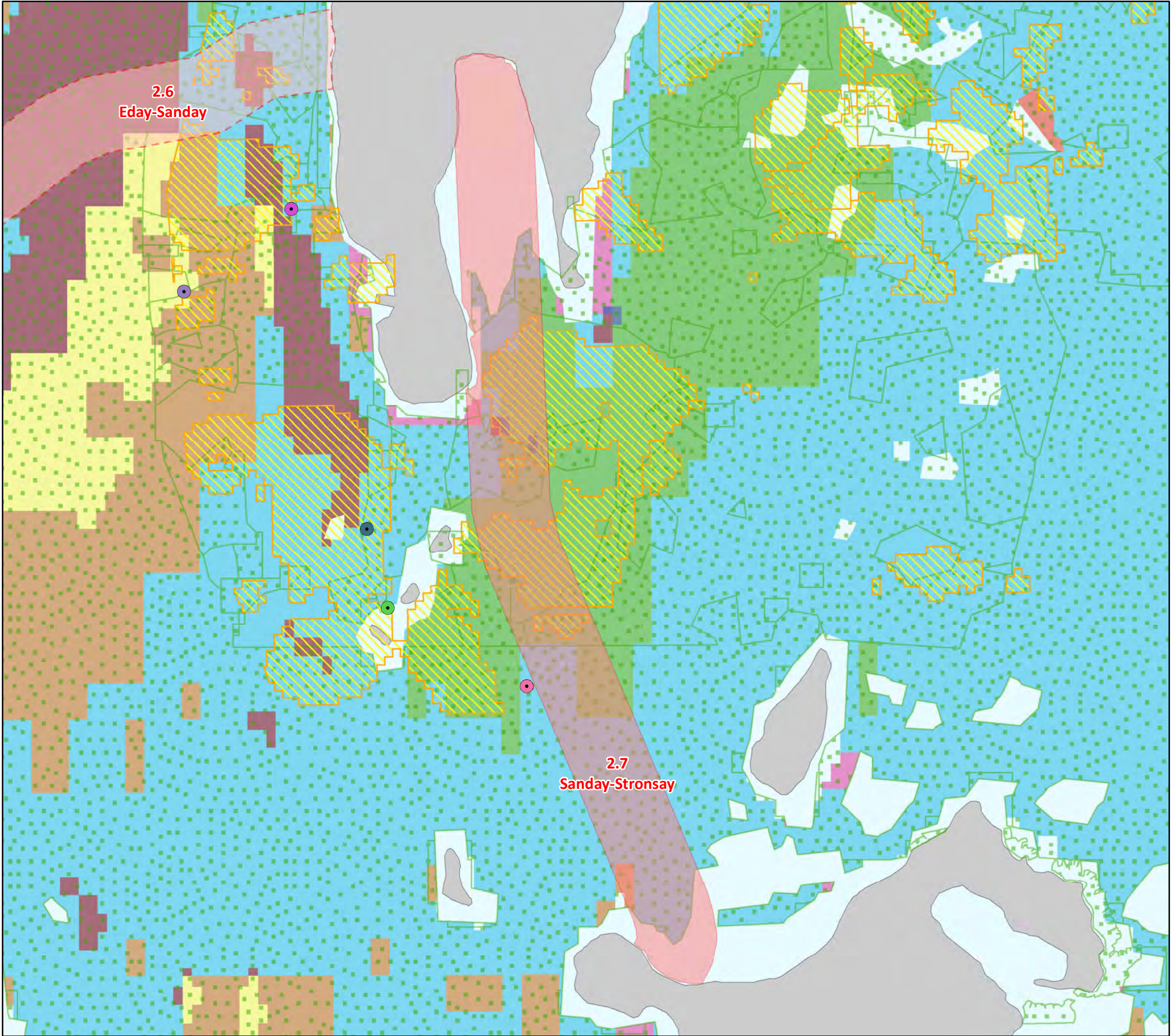
<sup>2</sup> Habitats and species/benthic information are obtained from previous surveys within or adjacent to the Cable corridor by EMODnet Seabed Habitat partners (EMODnet, 2020)

### 5.3.7.3 Sediment characterisation and sandeel potential

Cable Corridor 2.7 was outside of the extent of data available for BGS sediment and sandeel probability mapping. Both UKHO charts and EUSM broad habitat classifications show that there are rock habitats across most of the cable corridor in the centre of Spurness Sound. UKHO charts suggest that sand is present close to the landing at the Sands of Odie on Stronsay (Global Marine, 2021).

As sandeel require sandy substrate, the sand located offshore of Stronsay may provide suitable sandeel habitat.





SCOTTISH ISLES

FIBRE OPTIC CABLE PROJECT

SEABED HABITATS

EUSeaMap and Priority Marine Features

2.7 Sanday-Stronsay

Drawing No: P2308-HAB-002

A

Legend

Cable Route Application Corridor

Other Cable Route Application Corridor

Priority Marine Feature

Kelp and seaweed communities on sublittoral sediment

Kelp beds

Maerl beds

Tide-swept algal communities

Tide-swept algal communities and Kelp beds

Sandbank Area (High Confidence)

Annex I Reef Habitat

Bedrock and/or Stony

EUNIS Classification

A3

A3.1

A3.2

A3.3

A4

A4.1

A4.2

A4.3

A5.23 or A5.24

N

W

S

E

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	23 August 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

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km

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### 5.3.8 Cable Corridor 2.9 Orkney Mainland to Rousay

Cable Corridor 2.9 Orkney Mainland to Rousay is located in Eynhallow sound, which is moderately sheltered and has moderate current speeds of up to 1.5m/s (MEA Chapter 4). The adjacent Wyre and Rousay Sounds host a variety of kelp and maerl bed habitats (NatureScot, 2014).

#### 5.3.8.1 Intertidal area

Table 5-11 summarises the intertidal information for the intertidal 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 2.9 Orkney Mainland to Rousay landing points**

Corridor 2.9	Orkney Mainland landing point	Rousay landing point
<b>Location</b>	The Orkney Mainland landing point is on the north-east side of the island to the west of the Sands of Evie bay.	The Rousay landing point is at a narrow beach on the south of Rousay at the Bay of Westness.
<b>Description</b>	A small stone pier divides the shore into two. West of the pier is gently sloping to bedrock. East of the pier is sloping bedrock for approximately 150m, followed by large boulders and opening up to sand at Evie Sands.	A groyne splits the survey area in two. South of the groyne is characterised by bare cobbles and a rocky ledge profile below. North of the groyne is similar but with more bedrock on the upper shore. Above high water, the shore is backed by large quantities of dumped rubble.
<b>No. of biotopes recorded by Phase 1 intertidal survey</b>	11	16
<b>Presence of Annex I habitat or PMF</b>	No	No
<b>Presence of OSPAR Listed Threatened and/or Declining Species</b>	Dog whelk - common across UK and not locally protected	No
<b>BAP priority marine species or habitats</b>	No	No

#### 5.3.8.2 Subtidal area

Two broad EUNIS habitat types were identified within the cable corridor (Table 5-12; Figure 5-7, Drawing Reference: P2308-HAB-002\_2.9 Orkney Mainland-Rousay). The dominant habitat type was Atlantic and Mediterranean high energy infralittoral rock (EUNIS Habitat A3.1) with patches of Infralittoral rock and other hard substrata (EUNIS habitat A3) at the centre of the cable corridor. Previous surveys, undertaken by EMODnet seabed habitat partners, have identified EUNIS habitats A4.2143 and A5.234 adjacent to the centre of the cable corridor (Table 5-12; Figure 5-7, Drawing Reference: P2308-HAB-002\_2.9 Orkney Mainland-Rousay).

The cable corridor intersects bedrock/stony Annex I reef habitat along most of the route 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. Seagrass, sandeel and maerl bed PMFs are found approximately 800m from the cable corridor.



**Table 5-12 EUNIS habitats within Cable Corridor 2.9 Orkney Mainland to Rousay**

Habitat	EUNIS code	Species/ benthic features identified from previous surveys	Source
Atlantic and Mediterranean moderate energy circalittoral rock	A3	NA – Broad-scale seabed habitat map only available.	1
Atlantic and Mediterranean low energy circalittoral rock	A3.1	NA – Broad-scale seabed habitat map only available. Bedrock, boulders and cobbles subjected to strong tidal streams at 30m depth. The rock had a dense cover of <i>Alcyonium digitatum</i> . Areas subjected to a bit of scour had dense <i>Flustra foliacea</i> , <i>Securiflustra securifrons</i> .	1
<i>Alcyonium digitatum</i> with <i>Securiflustra securifrons</i> on tide-swept moderately wave-exposed circalittoral rock has also been identified	A4.2143	<ul style="list-style-type: none"> <li>▪ Bedrock, boulders and cobbles</li> <li>▪ Dense <i>Alcyonium digitatum</i> cover</li> <li>▪ <i>Flustra foliacea</i> and <i>Securiflustra securifrons</i> in scoured areas</li> <li>▪ Sponges</li> </ul>	2
Semi-permanent tube-building amphipods and polychaetes in sublittoral sand	A5.234	<ul style="list-style-type: none"> <li>▪ <i>Chordata filum</i></li> <li>▪ <i>Ulva spp</i></li> <li>▪ <i>Ensis arcuatus</i></li> <li>▪ <i>Echinocardium cordatum</i></li> <li>▪ <i>Lanice conchilega</i></li> </ul>	2

Sources:

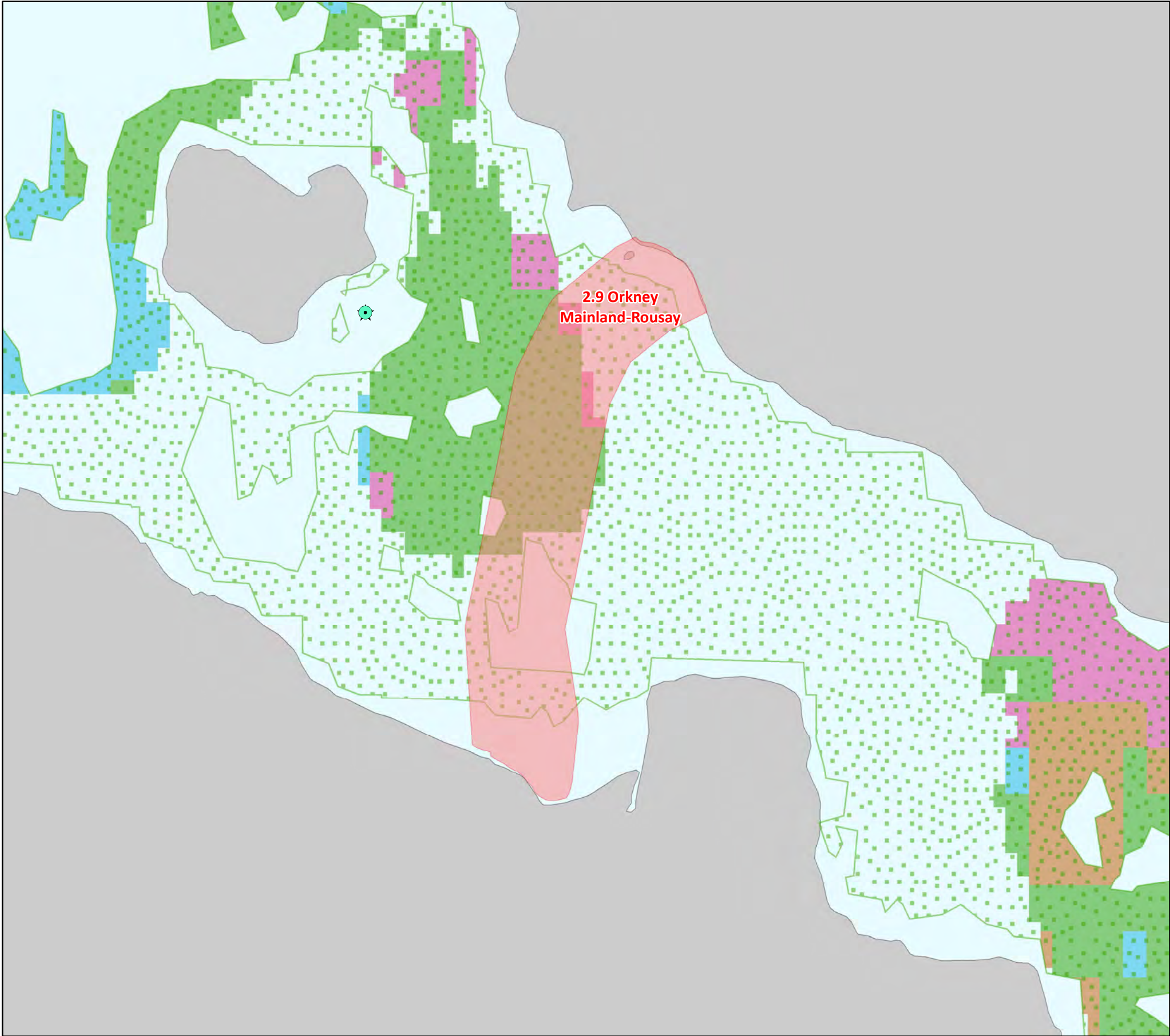
<sup>1</sup> Habitats are obtained from the EMODnet broad-scale seabed (EUNIS) habitat map (EMODnet, 2019)

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

#### 5.3.8.3 Sediment characterisation and sandeel potential

Cable Corridor 2.9 was outside of the extent of data available for BGS sediment and sandeel probability mapping. EUSM broad habitat types identified across the centre of the cable corridor are types of infralittoral and circalittoral rock. UKHO charts also suggest that the beach at the Evie landing is predominantly composed of rock (Global Marine, 2021).

As sandeel require sediment habitats, there is unlikely to be suitable sandeel habitat present within the cable corridor.



SCOTTISH ISLES  
FIBRE OPTIC CABLE PROJECT  
SEABED HABITATS  
EUSeaMap and Priority Marine Features  
2.9 Orkney Mainland-Rousay

Drawing No: P2308-HAB-002

A

- Legend**

  - Cable Route Application Corridor
  - Priority Marine Feature**
    - Seagrass beds
    - Sandeels
  - Annex I Reef Habitat**
    - Bedrock and/or Stony
- EUNIS Classification**

  - A3
  - A3.1
  - A3.2
  - A3.3



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

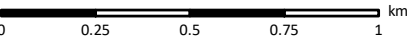
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Longitude: -4.9219°W

Scale @A3 1:20,000,000



NOTE: Not to be used for Navigation

Date	23 August 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



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### 5.3.9 Cable Corridor 2.10 Orkney Mainland to Shapinsay

Cable Corridor 2.10 Orkney Mainland to Shapinsay is in the relatively sheltered Shapinsay sound, with peak current tides of 0.5m/s (MEA Chapter 4). Shapinsay sound is dominated by sand and mixed stony layers which support sparse fauna of portunid crabs, starfish and maerl, with barnacles, bryozoans and sponges encrusted on stones (Marine Scotland, 2014).

#### 5.3.9.1 Intertidal area

Table 5-13 summarises the intertidal information for the intertidal landing points. A detailed description of the biotopes and features observed are provided in the intertidal survey reports (Appendix A).

**Table 5-13 Characteristics of Cable Corridor 2.10 Orkney Mainland to Shapinsay landing points**

Route 2.10	Orkney Mainland landing point	Shapinsay landing point
<b>Location</b>	The Orkney Mainland landing point for is located at Sand of Heatherhouse on the North coast of the south west area of the island.	The Shapinsay landing point is located in the sheltered Bay of Sandgarth on the south of the island.
<b>Description</b>	Central sandy beach flanked by seaweed covered bedrock to the east and west and backed by a small dune system. The bedrock to the east is stepped and sloped to the west.	Central sandy shore flanked by rocky shore on both sides. Centre and east of the survey area backed by embryonic dunes, and west backed by dunes and small cliff structures.
<b>No. of biotopes recorded by Phase 1 intertidal survey</b>	11	12
<b>Presence of Annex I habitat or PMF</b>	No	No
<b>Presence of OSPAR Listed Threatened and/or Declining Species</b>	Dog whelk - common across UK and not locally protected	Dog whelk - common across UK and not locally protected
<b>BAP priority marine species or habitats</b>	No	No

#### 5.3.9.2 Subtidal area

Six broad EUNIS habitat types were identified within the cable corridor (Table 5-14). The dominant habitat types were Atlantic and Mediterranean low energy infralittoral rock (EUNIS habitat A3.2) and Infralittoral coarse sediment (EUNIS A5.13), with other habitats occurring as patches. Previous surveys, undertaken by EMODnet Seabed Habitat partners, at the cable corridor have also identified EUNIS habitats A3.2141 and A5.23 at the entrance to the bay of Sangarth off Shapinsay. In the centre of the corridor EUNIS habitats A4.1343 and A5.23 have also been identified (Table 5-14; Figure 5-8, Drawing Reference: P2308-HAB-002\_2.10 Orkney Mainland Shapinsay).

The northern and southern ends of the cable corridor intersect potential bedrock/stony Annex I reef habitat. Several PMFs, namely maerl beds and kelp beds, have also been identified in the vicinity of the cable corridor. DDV surveys, undertaken by Envision to inform the MEA, identified that the distribution of Annex I features, maerl bed and kelp bed PMFs was consistent with the reported GeMS distribution of these features (Table 5-15). Full details of the DDV benthic survey and supporting figures are provided in Appendix A.

GeMS data suggested that horse mussel beds may also be present within the centre of the cable corridor. However, DDV of the points within the corridor did not identify any horse mussel beds, and instead identified this area to be sublittoral coarse sediment dominated by brittle stars.

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

**Table 5-14 EUNIS habitats within Cable Corridor 2.10 Orkney Mainland to Shapinsay**

Habitat	EUNIS code	Species/ benthic features identified from previous surveys	Source
Atlantic and Mediterranean moderate energy circalittoral rock	A3	NA – Broad-scale seabed habitat map only available.	1
Atlantic and Mediterranean low energy circalittoral rock	A3.1	NA – Broad-scale seabed habitat map only available.	1
Atlantic and Mediterranean moderate energy infralittoral rock	A3.2	NA – Broad-scale seabed habitat map only available.	1
<i>Laminaria hyperborea</i> forest and foliose red seaweeds on moderately exposed upper infralittoral rock	A3.2141	<ul style="list-style-type: none"> <li>▪ <i>Laminaria hyperborea</i> on sandy bedrock and boulders</li> <li>▪ Epiphytic red algae (e.g. <i>Plocamium cartilagineum</i> and <i>Delesseria sanguinea</i>)</li> <li>▪ Crustose coralline algae</li> </ul>	2
Atlantic and Mediterranean low energy infralittoral rock	A3.3	NA – Broad-scale seabed habitat map only available.	1
Infralittoral coarse sediment	A5.13	NA – Broad-scale seabed habitat map only available.	1
Circalittoral coarse sediment	A5.14	<p>NA – Broad-scale seabed habitat map only available.</p> <p>Sand with occasional cobbles and boulders. The sand supported <i>Arenicola marina</i> and occasional <i>Urticina felina</i> whilst the cobbles supported <i>Furcellaria lumbricalis</i> with occasional <i>Halidrys siliquosa</i>.</p>	1
Infralittoral fine sand	A5.23	<ul style="list-style-type: none"> <li>▪ Sand with cobbles and boulders</li> <li>▪ <i>Arenicola marina</i> and <i>Urticina felina</i></li> </ul>	2

Source:

<sup>1</sup> Habitats are obtained from the EMODnet broad-scale seabed (EUNIS) habitat map (EMODnet, 2019)

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



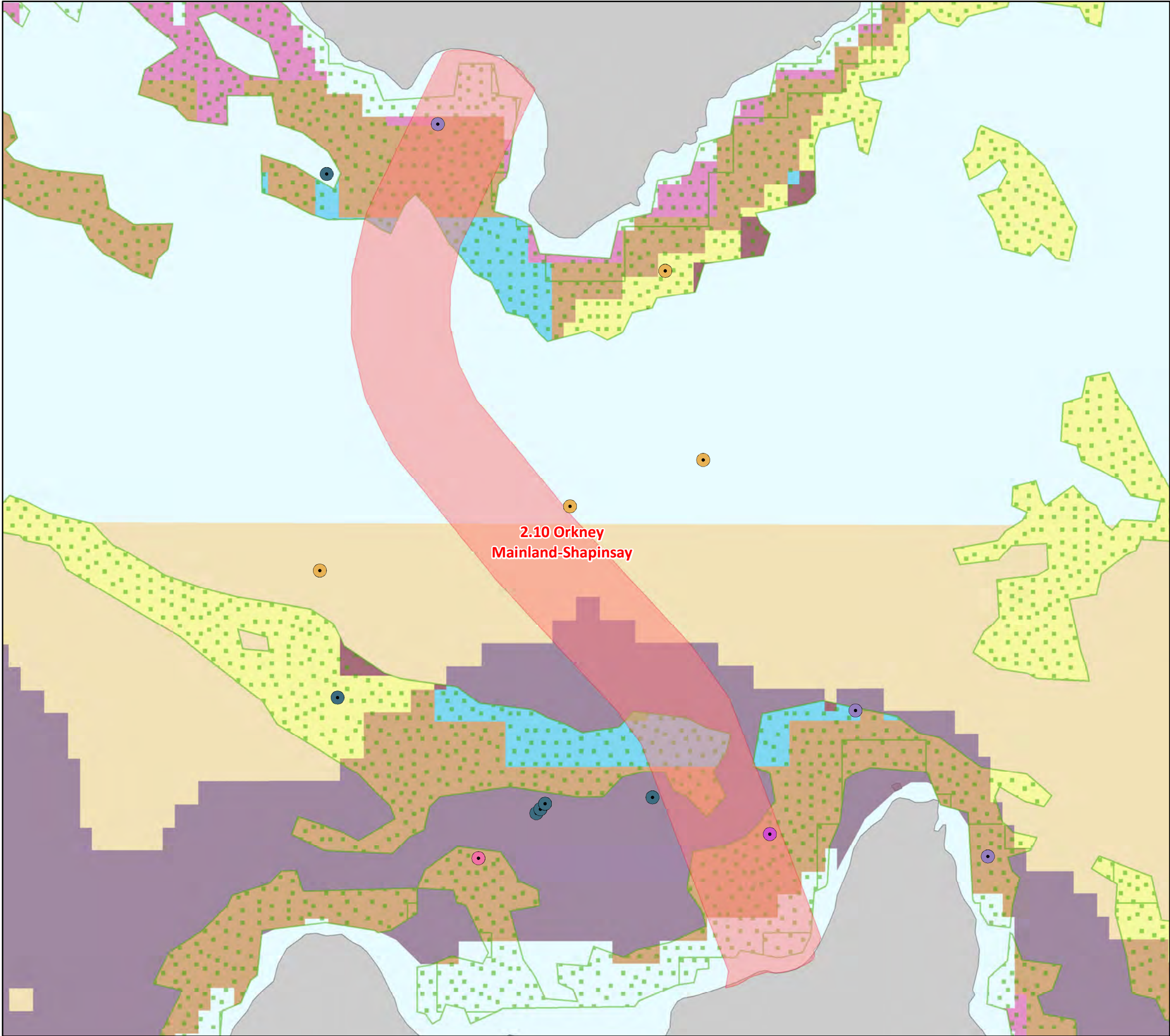
**Table 5-15 Habitat types identified from the video and still imagery analysis for the Cable Corridor 2.10 Orkney Mainland to Shapinsay**

EUNIS Code	Habitat	PMF	Annex I	Location
A3.212	<i>Laminaria hyperborea</i> on tide-swept, infralittoral rock	Kelp Beds	Bedrock Reef Sub-Feature	At two survey stations offshore of the Shapinsay landing point.
A5.14	Circalittoral coarse sediment	None	None	At four survey stations in the northern subtidal cable corridor area, and one survey station towards the south
A5.445	<i>Ophiothrix fragilis</i> and/or <i>Ophiocomina nigra</i> brittlestar beds on sublittoral mixed sediment	None	None	At four stations in the centre of the cable corridor
A5.5	Sublittoral macrophyte-dominated communities on sediments	None	None	At four survey stations at the south of the cable corridor and one survey station at the north
A5.51	Maerl beds	Maerl Beds	Large shallow inlets and bays Component Feature	At three survey stations at the southern end of the corridor between 10-20m depth.

#### 5.3.9.3 Sediment characterisation and sandeel potential

EMODnet bathymetry survey data indicates that sediment cover is extensive across the cable corridor except for rocky areas within the Bay of Sandgarth on Shapinsay (Global Marine, 2021). This is consistent with EUSM broad habitat identifying 31.3% of the cable corridor (in the north and south) as coarse sediment (Figure 5-8, Drawing Reference: P2308-HAB-002\_2.10) and BGS data which covers the southern half of the cable corridor, showing the seabed to be sandy gravel (BGS, 2020). Drop down camera surveys of the cable corridor confirmed the presence of subtidal mixed sediments in the centre of the cable corridor, and subtidal coarse sediment towards the north and south. However, no sandeel were identified during the drop-down camera surveys.

Whilst no sandeel were identified in the drop-down camera surveys, coarse sediments are located within the cable corridor, and are the preferred habitat for sandeel. Therefore, there is potential for suitable sandeel habitat within the cable corridor.



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FIBRE OPTIC CABLE PROJECT  
SEABED HABITATS  
EUSeaMap and Priority Marine Features  
2.10 Orkney Mainland-Shapinsay

Drawing No: P2308-HAB-002

A

- Legend**

  - Cable Route Application Corridor
  - Priority Marine Feature**
    - Horse mussel beds
    - Kelp and seaweed communities on sublittoral sediment
    - Kelp beds
    - Maerl beds
    - Tide-swept algal communities and Kelp beds
  - Annex I Reef Habitat**
    - Bedrock and/or Stony
- EUNIS Classification**

  - A3
  - A3.1
  - A3.2
  - A3.3
  - A4.2
  - A4.3
  - A5.13
  - A5.14



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

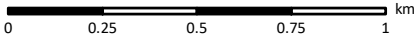
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NOTE: Not to be used for Navigation

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### 5.3.10 Cable Corridor 2.11 Hoy to Flotta

Cable Corridor 2.11 Hoy to Flotta is located in the water between West Weddell Sound and Switha sound, southwest of Scapa Flow. This area sheltered, with peak current tides of 0.25m/s (MEA Chapter 4). Sediments in the shallower bays around Scapa Flow, like where the Cable corridor is located, are primarily muddy sands which support communities of sea pens, polychaete worms, urchins and bivalve shellfish (Murray *et al.*, 1999).

#### 5.3.10.1 Intertidal area

Table 5-16 summarises the intertidal information for the intertidal 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 2.11 Hoy to Flotta landing points**

Corridor 2.11	Hoy landing point	Flotta landing point
<b>Location</b>	The landing point at Hoy is located on the south-east side of the island at Crock Ness.	The landing point at Flotta is located on the western side of the island at Gutter Sound in Scapa Flow.
<b>Description</b>	Rocky shore with bedrock and flattened rocks with classic zonation patterns. Backed by gravel cobbles and flat rocks	Predominantly sublittoral fringed rock backed by a wide zone of cobbles. The southern half of the survey area is underlain by bedrock backed cliffs, and the northern area by boulders and mixed sediment sloping into heathland.
<b>No. of biotopes recorded by Phase 1 intertidal survey</b>	16	8
<b>Presence of Annex I habitat or PMF</b>	No	No
<b>Presence of OSPAR Listed Threatened and/or Declining Species</b>	Dog whelk - common across UK and not locally protected	Dog whelk - common across UK and not locally protected
<b>BAP priority marine species or habitats</b>	Coastal saltmarsh BAP priority habitat located 200m south of the BMH.	Coastal saltmarsh BAP priority habitat located in the southern shore – main area is 50m south of the BMH with small patch of broken saltmarsh in the vicinity of the BMH.

#### 5.3.10.2 Subtidal area

The cable corridor was outside of the area covered by the EMODnet broad-scale seabed (EUNIS) habitat map. However, previous surveys, undertaken by EMODnet Seabed Habitat partners, have identified Infralittoral mixed sediments (EUNIS A5.43) and infralittoral fouling seaweed communities (EUNIS A3.72) adjacent to the cable corridor (Table 5-17; Figure 5-9, Drawing Reference: P2308-HAB-002\_2.11 Hoy-Flotta).

The cable corridor intersects potential bedrock/stony Annex I reef habitat at each landing point and a subtidal area at the south of the cable corridor. The PMF kelp and seaweed communities on sublittoral sediment is found within the cable corridor, however this is not a high priority feature. The PMF flame shell beds are located approximately 660m from the cable corridor. The cable corridor is not in the vicinity of any protected sites which are designated for benthic species or features.

**Table 5-17 EUNIS habitats within Cable Corridor 2.11 Hoy to Flotta**

Habitat	EUNIS code	Species/ benthic features identified from previous surveys	Source
Infralittoral fouling seaweed communities	A3.72	<ul style="list-style-type: none"> <li>Disused metal pipeline</li> <li>Encrusting pink algae</li> <li>Urchins</li> </ul>	2
Infralittoral mixed sediments	A5.43	<ul style="list-style-type: none"> <li>Muddy sand and shell gravel</li> <li>Spoon worms (<i>Echiura</i> sp)</li> <li>Threads of <i>Limaria hyans</i></li> </ul>	2

Source:

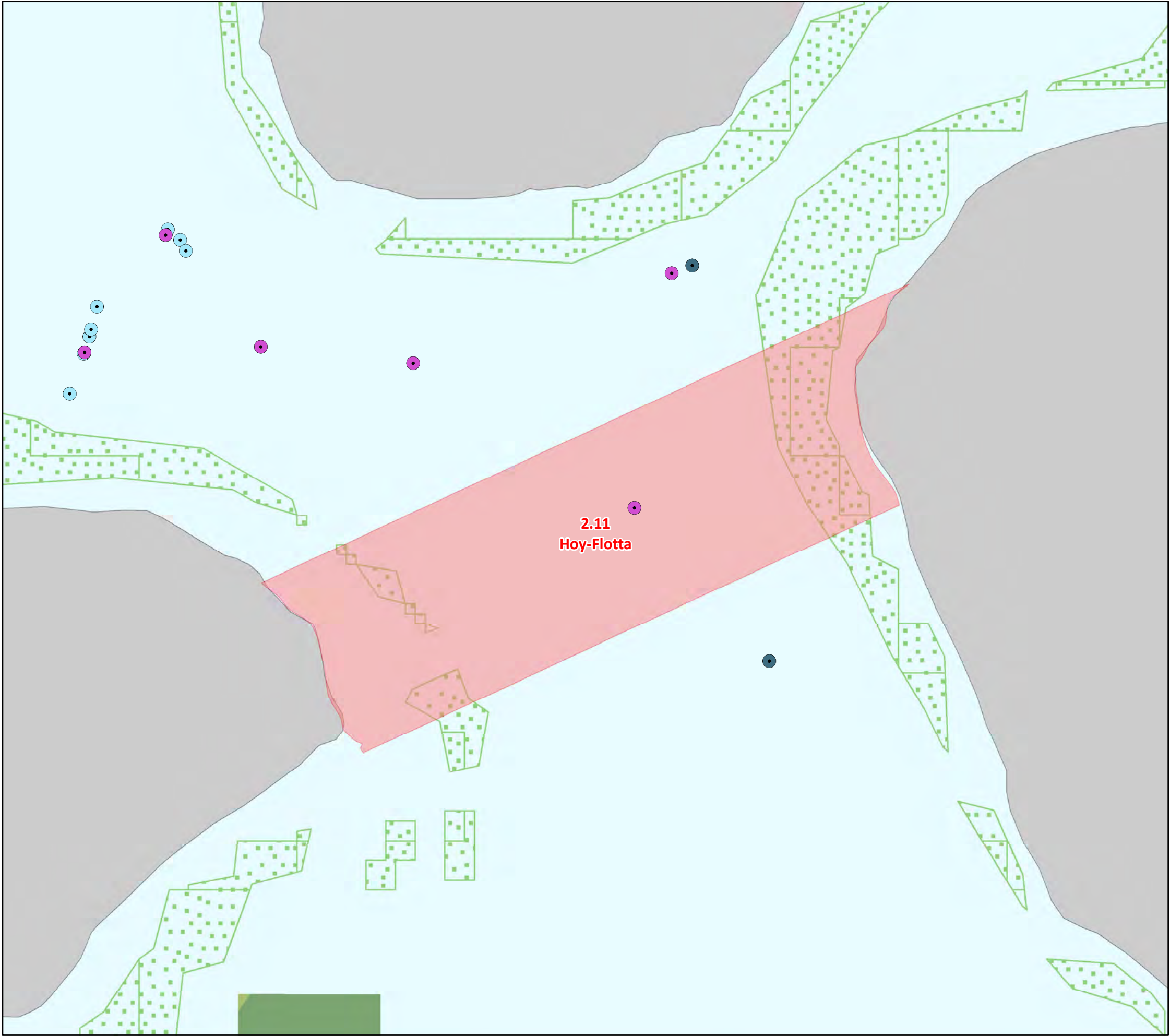
<sup>1</sup> Habitats are obtained from the EMODnet broad-scale seabed (EUNIS) habitat map (EMODnet, 2019)

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

#### 5.3.10.3 Sediment characterisation and sandeel potential

The cable corridor is covered by BGS data, which shows this area to be muddy sandy gravel, comprised of 10% to 90% mud sediment (Global Marine, 2021). Exposed bedrock is evident from satellite imagery in the vicinity of the proposed cable landing points.

Exposed bedrock is not suitable for sandeel. Sandeel are also only able to tolerate up to 10% of silt sediments, so are unlikely to be found within the cable corridor.



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SEABED HABITATS

EUSeaMap and Priority Marine Features

2.11 Hoy-Flotta

Drawing No: P2308-HAB-002

A

Legend

Cable Route Application Corridor

Priority Marine Feature

Annex I Reef Habitat

Flame shell beds

Kelp and seaweed communities on sublittoral sediment

Maerl beds

Bedrock and/or Stony

EUNIS Classification

A5.33

A5.43

N

W

S

E

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	23 August 2021
Coordinate System	WGS 1984 UTM Zone 30N
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0

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km

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### 5.3.11 Cable Corridor 2.12 Flotta to South Ronaldsay

Cable Corridor 2.12 Flotta to South Ronaldsay crosses the Sound of Hoxa at the south of Scapa Flow. Greater tidal flows at the centre of the Sound of Hoxa are associated with cleaner sands and gravels (Murray et al., 1999). Whilst sediments in the shallower bay, such as on the western side of the corridor, are primarily muddy sands which support communities of seapens, polychaete worms, urchins and bivalve shellfish (Murray et al., 1999).

#### 5.3.11.1 Intertidal area

Table 5-18 summarises the intertidal information for the intertidal landing points. A detailed description of the biotopes and features observed are provided in the intertidal survey reports (Appendix A).

**Table 5-18 Characteristics of Cable Corridor 2.12 Flotta to South Ronaldsay landing points**

Corridor 2.12	Flotta landing point	South Ronaldsay landing point
<b>Location</b>	The Flotta landing point is off the western side of the island at Pan hope, on the entrance to Curries Firth.	The landing point at South Ronaldsay is in the Dam of Hoxa on the north-east side of the island.
<b>Description</b>	The west of the landing point corridor consists of mixed sediment over bedrock, with a more boulder-dominated shore to the east. The northern shore closest to the BMH has an even, flat shore profile with an even slope to the sea.	A small north facing embayment, flanked by bedrock backed by cobbles and a strandline. Small lochans back the beach which feeds freshwater into the bay.
<b>No. of biotopes recorded by Phase 1 intertidal survey</b>	16	15
<b>Presence of Annex I habitat or PMF</b>	The eastern shore has under boulder communities which are a UK BAP Priority habitat. However, these are located more than 300m from the BMH these will not be impacted by installation activities.	No
<b>Presence of OSPAR Listed Threatened and/or Declining Species</b>	Dog whelk - common across UK and not locally protected	Dog whelk - common across UK and not locally protected
<b>BAP priority marine species or habitats</b>	No	No

#### 5.3.11.2 Subtidal area

Eight broad EUNIS habitat types were identified within the cable corridor (Table 5-19). The cable corridor is dominated by Circalittoral mixed sediments (EUNIS habitat 5.44) in the centre, with patches of the remaining habitat types on the west and east sides of the cable corridor (Figure 5-10, Drawing Reference: P2308-HAB-002\_2.12 Flotta-South Ronaldsay). Through previous benthic survey, undertaken by EMODnet Seabed Habitat partners, a variety of further habitats have been identified within and adjacent to the cable corridor (Table 5-20).

Several areas of bedrock/stony Annex I reef intersect the cable corridor on the eastern side. The majority of this is along the Ronaldsay coast, with patches just offshore of Ronaldsay. The cable corridor is not in the vicinity of any protected sites which are designated for benthic species or features, and there are no PMFs within the cable corridor. Kelp bed PMFs are found adjacent to the corridor, however as these are approximately 500m from the cable corridor.

**Table 5-19 EUNIS habitats within Cable Corridor 2.12 Flotta to South Ronaldsay**

Habitat	EUNIS code	Species/ benthic features identified from previous surveys	Source
Atlantic and Mediterranean moderate energy circalittoral rock	A3	NA – Broad-scale seabed habitat map only available.	1
Atlantic and Mediterranean low energy infralittoral rock	A3.3	NA – Broad-scale seabed habitat map only available.	1
Circalittoral fouling faunal communities	A4.72	<ul style="list-style-type: none"> <li>▪ Metal submarine wreckage</li> <li>▪ Mostly cnidarian turf</li> </ul>	2
Sublittoral sediment	A5	NA – Broad-scale seabed habitat map only available.	1
Dense <i>Lanice conchilega</i> and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand	A5.137	<ul style="list-style-type: none"> <li>▪ Shell gravel and coarse sand</li> <li>▪ <i>Lanice conchilega</i></li> </ul>	2
Circalittoral sandy mud	A5.35	NA – Broad-scale seabed habitat map only available.	1
<i>Virgularia mirabilis</i> and <i>Ophiura</i> spp. with <i>Pecten maximus</i> on circalittoral sandy or shelly mud	A5.354	<ul style="list-style-type: none"> <li>▪ Flat muddy seabed</li> <li>▪ Slender seapens</li> <li>▪ Burrowing anemones</li> <li>▪ Lugworms</li> </ul>	2
Infralittoral mixed sediments	A5.43	NA – Broad-scale seabed habitat map only available.	1
Circalittoral mixed sediments	A5.44	NA – Broad-scale seabed habitat map only available.	1
<i>Mysella bidentata</i> and <i>Thyasira</i> spp. in circalittoral muddy mixed sediment	A5.443	<ul style="list-style-type: none"> <li>▪ Rich polychaete community (including <i>Exogone naidina</i>, <i>Prionospio fallax</i>)</li> <li>▪ Crustaceans (including <i>Urothoe elegans</i> and <i>Harpinia antennaria</i>)</li> <li>▪ Cnidaria (including <i>Virgularia mirabilis</i> and <i>Cerianthus lloydii</i>)</li> </ul>	2

Source:

<sup>1</sup> Habitats are obtained from the EMODnet broad-scale seabed (EUNIS) habitat map (EMODnet, 2019)

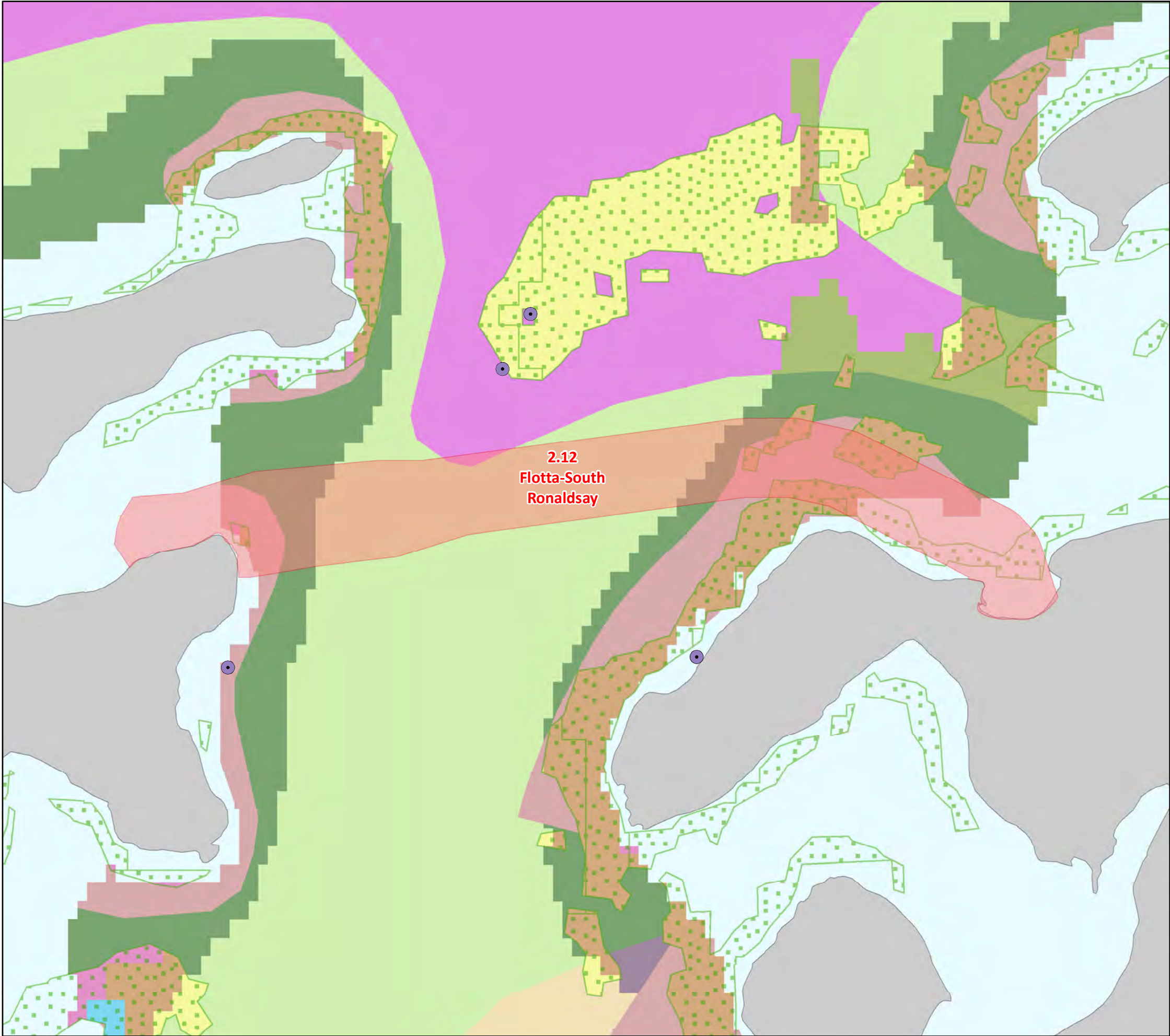
<sup>2</sup> Habitats and species/benthic information are obtained from previous surveys within or adjacent to the Cable corridor by EMODnet Seabed Habitat partners (EMODnet, 2020)

### 5.3.11.3 Sediment characterisation and sandeel potential

The BGS data indicates rock at Flotta and muddy sandy gravel in the channel with a large rock outcrop from Hoxa Head on South Ronaldsay (Global Marine, 2021). The EUSM habitat is consistent with this, identifying mixed sediments along most of the cable corridor. Mixed sediments, including muddy sandy gravel, are comprised of 10% to 95% mud, <90% sand and ≥5% gravel (BGS, 2020).

The rock outcrops identified near the landing points are not suitable for sandeel. Sandeel are also only able to tolerate up to 10% of silt sediments, so are unlikely to be found within the cable corridor.





SCOTTISH ISLES  
FIBRE OPTIC CABLE PROJECT  
SEABED HABITATS  
EUSeaMap and Priority Marine Features  
2.12 Flotta-South Ronaldsay

Drawing No: P2308-HAB-002

A

**Legend**

Cable Route Application Corridor

**Priority Marine Feature**

Kelp beds

**Annex I Reef Habitat**

Bedrock and/or Stony

**EUNIS Classification**

A3

A3.2

A3.3

A4.3

A5

A5.13

A5.14

A5.33

A5.35

A5.43

A5.44



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

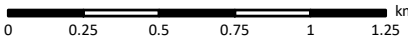
**Map Centre**  
Latitude: 56.3156°N  
Longitude: -4.9219°W

Scale @A3 1:20,000,000



NOTE: Not to be used for Navigation

Date	23 August 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



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Source: Office for National Statistics licensed under the Open Government Licence v3.0. Contains OS data © Crown copyright and database right (2018); Information contained here has been derived from data that is made available under the European Marine Observation Data Network (EMODnet) Seabed Habitats project (www.emodnet-seabedhabitats.eu), funded by the European Commission's Directorate-General for Maritime Affairs and Fisheries (DG MARE); ©Esri; Priority Marine Feature Data collated by NatureScot and Joint Nature Conservation Committee. Copyright ownership is recorded against individual records and varies from record to record the following are the copyright owners of individual records: A.C. Stephen, Agri-Food and Biosciences Institute (Northern Ireland), Assynt Field Club, Bernard Pictou, BMT Cordah Ltd, British Petroleum International, Community of Arran Seabed Trust (COAST), Conoco Phillips, Crown copyright (Centre for Environment Fisheries and Aquaculture Science; Department for Business, Energy and Industrial Strategy; Department of Agriculture, Environment and Rural Affairs (Northern Ireland); Marine Scotland), Dove Marine Laboratory, E Wilson, F.R. Woodward, Hebridean Whale and Dolphin Trust, Heriot-Watt University, International Council for the Exploration of the Sea, Joint NatureScot, Natural Resources Wales and Natural England - former NCC data), Joint Nature Conservation Committee, Jon Moore, Julia Nunn, Kames Fish Farming Ltd, L Hawkins, Lothian Divers/ Marine Conservation Society (Scotland), Marine Biological Association of the United Kingdom, Marine Conservation Society (Scotland), National Museums of Scotland, Natural England, NatureScot, Nick Stewart, Organic Sea Harvest Ltd, Orkney Skate Trust, Paula Low, Pictou, B. E., Porcupine Marine Natural History Society, Queen's University Belfast, R Witbaard, Rae & Lamont, Royal Dutch Shell, SCANS II data, EU LIFE Nature project LIFE04NAT/GB/000245, Scottish Aquaculture Research Forum (SARF), Scottish Environment Protection Agency, Sea Mammal Research Unit and NatureScot, Seabird Monitoring Programme Database, Shark Trust, Shetland Field Studies Group, Shetland Oil Terminal Environmental Advisory Group / Sullom Voe Association Limited, Skyak Adventures, St Abbs and Eyemouth Voluntary Marine Reserve, The Conchological Society of Great Britain and Ireland, The Royal Society of Edinburgh, Unicomarine, University of Dundee, University of Exeter, University of London, University of Plymouth, University of St Andrews, University of the Highlands and Islands (NAFC Marine Centre), University of the Highlands and Islands (Scottish Association for Marine Science), Vincent Wildlife Trust, Wave Action / The Wildlife Trusts



## 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 5-20 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 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. 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 5-20 Pressures considered for cable corridors in Orkney 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 5-21, below, lists the identified pressures, the associated cable installation activities, the footprint of these pressures and the habitats identified as sensitive to these pressures.

**Table 5-21 Potential pressures, installation activities and key sensitive receptors**

Potential pressure	Activities resulting in pressure	Footprint of Installation		Key sensitive receptor
		Cable Corridor	Footprint (m <sup>2</sup> )	
Abrasion/disturbance at the surface of the substratum	Plough (skids and share) and Jetting Plough, Pre-Lay Grapnel Run (PLGR) and surface laid cable. Footprint: 2.6m wide x length of cable corridor with cable burial (worst case)	2.5	17030	<ul style="list-style-type: none"> <li>Reef habitat</li> <li>Kelp PMF</li> <li>Maerl PMF</li> <li>Sandbank habitat</li> <li>Sandeel</li> <li>Saltmarsh</li> </ul>
		2.6	11700	
		2.7	17680	
		2.9	8320	
		2.10	14950	
		2.11	4550	
		2.12	17420	
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Plough (skids and share) and Jetting Plough and PLGR Footprint: 2.6m wide x length of cable corridor with cable burial (worst case) Up to 1m deep (penetration)	2.5	5000	<ul style="list-style-type: none"> <li>Sandbank habitat</li> <li>Sandeel</li> <li>Saltmarsh</li> </ul>
		2.6	5847	
		2.7	7576	
		2.9	0	
		2.10	10144	
		2.11	3422	
		2.12	14537	
Physical change to another seabed type	External cable protection (concrete mattresses, rock bags) Footprint (worst case deposits): 7m <sup>2</sup> per rock bag 18m <sup>2</sup> per mattress	2.5	25 rock bags + 3 mattresses = 229m <sup>2</sup>	<ul style="list-style-type: none"> <li>Reef habitat</li> <li>Sandbank habitat</li> <li>Sandeel</li> </ul>
		2.6	25 rock bags + 3 mattresses = 229m <sup>2</sup>	
		2.7	40 rock bags + 3 mattresses = 334m <sup>2</sup>	
		2.9	52 rock bags + 3 mattresses = 418m <sup>2</sup>	
		2.10	18 rock bags + 3 mattresses = 180m <sup>2</sup>	
		2.11	10 rock bags + 3 mattresses = 124m <sup>2</sup>	
		2.12	10 rock bags + 3 mattresses = 124m <sup>2</sup>	
Siltation rate changes including smothering (depth of vertical sediment overburden)	Siltation from the Plough and Jetting Plough Footprint (worst case): 100m x length of the cable corridor with cable burial	2.5	192289	<ul style="list-style-type: none"> <li>Sandbank habitat</li> <li>Sandeel</li> </ul>
		2.6	224865	
		2.7	291385	
		2.9	0	
		2.10	390169	
		2.11	131600	
		2.12	559100	

For each of the pressures which have been screened in Table 5-21, the cable corridors where the pressure applies, and the relevant protected receptors present within each cable corridor has been summarised in Table 5-22.

Due to the distance of the cable corridor to Sanday SAC (approximately 3.6km from the closest cable corridor - Cable Corridor 2.7 Sanday to Stronsay) no pressure pathway to the SAC was identified to the benthic qualifying interest mudflats and sandflats not covered by seawater at low tide, reefs and sandbanks which are slightly covered by seawater all the time. The PMF flame shell beds which are located approximately 660m from the Cable Corridor 2.7 Sanday to Stronsay cable corridor are also far enough that they will not be impacted by installation activities.

Summary of pressures and relevant protected receptors identified for cable corridors in Orkney geographical area

**Table 5-22 Summary of pressures and relevant protected receptors identified for cable corridors in Orkney geographical area**

Potential Pressure	Cable Corridor						
	2.5	2.6	2.7	2.9	2.10	2.11	2.12
Abrasion/disturbance at the surface of the substratum	Reef Habitat	Reef Habitat Sandbanks	Reef Habitat Sandbanks Sandeel	Reef Habitat	Reef Habitat Maerl bed PMF Kelp bed PMF Sandeel	Reef Habitat Kelp Bed PMF Saltmarsh UKBAP	Reef Habitat
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion		Sandbanks	Sandbanks Sandeel		Maerl bed PMF Sandeel	Saltmarsh UKBAP	
Physical change to another seabed type	Reef Habitat	Reef Habitat Sandbanks	Reef Habitat Sandbanks Sandeel	Reef Habitat	Reef Habitat Maerl bed PMF Kelp bed PMF Sandeel	Reef Habitat Kelp Bed PMF	Reef Habitat
Siltation rate changes including smothering (depth of vertical sediment overburden)	Reef Habitat	Reef Habitat	Reef Habitat Sandeel		Reef Habitat Maerl bed PMF Kelp bed PMF Sandeel	Reef Habitat Kelp Bed PMF	Reef Habitat

Blue cells denote cable corridors where a pressure-receptor pathway exists.

## 5.4.2 Compliance and best practice measures – biological environment

The R100 Project within the Orkney 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 5-23, below. When undertaking the assessment, it has been assumed that these measures will be complied with.

**Table 5-23 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 Orkney cable routes, 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 0.016km<sup>2</sup> 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 Sandbanks potential Annex I habitat.
- Potential Annex I Reef: (bedrock reef, stony reef) and related sub-features, including Kelp Bed PMFs.
- Sandeel.
- Maerl Bed PMF.
- Saltmarsh UKBAP

#### **Sediment Habitats including potential Annex I Sandbanks**

Sediment habitats, including potential Annex I sandbanks, 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 and potential Annex I sandbanks has been assessed as negligible and is not significant.

#### **Potential Annex I Reef Habitats including Kelp Bed PMFs**

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 are a sub-feature of Annex I reef habitats, such as *Laminaria hyperborea* on tide-swept, infralittoral rock (EUNIS A3.212) which was identified within the Cable 2.10 cable corridor. 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. 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 Orkney, 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 habitats and kelp bed PMFs has been assessed as negligible and is not significant.

#### **Sandeel**

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 eggs.

Potential suitable sandeel habitat was only found in patches within the cable corridors of Cable Corridors 2.7 Sanday to Stronsay and 2.10 Orkney Mainland to Shapinsay, although there were no sandeel identified during DDV surveys for Cable Corridor 2.10 Orkney Mainland to Shapinsay. The area 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 and is not significant.

#### **Maerl Bed PMF**

Maerl Beds were identified in benthic surveys within the Cable Corridor 2.10 Orkney Mainland to Shapinsay. The Maerl identified is not a feature of a protected site, however Maerl is a PMF and is also given protection under Annex I as a sub-feature habitat and as an indicator of a biodiversity hotspot. Maerl is slow growing, long lived with a very low resistance to change, very low resilience and is highly sensitive to the pressures of cable installation (MarLIN, 2021). The FEAST tool has assessed maerl to be highly sensitive to surface abrasion. Physical disturbance may break up maerl, making it easier for the plants to be displaced through wave action or tidal currents, and may disrupt the physical integrity of the maerl beds (Marine Scotland, 2021). European species of maerl may grow up to 1mm per year and rarely produce reproductive spores making it unlikely to recover following disturbance to the seabed from this pressure.

Due to the high sensitivity and very low resilience and recoverability, there is potential for significant effects to maerl from abrasion / disturbance at the surface of the substratum within the Cable 2.10 Orkney Mainland to Shapinsay cable corridor and project specific mitigation is required to reduce the effect.

Appendix A Shapinsay to Orkney Mainland habitat and PMF mapping Figure 14<sup>1</sup> shows the estimated distribution of maerl beds across the cable corridor. An area of maerl is predicted to occur between approximately 10-20m depth in a patchy distribution with sand/coarse sediment. In deeper areas, near the 20m depth contour the maerl is predicted to occur in a more consistent band across the cable corridor with an estimated width of 200m. Micro-routeing will be undertaken to avoid maerl where possible. Where sections of maerl cannot be avoided, the cable will be surface laid. The footprint of surface lay installation is significantly less than that for the installation plough. As the cable will be stabilised (removing the potential for movement on the seabed), the effects of continued abrasion once the cable is installed are negligible. Therefore, the effects of cable installation will be confined to a footprint of disturbance from surface lay within the maerl bed which is up to approximately 30m<sup>2</sup> (15cm x length of cable through maerl area), worst case.

Due to its high sensitivity and very low resilience and recoverability, there is potential for significant effect to maerl from abrasion and/or disturbance of the substratum within Cable Corridor 2.10 Orkney Mainland to Shapinsay and project specific mitigation is required to reduce the effect.

#### **Saltmarsh**

The recoverability of saltmarsh to direct disturbance is dependent on the plant species present (Allison 1995). Saltmarsh are tolerant to low levels of abrasion from activities such as trampling or vehicle use, which can encourage growth and species richness (Packham and Willis, 1997). However, significant abrasion which displaces vegetation is likely to result in their break-up and loss. Any marine infauna or burrowing insects which are displaced may be injured or be more vulnerable to predation (MarLIN, 2021).

<sup>1</sup> The estimated distribution has been modelled by Envision following a review of geophysical survey data. Areas which had a similar acoustic signature to maerl were inferred to be maerl habitat.

Saltmarsh habitat was found at the southern shore of the Flotta landing point of Cable Route 2.11 Hoy to Flotta. Appendix A Intertidal Survey Report for Hoy to Flotta, Figure 2-2 shows the estimated distribution of maerl beds across the cable corridor<sup>1</sup>. The main area of saltmarsh is approximately 50m south of the BMH, with a small patch of broken saltmarsh in the vicinity of the BMH. Due to the close proximity to the BMH, there is potential for disturbance to saltmarsh during cable burial at the landing point from shore end installation equipment, such as excavators.

Due to the sensitivity of saltmarsh, there is potential for significant effect to saltmarsh from abrasion and/or disturbance of the substratum at the Flotta landing point within Cable Corridor 2.11 Hoy to Flotta and project specific mitigation is required to reduce the effect.

#### 5.4.3.2 Project Specific Mitigation

- M4 - Micro-routeing and surface laying will be undertaken to minimise effects to maerl beds identified within the Cable Corridor 2.10 Orkney Mainland to Shapinsay and a method statement to reduce the impact to maerl will be agreed with NatureScot prior to installation.
- M5 - Micro-routeing will be undertaken, to avoid saltmarsh identified within the Cable Corridor 2.11 Hoy - Flotta corridor, Flotta landing point only.

### 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, PLGR will be undertaken along the proposed cable corridors. Typically 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 debris and obstructions such as wire, derelict fishing gear and this can cause some disturbance to sediments. The sediments along the cable corridors 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 potential Annex I Sandbanks.
- Sandeel.

- Maerl Bed PMF.
- Saltmarsh UKBAP

As Potential Annex I reefs and their sub features, including kelp bed PMFs, 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, including potential Annex I Sandbanks**

Sediment habitats, including Annex I sandbanks, along the cable corridors are mobile bedforms of high energy environments, meaning it has 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, including Annex I sandbanks has been assessed as negligible and is not significant.

#### **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 only found in patches within the cable corridors of cable routes 2.7 Sanday to Stronsay and 2.10 Orkney Mainland to Shapinsay, although there were no sandeel identified during DDV surveys within the 2.10 Orkney Mainland to Shapinsay cable corridor. However, 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 and is not significant

#### **Maerl Beds PMF**

Maerl Beds were identified in benthic surveys within Cable Corridor 2.10 Orkney Mainland to Shapinsay. Maerl has very low resistance to change, very low resilience and is highly sensitive to the pressures of cable installation (MarLIN, 2021). Sub-surface abrasion or penetration can break up the maerl, making it easier for it to be displaced through wave action or tidal currents and disrupt the physical integrity of the maerl beds (Marine Scotland, 2021). The FEAST tool has therefore assessed them to be highly sensitive to this pressure (Marine Scotland, 2021). European species may grow up to 1mm per year and rarely produce reproductive spores. This makes recovery following disturbance to the seabed from cable installation activities unlikely, leading to a loss of habitat extent.

Due to the high sensitivity and very low resilience and recoverability, there is potential for significant effects to maerl from penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion within Cable Corridor 2.10 Orkney Mainland to Shapinsay. Project specific mitigation is required to reduce the effect.

Where sections of maerl cannot be avoided, the cable will be surface laid. As PLGR is only required prior to cable burial, there will be no PLGR used within the extent of the maerl bed. Surface lay installation will have no impact on the substrate below the seabed, therefore implementation of the mitigation will remove the pressure-receptor pathway.



Due to its high sensitivity and very low resilience and recoverability, there is potential for significant effect to maerl from abrasion and/or disturbance of the substratum within Cable Corridor 2.10 Orkney Mainland to Shapinsay and project specific mitigation is required to reduce the effect.

#### **Saltmarsh**

The recoverability of saltmarsh to direct disturbance is dependent on the plant species present (Allison 1995). Removal of the vascular plants from their substratum by penetration is likely to result in their break-up and loss. Most of the marine infaunal species are also likely to be adversely affected by abrasion that penetrates the sediment, and a proportion of the population will probably be lost or will be more vulnerable to predation if they are removed from the sediment (MarLIN, 2021).

Saltmarsh was identified at the Flotta landing point of Cable Route 2.11 Hoy to Flotta. The main area of saltmarsh present at this landing point is 50m south of the BMH, so it unlikely to be impacted by the installation activities. However, a small patch of broken saltmarsh is present in the vicinity of BMH at the Flotta landing point of Cable Route 2.11 Hoy to Flotta which could be affected.

Due to the sensitivity of saltmarsh, there is potential for significant effect to saltmarsh from penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion within the Cable 2.11 Hoy to Flotta cable corridor and project specific mitigation is required to reduce the effect.

#### **5.4.4.2 Project Specific Mitigation**

- M4 - Micro-routeing and surface laying will be undertaken to minimise effects to maerl beds identified within Cable Corridor 2.10 Orkney Mainland to Shapinsay and a method statement to reduce the impact to maerl will be agreed with NatureScot prior to installation.
- M5 - Micro-routeing will be undertaken to avoid saltmarsh identified within Cable Corridor 2.11 Hoy - Flotta at the Flotta landing point.

### **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, 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 will only potentially be used at cable crossings. As there are no cable crossings within the Orkney geographical area, concrete mattresses are unlikely to be used for cable routes in the Orkney geographical area.

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 route has been given in Table 5-22.

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

- Sediment habitats, including potential Annex I Sandbanks.
- Potential Annex I Reef Habitats including Kelp Bed PMFs
- Sandeel.
- Maerl Bed PMF.

#### **Sediment Habitats including Annex I Sandbanks**

In areas of softer sediments, it is likely that the cable will achieve adequate burial depth, so cable protection measures will not be implemented. The only potential for introduction of rock bags or concrete mattresses in soft sediment areas will be for a requirement of a crossing agreement. As there are no cable crossings within the Orkney geographical region, there is unlikely to be any cable protection measures used in soft sediments.

No effect.

#### **Potential Annex I Reef Habitats including Kelp Bed PMFs**

In 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), 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 Orkney 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 Annex I reef habitats and Kelp Bed PMFs has been assessed as minor and is not significant.

#### **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. However, there is unlikely to be any external protection used in soft sediment in, as described above.

No effect.

#### **Maerl Bed PMF**

Maerl beds occur on clean gravel or coarse sand, either on the open coast or in tide-swept channels of marine inlets. They are therefore highly sensitive to a change from sediment to a solid substrate. Tolerance to physical change to another seabed type is low, and the pressure is permanent, so recovery is low (Marine Scotland, 2021). The deposit of external cable protection within an area of Maerl bed would result in a significant effect.

Due to the high sensitivity and very low tolerance and recoverability, there is potential for significant impact to maerl from physical change to another seabed type within Cable Corridor 2.10 Orkney Mainland to Shapinsay. It is unlikely that rock placement or rock berms will be used within the maerl

beds within Cable Corridor 2.10 Orkney Mainland to Shapinsay. However, should rock bags be used, due to the high sensitivity and very low resilience and recoverability, there is potential for significant effects to maerl from physical change to another seabed type. Project specific mitigation is required to reduce the effect.

Due to its high sensitivity and very low resilience and recoverability, there is potential for significant effect to maerl from physical change to another seabed type within Cable Corridor 2.10 Orkney Mainland to Shapinsay and project specific mitigation is required to reduce the effect.

#### 5.4.5.2 Project Specific Mitigation

- M4 - Micro-routeing and surface laying will be undertaken to minimise effects to maerl beds identified within Cable Corridor 2.10 Orkney Mainland to Shapinsay and a method statement to reduce the impact to maerl will be agreed with NatureScot prior to installation.

### 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 Habitats including Kelp Bed PMFs
- Sandeel.
- Maerl Bed PMF.

#### **Potential Annex I Reef Habitats including Kelp Bed PMFs**

The sensitivity of reef habitats and kelp beds 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 Habitats including Kelp Bed PMFs has been assessed as negligible and is not significant.

#### **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 only found in patches within Cable Corridor 2.7 Sanday to Stronsay and Cable Corridor 2.10 Orkney Mainland to Shapinsay, although there were no sandeel identified during DDV surveys of Cable Corridor 2.10 Orkney Mainland to Shapinsay. Therefore, the impact to sandeel will be 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 and is not significant.

#### **Maerl Bed PMF**

Maerl beds have high sensitivity to siltation changes (Marine Scotland, 2021). Smothering of the main structural species, *Phymatolithon calcareum*, can result in a major decline in species richness for the area. Once a population has become extinct, the lack of propagules means that it is unlikely that it will be re-established. Even if reproductive propagules arrive from elsewhere, with the very slow growth rate of *Phymatolithon calcareum*, it will take a very long time to re-establish a similar population. The habitat has been assessed as having a very low recoverability from smothering (Marine Scotland, 2021).

Sediment deposition can occur from ploughing or ROV jetting up to approximately 66m to 70m from the maerl, depending on the adjacent sediment types. Significant sediment deposition could occur from ploughing or ROV up to 10m from the maerl. Therefore, due to the high sensitivity and very low tolerance and recoverability, there is potential for significant impact to maerl from siltation rate changes including smothering (depth of vertical sediment overburden) within the 2.10 Orkney Mainland to Shapinsay cable corridor and project specific mitigation is required to reduce the effect.

As described above, to mitigate the impact of cable installation micro-routeing will be undertaken to avoid maerl. Where micro-routeing is not feasible the cable will be surface laid to minimise the footprint across the maerl bed. Sediment disturbance from surface lay cable is negligible and unlikely to raise suspended sediment above background levels. With the implementation of mitigation the effect of cable installation on the maerl beds will be reduced to not significant.

Due to the high sensitivity and very low tolerance and recoverability, there is potential for significant effect to maerl from siltation rate changes including smothering (depth of vertical sediment overburden) within Cable Corridor 2.10 Orkney Mainland to Shapinsay and project specific mitigation is required to reduce the effect.

#### **5.4.6.2 Project Specific Mitigation**

- M4 - Micro-routeing and surface laying will be undertaken to minimise effects to maerl beds identified within Cable Corridor 2.10 Orkney Mainland to Shapinsay and a method statement to reduce the impact to maerl will be agreed with NatureScot prior to installation.

### 5.4.7 Conclusion

In conclusion, the installation of the cable routes will not cause significant impacts to protected benthic features or sensitive habitats within the Orkney geographical area, except for potential impact to maerl beds in Cable Corridor 2.10 Orkney Mainland to Shapinsay, and saltmarsh at the Flotta landing point of Cable Corridor 2.11 Hoy to Flotta.

The following project-specific mitigation has been proposed to avoid significant impact to maerl beds and saltmarsh:

- M4 - Micro-routeing and surface laying will be undertaken to minimise effects to maerl beds identified within Cable Corridor 2.10 Orkney Mainland to Shapinsay and a method statement to reduce the impact to maerl will be agreed with NatureScot prior to installation.
- M5 - Micro-routeing will be undertaken to avoid saltmarsh identified within Cable Corridor 2.11 Hoy - Flotta at the Flotta landing point.

By applying project specific mitigation, there will be no impact to protected benthic features or sensitive habitats within the Orkney geographical area.

## 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 5-23 highlights the periods when marine mammal, marine turtles, European otter and basking shark are most likely to be present within the Orkney geographical area.



**Table 5-24 Seasonal summary of marine mammal, fish and reptile presence within the Orkney geographical area**

Receptor	Associated protected area* within Orkney	Winter			Summer						Winter		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Harbour porpoise													
White beaked dolphin													
Bottlenose Dolphin													
Minke whale													
Killer whale													
Risso's dolphin													
Grey seal													
Harbour seal													
Leatherback turtle													
Basking shark													
Otter													
Key		Breeding											
		Present											
		Moulting											
		Unlikely to be present in significant numbers											

## 5.5.2 Fish

There are no protected sites designated for fish species within the search area for the cable corridors in the Orkney 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 sites (two Special Area of Conservation (SACs) and one Site of Special Scientific Interest (SSSI)) where there exists potential for either grey seal or 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.

Seals 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 generated 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).

The Habitats Regulation Appraisal (HRA), presented in the Protected Sites Assessment, concluded that Appropriate Assessment (AA) should be undertaken for the Faray and Holm of Faray SAC for potential visual and underwater noise disturbance to grey seal. Information to inform AA concluded that as Cable Corridor 2.5 Eday to Westray is within the SAC, mitigation should be implemented to reduce the significance of effects.

The HRA also concluded that AA should be undertaken for the Sanday SAC for potential underwater noise disturbance to harbour seal. However, information to inform the AA concluded that due to the distance of all the cable corridors to the SAC (approximately 3.6km from the closest cable corridor - Cable Corridor 2.7 Sanday to Stronsay), a likely significant effect can be excluded.

The potential for installation works to hinder the achievement of the management objectives for the Eynhallow SSSI was also assessed within the Protected Sites Assessment. Assessment concluded that as the disturbance will be temporary and localised, there will be no potential for significant adverse effects on harbour seals.

The information to inform AA concluded that with the implementation of the mitigation measures prescribed below, the proposed installation activities will not have an adverse effect on the integrity of any Protected Sites, and their conservation objectives will be maintained.

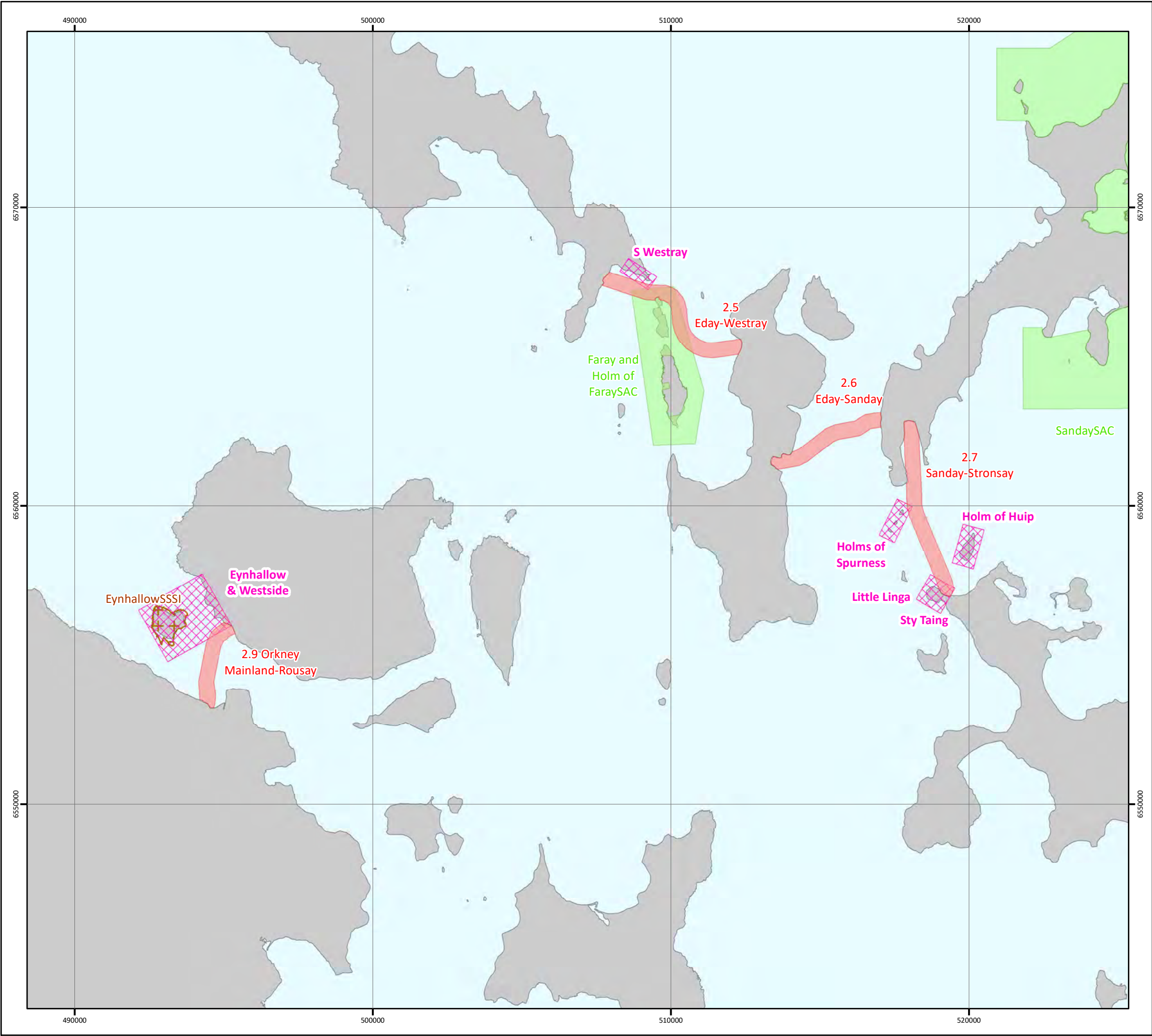
Whilst seals from these protected sites could be found foraging within other cable corridors in the Orkney geographical area, as underwater noise from the installation activities is well below the threshold for injury to seal, and the installation activities are temporary there will be no long-lasting,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

In addition to the protected sites which list seal as a Qualifying Interest, there are several designated haul out sites in the vicinity of the cable corridors. These 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). Haul-out sites within 500m of the cable corridors were identified and are outlined in Table 5-24 below and are shown in Figure 5-11 (Drawing Reference: P2308-MAMM-004\_OR).

**Table 5-25 Relevant designated seal haul-out sites**

Haul-Out Site Name	Cable Corridor	Distance to boundary (m)*	Distance to land (m)*	Species
S Westray	2.5 – Eday-Westray	0 (within)	98	Grey seal
Holms of Spurness	2.7 – Sanday - Stronsay	0 (within)	144	Grey seal
Holm of Huip	2.7 – Sanday - Stronsay	224	570	Grey seal
Sty Taing	2.7 – Sanday - Stronsay	0 (within)	0 (within)	Grey seal
Eynhallow and Westside	2.9 – Orkney Mainland - Rousay	0 (within)	0 (within)	Harbour seal and grey seal

\*Distances are measured at the closest point between the cable corridor and the designated haul-out site.



SCOTTISH ISLES  
FIBRE OPTIC CABLE PROJECT  
MARINE MAMMALS  
Relevant Seal Designated Haul-Out Sites  
and Protected Sites

Drawing No: P2308-MAMM-004\_OR

A

Legend

Cable Route Application Corridor

Designated Seal Haul-out Site

Environmental Designation

SAC

SSSI

N

W

E

S

NOTE: Not to be used for Navigation

Date	28 September 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ESRI; OSOD; SNH; MS
File Reference	J:\P2308\Mxd\09_MAMM\ P2308-MAMM-004_OR.mxd
Created By	Jess Harvey
Reviewed By	Chris Dawe
Approved By	Paula Daglish

BT

Global Marine

intertek

0

1.5

3

4.5

6

km

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#### **Assessment for S Westray and Holms of Spurness designated haul out site**

There is potential for visual disturbance from the installation vessels to seals hauled out at S Westray and Holms of Spurness during installation of Cable Corridor 2.5 Eday to Westray. However, the installation vessels will only be within 500m of the land at S Westray for 2km and 1km for Holms of Spurness. Should ploughing be undertaken along this cable corridor, the vessel would only be laying within 500m of the designated haul out site for approximately 3.3 hours for S Westray, and 1.7 hours for Holms of Spurness (based on an installation speed of 0.6km/hour for up to 2km and 1km, respectively), worst case. The installation activity is a one-off occurrence and will not be repeated. Therefore, as seal hauled out within S Westray and Holms of Spurness designated haul out sites will only be subject to a one-off, temporary and localised disturbance, there will be no significant disturbance.

#### **Assessment for Holm of Huip designated haul out site**

As the land within Holm of Huip is more than 500m away from the cable corridors, there will be no visual disturbance to seals hauled out within this designated haul out site from the installation activities.

#### **Assessment for Sty Taing designated haul out site**

The Stronsay landing point for Cable Corridor 2.7 Sanday to Stronsay is almost entirely within the Sty Taing designated haul out site. The site is designated for grey seal, which are most sensitive during their breeding season between October and December. Disturbance during this period could impact the success of seal pups, as discussed in Appendix C – Protected Sites Assessment. Therefore, there is potential for significant disturbance to seals, should installation activities for Cable Corridor 2.7 occur between October and December.

#### **Assessment for Eynhallow and Westside designated haul out site**

Cable Corridor 2.9 Orkney Mainland to Rousay overlaps with Eynhallow and Westside designated haul out site for an area of approximately 1.3km<sup>2</sup> at Rousay. Offshore installation vessels will only be within 500m of the designated haul out for approximately 700m. Should ploughing be undertaken along this cable corridor, the vessel would only be laying within 500m of the designated haul out for approximately 1.2 hours (based on an installation speed of 0.6km/hour for up to 700m), worst case. Therefore, seal hauled out within Eynhallow and Westside designated haul out site will only be subject to a one-off, temporary, and localised disturbance from installation vessels.

The BMH for seals is within 500m (56m) of the Eynhallow and Westside designated haul out site. Therefore, shore-end installation activities, such as shore-end burial using excavators, will be within 500m of the designated haul out site. Whilst the topography of the coastline is likely to eliminate visual disturbance to seals on the north western side of the designated haul out, there is potential for significant visual disturbance to hauled out seals within the designated haul out site adjacent to the Rousay landing point. Screens can be used to reduce the impact to wildlife from visual and noise disturbance. Therefore, by placing screens northwest of the BMH between the installation activities and the designated haul out prior to the commencement of shore end installation, disturbance to seals hauled out within Eynhallow and Westside designated haul out site will be reduced. The shore end burial is also estimated to take up to 6 days (as outlined in Chapter 2: Project Description) including contingency, however it is likely to be much less than this. Therefore, as the installation will be a one-off event, and temporary disturbance, and through the implementation of mitigation screens to reduce visual disturbance to hauled out seals, there will be no significant impact to seals.

#### **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 hauled-out seal in the Orkney geographical area is summarised below:



- M1 - Installation activities should not occur at Cable Corridor 2.5 Eday to Westray during the peak grey seal breeding season in October and November (inclusive).
- M4 - Installation activities should not occur at Cable Corridor 2.7 Sanday to Stronsay during the peak grey seal breeding season in October and November (inclusive).
- M6 - Screens should be used to reduce visual disturbance to grey seal for installation activities for Cable Corridor 2.9 at the Rousay landing point.

#### 5.5.4 Eurasian otter (*Lutra lutra*)

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

Standard walkover surveys (NatureScot, 2019) were undertaken between 13/08/2021 and 15/09/2021 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.

Surveys undertaken at all cable landing points identified potential for otters at all landing points within Orkney, as shown in Table 5-25. It should be noted that there are no designated sites which list otter as a primary or qualifying interest feature within 1km of any of the landing points.

**Table 5-26 Otter presence in the vicinity of each Orkney cable**

Corridor	Landfall	NBN records in proximity to cable landing point*	Otters Present? (As determined by otter surveys)	Otter Survey Findings
2.5	Westray	2	Yes	<ul style="list-style-type: none"> <li>▪ No otters sighted</li> <li>▪ Spraints identified next to BMH</li> </ul>
	Eday		Yes	<ul style="list-style-type: none"> <li>▪ No otters sighted</li> <li>▪ Old spraints identified in area</li> </ul>
2.6	Sanday	3	Yes	<ul style="list-style-type: none"> <li>▪ Old and recent spraints identified in area</li> <li>▪ Possible resting places identified</li> <li>▪ No holt identified</li> </ul>
	Eday		Yes	<ul style="list-style-type: none"> <li>▪ Old otter spraints identified</li> <li>▪ Partial prints found in wet mud</li> </ul>
2.7	Sanday	None	Yes	<ul style="list-style-type: none"> <li>▪ Old spraint on culvert parapet</li> <li>▪ Indistinct prints in soft mud</li> <li>▪ Short trail identified with muddy tussocks adjacent</li> </ul>
	Stronsay		Yes	<ul style="list-style-type: none"> <li>▪ Old otter spraint identified west of the proposed landing point</li> <li>▪ Old spraint identified in uninhabited farmyard</li> </ul>

Corridor	Landfall	NBN records in proximity to cable landing point*	Otters Present? (As determined by otter surveys)	Otter Survey Findings
2.9	Rousay	1	Yes	<ul style="list-style-type: none"> <li>Recent and old spraint beside slabs with a hole</li> <li>Old and recent spraint identified around the area</li> </ul>
	Orkney		Yes	<ul style="list-style-type: none"> <li>No otters sighted</li> <li>Potential resting site in shed next to the BMH with old spraint and a trail identified</li> </ul>
2.10	Orkney	None	Yes	<ul style="list-style-type: none"> <li>No otters sighted</li> <li>No otter signs identified</li> <li>Resting place with potential for otter ~175m NW of the BMH</li> </ul>
	Shapinsay		Yes	<ul style="list-style-type: none"> <li>Old and recent spraints identified in various areas</li> <li>One old spraint found in disused pumphouse which could be a potential shelter</li> </ul>
2.11	Flotta	None	Yes	<ul style="list-style-type: none"> <li>Potential drying spot identified</li> <li>Potential lie-up identified down side of ditch towards iris clump</li> <li>Small cave with one old spraint located outside</li> <li>Small cave with one recent spraint located outside</li> <li>Recent spraints identified in area</li> </ul>
	Hoy		Yes	<ul style="list-style-type: none"> <li>Well used sprainting point but not recently used near man-made hole in a mound</li> <li>One old spraint near Martello tower</li> </ul>
2.12	Flotta	1	Yes	<ul style="list-style-type: none"> <li>One old spraint at ditch outfall onto beach</li> <li>Old and recent spraints identified in various locations</li> <li>Potential shelter in two locations</li> </ul>
	South Ronaldsay		Yes	<ul style="list-style-type: none"> <li>Path/trail shore track down into tussocky grassland</li> <li>Spraint on path/trail between shore and lagoon</li> <li>Wind-thrown willow inside scrub area; a rather damp space under roots 1 m x 0.5 m x 0.5 m; no otter signs</li> </ul>

\* National Biodiversity Network (NBN Atlas, 2021).

## 5.5.5 Birds

### 5.5.5.1 Assessment summary

The HRA and SSSI assessment, presented in the Protected Sites Assessment (Appendix C), identified nine Special Protection Areas (SPA), two proposed Special Protection Areas (pSPA) 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 has been provided.

No protected sites require AA for changes in supporting habitat and prey availability due to the distance from the cable corridors, or due to the small footprint of the installation activities within the protected site.

Sites which require AA, and the qualifying bird species that have been screened through to AA, are summarised in Table 5-26. 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 5-27.

The assessment concluded that of the 11 SPAs and pSPAs, in the absence of mitigation, LSE could occur to the qualifying interests of North Orkney pSPA and Scapa Flow pSPA. As a result, project specific mitigation measures have been proposed to prevent LSE from occurring to one sensitive moulting species.

The information to inform AA concluded that with the implementation of the mitigation measures prescribed below, the proposed installation activities will not have an adverse effect on the integrity of any Protected Sites, and their conservation objectives will be maintained.

**Table 5-27 A summary of screening decisions for birds in protected sites within Orkney.**

Qualifying Feature	Calf of Eday SPA	Copinsay SPA	East Sanday Coast SPA	Hoy SPA	Orkney Mainland Moors SPA	Pentland Firth Islands SPA	Rousay SPA	Switha SPA	West Westray SPA	North Orkney pSPA	Scapa Flow pSPA	Doomy and Whitemaw Hill SSSI
Cormorant ( <i>Phalacrocorax carbo</i> )	B											
Guillemot ( <i>Uria aalge</i> )	B	B		B			B		B			
Red-throated diver ( <i>Gavia stellata</i> )				B	B					B	B	
Puffin ( <i>Fratercula arctica</i> )				B								
Arctic tern ( <i>Sterna paradisaea</i> )						B	B		B			
Razorbill ( <i>Alca torda</i> )									B			
Common goldeneye ( <i>Bucephala clangula</i> )											NB	
Common eider ( <i>Somateria mollissima</i> )										NB	NB	
European shag ( <i>Phalacrocorax aristotelis</i> )										NB	NB	
Long tailed duck ( <i>Clangula hyemalis</i> )										NB	NB	
Red-breasted merganser ( <i>Mergus serrator</i> )										NB	NB	
Great northern diver ( <i>Gavia immer</i> )										NB	NB	
Slavonian grebe ( <i>Podiceps auratus</i> )										NB	NB	
Velvet scoter ( <i>Melanitta fusca</i> )										NB		
Black throated diver ( <i>Gavia arctica</i> )											NB	
Whimbrel ( <i>Numenius phaeopus</i> )												B
Greenland barnacle goose								NB				
Great skua ( <i>Stercorarius skua</i> )				B								
Arctic skua ( <i>Stercorarius parasiticus</i> )				B			B		B			B
Fulmar ( <i>Fulmarus glacialis</i> )	B	B		B			B		B			
Kittiwake ( <i>Rissa tridactyla</i> )	B	B		B			B		B			
Great black-backed gull ( <i>Larus marinus</i> )	B	B		B								
Bar-tailed godwit ( <i>Limosa lapponica</i> )			NB									
Purple sandpiper ( <i>Calidris maritima</i> )			NB									
Turnstone ( <i>Arenaria interpres</i> )			NB									
Peregrine ( <i>Falco peregrinus</i> )				B								
Hen Harrier ( <i>Circus cyaneus</i> )					NB							
Short-eared owl ( <i>Asio flammeus</i> )					B							
<b>Key:</b>	Screened In	B = Breeding										
	Screened Out	NB = Non-Breeding										

**Table 5-28 Summary of birds screened in for AA**

Qualifying Feature		Woodhall et al., 2019	Joint SNCB, 2017		Suggested seasonal definitions for birds in the Scottish Marine Environment (NatureScot, 2020)											
		Mean-Max Foraging Range (km)	Disturbance Susceptibility	Habitat Specialisation	Winter			Summer						Winter		
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Auks																
Atlantic puffin ( <i>Fratercula arctica</i> )		137.1	2	3												
Guillemot ( <i>Uria aalge</i> )		73.2	3	3												
Razorbill ( <i>Alca torda</i> )		88.7	3	3												
Cormorants and Shags																
Cormorant ( <i>Phalacrocorax carbo</i> )		25.6	4	3												
European shag ( <i>Phalacrocorax aristotelis</i> )		13.2	3	3												
Divers																
Black-throated diver ( <i>Gavia arctica</i> )		Unknown	5	4												
Great northern diver ( <i>Gavia immer</i> )		Unknown	5	3												
Red-throated diver ( <i>Gavia stellata</i> )		9.0	5	4												
Sea Ducks and Grebes																
Common eider ( <i>Sometaria mollissima</i> )		21.5	3	4												
Common goldeneye ( <i>Bucephala clangula</i> )		Unknown	4	4												
Long tailed duck ( <i>Clangula hyemalis</i> )		Unknown	3	4												
Red-breasted merganser ( <i>Mergus serrator</i> )		Unknown	3	4												
Slavonian grebe ( <i>Podiceps auratus</i> )		Unknown	3	4												
Velvet scoter ( <i>Melanitta fusca</i> )		Unknown	5	3												
Gulls and Terns																
Arctic tern ( <i>Sterna paradisaea</i> )		25.7	2	3												
Kittiwake ( <i>Rissa tridactyla</i> )		156.1	2	2												
Petrels																
Northern fulmar ( <i>Fulmarus glacialis</i> )		542.3	1	1												
Skuas																
Arctic skua ( <i>Stercorarius parasiticus</i> )		62.5	1	2												
Great skua ( <i>Stercorarius skua</i> )		443.3	1	2												
Waders																
Whimbrel ( <i>Numenius phaeopus</i> )		Unknown	Unknown	Unknown												
Marine Mammals																
Grey seal ( <i>Halichoerus grypus</i> )		>100 (NatureScot, 2021d)	N/A	N/A												
Harbour seal ( <i>Phoca vitulina</i> )		21 (DECC, 2016).	N/A	N/A												
Key																
		Bird breeding season / Seal pupping season (NatureScot, 2021d)														
		Present														
		Period of flightless moult for common eider														
		Unlikely to be present in significant numbers														



### 5.5.5.2 Project specific mitigation

Project specific mitigation, as proposed in the Protected Site Assessment (Appendix C) to avoid impact on breeding and moulting bird species in the Orkney geographical area is summarised below:

- M2 - The 'Guide to Best Practice for Watching Marine Wildlife' guidance on birds will be followed where practicable, for installation activities for Cable Corridor 2.10 Orkney Mainland to Shapinsay, Cable Corridor 2.11 Hoy to Flotta and Cable Corridor 2.12 Flotta to South Ronaldsay to prevent LSE to moulting common eider.

## 5.6 Project specific mitigation

Project Specific Mitigation measures are measures which are not part of the project design and have been proposed to reduce or offset potential environmental impacts. Table 5-29 provides details of the project specific mitigation measures proposed for each of the proposed cable corridors relating to biological features.

**Table 5-29 Project specific mitigation measures for the Orkney geographical area**

ID	Aspect	Project specific mitigation	2.5	2.6	2.7	2.9	2.10	2.11	2.12
M1	Pinniped	Installation activities should not occur at Cable Corridor 2.5 Eday to Westray during the peak grey seal breeding season in October to December(inclusive).							
M2	Birds	The 'Guide to Best Practice for Watching Marine Wildlife' guidance on birds will be followed where practicable, for installation Activities for Cable Corridor 2.10 Orkney Mainland to Shapinsay, Cable Corridor 2.11 Hoy to Flotta and Cable Corridor 2.12 Flotta to South Ronaldsay to prevent LSE to moulting common eider.							
M3	Pinniped	Installation activities should not occur at Cable Corridor 2.7 Sanday to Stronsay during the peak grey seal breeding season in October to December (inclusive)							
M4	Maerl	Micro-routeing and surface laying will be undertaken to minimise effects to maerl beds identified within Cable Corridor 2.10 Orkney Mainland to Shapinsay and a method statement to reduce the impact to maerl will be agreed with NatureScot prior to installation.							
M5	Saltmarsh	Micro-routeing will be undertaken to avoid saltmarsh identified within Cable Corridor 2.11 Hoy - Flotta at the Flotta landing point.							
M6	Pinniped	Screens should be used to reduce visual disturbance to grey seal for installation activities for Cable Route 2.9 at the Rousay landing point.							

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

## 5.7 Conclusion

The environmental appraisal 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 maerl beds PMF, saltmarsh, grey seal and harbour seal. Where appropriate, project specific mitigation has been proposed to prevent significant effects from occurring.

## 6. HUMAN ENVIRONMENT

### 6.1 Introduction

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

### 6.2 Existing baseline conditions

#### 6.2.1 Marine Archaeology

##### 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 Orkney 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 3 known locations of historical interest within three cable corridors within the Orkney geographical area; namely Cable Corridor 2.9 Orkney Mainland-Rousay, Cable Corridor 2.11 Hoy-Flotta, and Cable Corridor 2.12 Flotta-South Ronaldsay. The known charted historical assets within 500m of the Orkney cable corridors are outlined within Table 6-1.

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

Corridor	Distance from corridor (m)	Description of archaeological asset	Type
2.3 Sanday to Shetland *	708m	Mount Misery chambered cairn	Prehistoric ritual and funerary
2.6 Eday-Sanday	66m	Bay of London, mound 290m SE of Youth Hostel, Eday	Scheduled Monument
2.9 Orkney Mainland-Rousay	0m	Heart of Neolithic Orkney World Heritage Site Sensitive Area	World Heritage Site
	239m	Westness, Viking houses, noost & graveyard	Scheduled Monument
2.10 Orkney Mainland-Shapinsay	387m	Rerwick Head, coastal battery (WW2) and camp	Scheduled Monument
2.11 Hoy-Flotta	0m	Crockness, Martello Tower, Long Hope	Scheduled Monument
	0m	Dangerous wreck	Wrecks and Obstructions
2.12 Flotta-South Ronaldsay	0m	Wreck showing any portion of hull or superstructure	Wrecks and Obstructions
	0m	Dangerous wreck	Wrecks and Obstructions

Note: \* Corridor 2.3 Sanday to Shetland is being assessed within the Shetland Marine Licence Application package, however, the corridor has been included here as it has a cable landing within Orkney which may be of interest to Orkney Island Council.

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\_R5391 Rev 0) and summarised to provide pertinent information associated with potential shipping and navigation risks in the Orkney 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 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 search area from each cable corridor in Orkney. Average monthly vessel density across the region of Orkney is shown in Figure 6-1 (P2308-SHIP-014\_OR) 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 Orkney geographical area ranges from low 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 Orkney geographical area are presented within Appendix E - NRA and are summarised below:

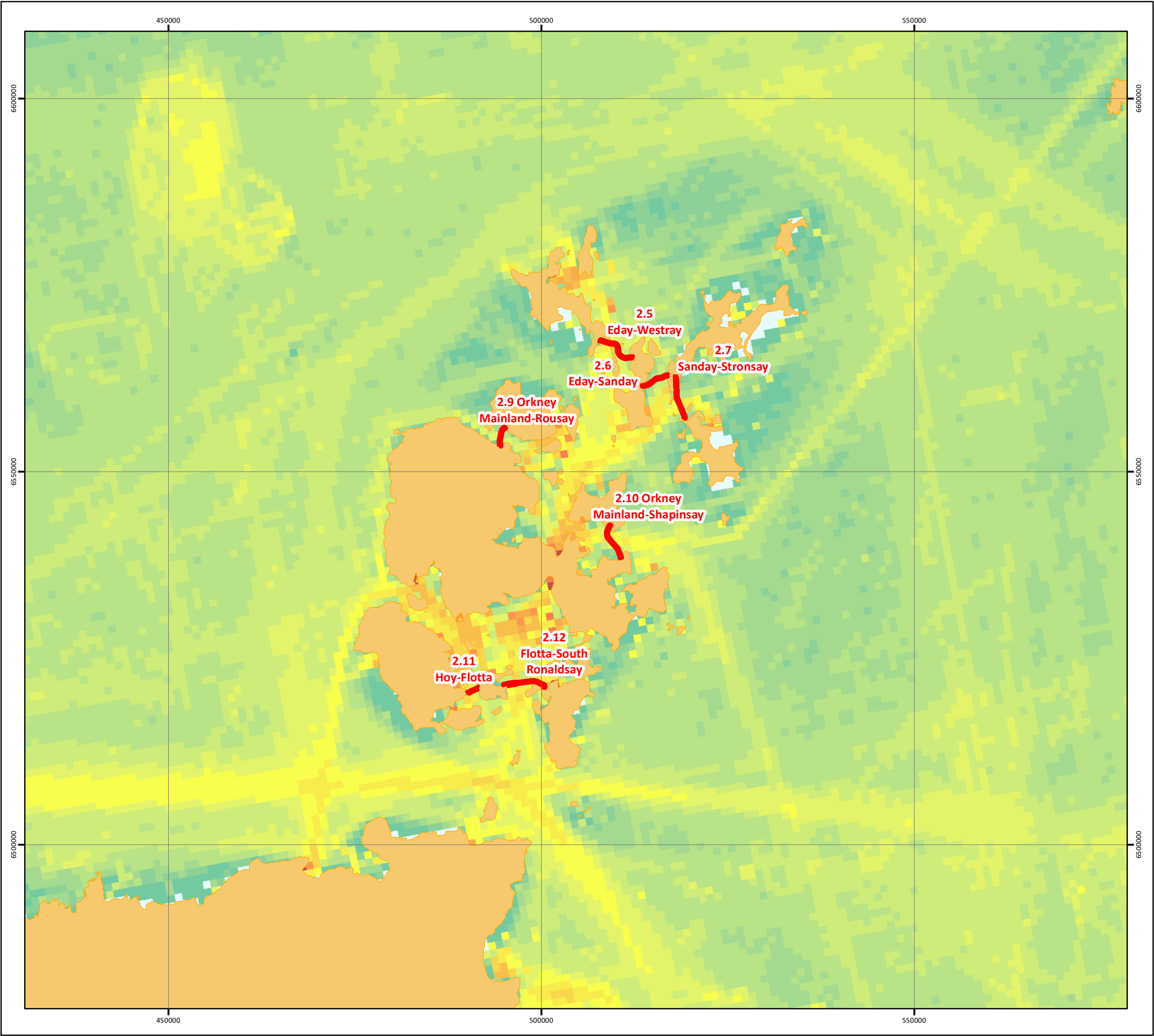
- **Cable Corridor 2.5 - Eday – Westray** – Anchorages are located in Rapness Sound off Westray and in Furness Bay on the west coast of Eday, both in water depths of less than 10m.
- **Cable Corridor 2.12 - Flotta – South Ronaldsay** - A navigation beacon, on a very small island, is located at the central northern part of the study area and Hoxa head lighthouse is located at the most south-eastern part of the study area.
- **Cable Corridor 2.10 - Orkney Mainland – Shapinsay** - A pilot boarding station is located approximately 1km from the cable route corridor. Project vessels may need to give way to pilots boarding and landing in the immediate area and for larger vessels needing pilotage through the study area.

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 Orkney**

Cable Corridor	General AIS Intensity (vhpy)	Number and Name of Ferry Routes in Study Area	Number and Name of Ports Within Vicinity of Study Area
2.5 Eday-Westray	Very Low (2-5)	<b>4 (transect cable corridor)</b> <ul style="list-style-type: none"> <li>▪ Westray to Pap Westray</li> <li>▪ Papa Westray to Kirkwall</li> <li>▪ Kirkwall to North Ronaldsay</li> <li>▪ Kirkwall to Westray</li> </ul>	<b>1</b> <ul style="list-style-type: none"> <li>▪ Rapness port</li> </ul>
2.6 Eday-Sanday	Very Low (1-2)	<b>3 (do not transect cable corridor)</b> <ul style="list-style-type: none"> <li>▪ Eday to Sanday</li> <li>▪ Kirkwall to Sanday</li> <li>▪ Sanday to Stronsay</li> </ul>	<b>1</b> <ul style="list-style-type: none"> <li>▪ Loth Port</li> </ul>
2.7 Sanday-Stronsay	Low (5-10)	<b>3 (transect cable corridor)</b> <ul style="list-style-type: none"> <li>▪ Eday to Stronsay</li> <li>▪ Sanday to Stronsay</li> <li>▪ Kirkwall to Stronsay</li> </ul> <b>2 (do not transect cable corridor)</b> <ul style="list-style-type: none"> <li>▪ Eday to Sanday</li> <li>▪ Kirkwall to Sanday</li> </ul>	<b>2</b> <ul style="list-style-type: none"> <li>▪ Loth Port</li> <li>▪ Whitehall Pier Marina</li> </ul>
2.9 Orkney Mainland-Rousay	Very Low (0-5)	<b>0</b>	<b>0</b>
2.10 Orkney Mainland-Shapinsay	Very Low (0-5)	<b>2 (transect cable corridor)</b> <ul style="list-style-type: none"> <li>▪ Kirkwall to Lerwick</li> <li>▪ Aberdeen to Kirkwall</li> </ul>	<b>0</b>
2.11 Hoy-Flotta	Very Low (1-5)	<b>3 (transect cable corridor)</b> <ul style="list-style-type: none"> <li>▪ South Walls to Flotta</li> <li>▪ Hoy to South Walls</li> <li>▪ Hoy to Flotta</li> </ul> <b>2 (do not transect cable corridor)</b> <ul style="list-style-type: none"> <li>▪ Houton to Hoy</li> <li>▪ Houton to Flotta</li> </ul>	<b>2</b> <ul style="list-style-type: none"> <li>▪ Lyness Port</li> <li>▪ Flotta Port</li> </ul>
2.12 Flotta-South Ronaldsay	Low (5-10)	<b>1 (transect cable corridor)</b> <ul style="list-style-type: none"> <li>▪ Gills Bay to South Ronaldsay</li> </ul>	<b>1</b> <ul style="list-style-type: none"> <li>▪ St Margaret's Hope Port</li> </ul>





SCOTTISH ISLES  
FIBRE OPTIC CABLE PROJECT

AIS VESSEL DENSITY  
Average Monthly Vessel Density  
All Vessels - Orkney

Drawing No: P2308-SHIP-014\_OR

A

Legend

Cable Route Application Corridor

2019 Vessel Density

Vessel Hours (per km²)

0

< 0.05

0.05 - 0.1

0.1 - 0.2

0.2 - 0.5

0.5 - 1

1 - 2

2 - 5

5 - 10

10 - 20

20 - 50

50 - 100

100 - 200

200 - 500

> 500

W

N

E

S

NOTE: Not to be used for Navigation

Date

17 June 2021

Coordinate System

WGS 1984 UTM Zone 30N

Projection

Transverse Mercator

Datum

WGS 1984

Data Source

EMODnet; GEBCO; ESRI;

File Reference

J:\P2308\Mxd\04\_SHIP\  
P2308-SHIP-014\_OR.mxd

Created By

Chris Dawe

Reviewed By

Abigale Nelson

Approved By

Paula Daglish

BT

Global Marine

intertek

0

5

10

15

20

km

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### 6.2.2.2 Recreation

Appendix E (Document Ref: P2308-R5391-AppD-OrkneyNRA) 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 Orkney geographical area is generally low. The following two cable corridors are shown to have a higher level of recreational boating activity than the other Orkney cable corridors:

- Cable Corridor 2.10 - Orkney Mainland to Shapinsay (see Figure 3.17, Appendix E Document Ref: P2308-R5391-AppD-Orkney-NRA)
- Cable Corridor 2.12 - Flotta to South Ronaldsay. The only general boating area intersects with this corridor however the sailing club is not located within the cable corridor.- (See Figure 3.37, Appendix D Document Ref: P2308-R5391-AppD-Orkney-NRA)

There are no other general boating areas, clubs, marinas, or training centres within the cable corridors of the Orkney geographical area, other than that identified in Cable Corridor 2.12 Flotta – South Ronaldsay. Smaller recreational vessels that do not transmit AIS are likely to be limited to localised boats and seasonal visitors and relatively low in number. The Holm RYA sailing club associated with Cable Corridor 2.10 Flotta – South Ronaldsay supports small pleasure craft which use the club as their port of operations.

There are no designated bathing waters or Blue Flag beaches located at the landfalls within or adjacent to the proposed Orkney 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 Orkney cable corridors (Appendix E). During this period, a total of 35 lifeboat launches to unique incidents across the Orkney 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 Orkney geographical area.

**Table 6-3 RNLI Accidents with 500m of Orkney cable corridors**

Cable Corridor	No of RNLI Accidents within 500m of corridor
2.5 Eday-Westray	3
2.6 Eday-Sanday	0
2.7 Sanday-Stronsay	1 but around headland
2.9 Orkney Mainland-Rousay	0
2.10 Orkney Mainland-Shapinsay	3
2.11 Hoy-Flotta	3
2.12 Flotta-South Ronaldsay	1

All UK-flagged commercial vessels are required by law to report accidents to the Marine Accident Investigation Branch (MAIB). A total of three marine incidents were reported within the Orkney region over a period of five years. In terms of yearly variations, this corresponds to less than one incidence per year and in 2017 and 2019 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

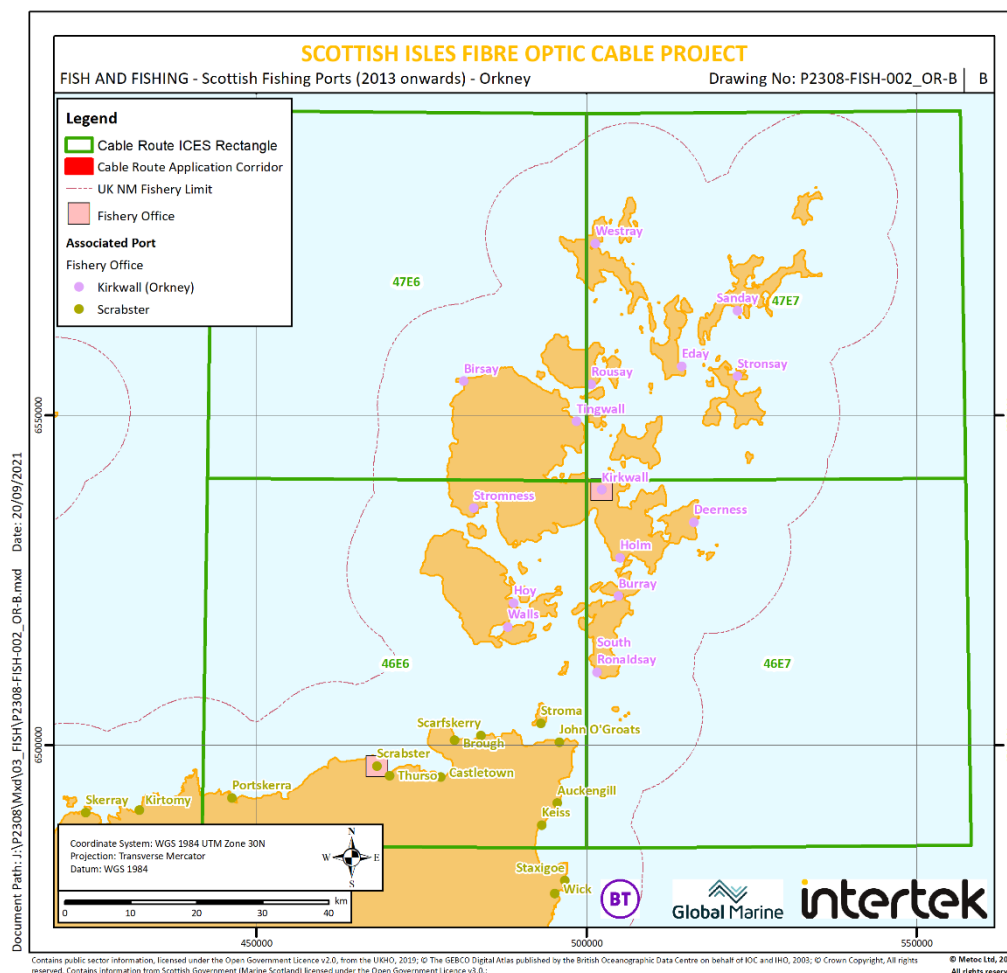
Information provided in this section has been derived from Appendix F – Fishing Activity Study (FAS). The FAS has reviewed publicly available fisheries data and has identified the fishing activity across the Orkney geographical area. This includes a review of target species and fishing methods, spatial 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 Orkney geographical area is presented in Table 6-4.

**Table 6-4 Summary of fisheries activity by cable corridor**

Cable Corridor	ICES rectangle	Target Species	Dominant Fishing type			Peak season
			Shellfish	Demersal	Pelagic	
2.5 Eday – Westray	47E7	Crab, Haddock, Scallop, Lobster, Plaice	✓			August - October
2.6 Eday - Sanday				✓		August - October
2.7 Sanday-Stronsay	47E7	Herring, Scallop, Crab, Lobster, Mackerel	✓			August - October
2.9 Orkney Mainland - Rousay	47E6	Cod, Monks or Anglers, Crabs, Haddock, Ballan Wrasse			✓	July - August
			✓			October
2.10 Orkney Mainland - Shapinsay	46E7	Crab, Haddock, Scallop, Lobster, Plaice	✓			December - January
				✓		
	47E7	Herring, Scallop, Crabs, Lobster, Mackerel	✓			August - October
2.11 Hoy - Flotta	46E6	Crab, Lobster, Cod, Haddock, Scallops	✓			October- December
2.12 Flotta – South Ronaldsay	46E6	Crab, Lobster, Cod, Haddock, Scallops	✓			October- December
					✓	
	46E7	Crab, Haddock, Scallop, Lobster, Plaice	✓			December - January
					✓	

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

**Figure 6-2 Scottish fishing ports (2013 onwards) – Orkney (Drawing No: P2308-FISH-002\_OR-B)**



From the information available, key fishing activities within the Orkney geographical area in relation to the proposed cable corridors are shellfish, demersal species and aquaculture. Shellfish are a key component with crab, European lobster, and scallop as target species. Static gear is widely used across the area in the nearshore region (within 6NM). Plaice are the key demersal target species. The most landed species in the Orkney geographical area are cod, haddock and crabs.

Landing tonnage and their respective value provide a good indication of the importance of commercial fishing in an area. The Orkney cable corridors are located within ICES rectangles 46E6, 46E7, 47E6 and 47E7. Landings data shows that waters in the north of Orkney are the most important ICES rectangles in terms of value (47E7 and 47E6) (Scottish Government 2020). Information presented in Appendix F – FAS has highlighted the importance of shellfish in the north of Orkney, however demersal species are more important in terms of value within ICES rectangle 47E6.

Figure 6-3 (Drawing reference: P2308-FISH-003\_OR), Figure 6-4 (Drawing reference: P2308-FISH-004\_OR) and Figure 6-5 (Drawing reference: P2308-FISH-005\_OR) show the spatial patterns of fishing activities within the Orkney 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 these figures, demersal fishing effort is high, particularly in waters offshore to the east, north-east, and north-west of Orkney within ICES rectangles 46E8 and 47E8, 48E7, and 47E6, respectively. Pelagic fishing effort within the Orkney geographical area is generally low, however there are areas of higher activity further

offshore to the east, north-east, and north-west of Orkney within ICES rectangles 47E8, 48E7, 48E5, respectively. Passive fishing effort (static gear, pots and creels) is generally low apart from two key areas of high activity in offshore waters to the north of Orkney within ICES rectangles 48E6 and 48E7 and coastal waters to the south of Orkney within ICES rectangles 46E6 and 46E7.

The seasonality of fishing activity within the vicinity of the proposed cable corridors varies between north of Orkney and south of Orkney. The peak seasonality is summarised in Table 6-5 below.

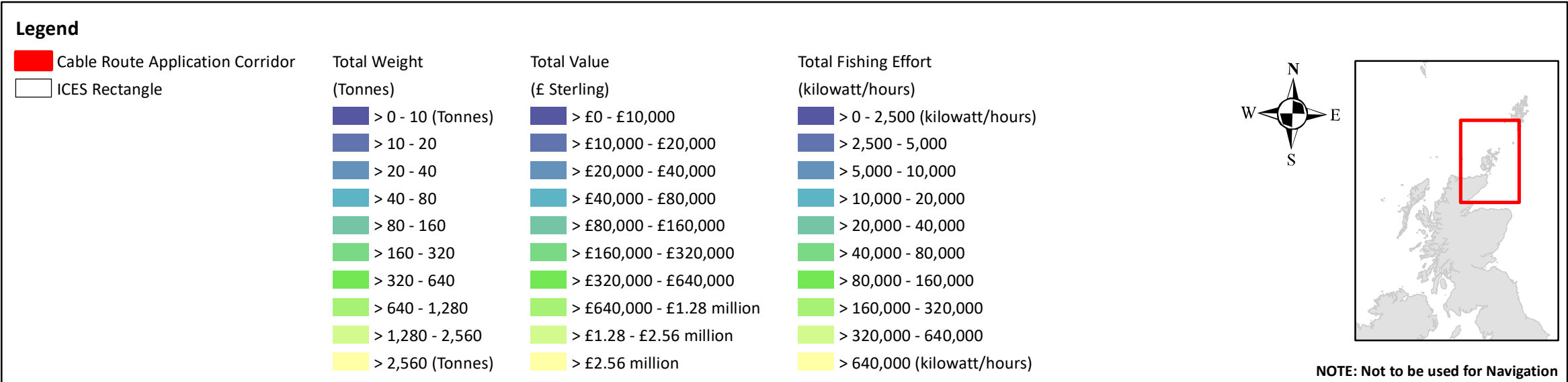
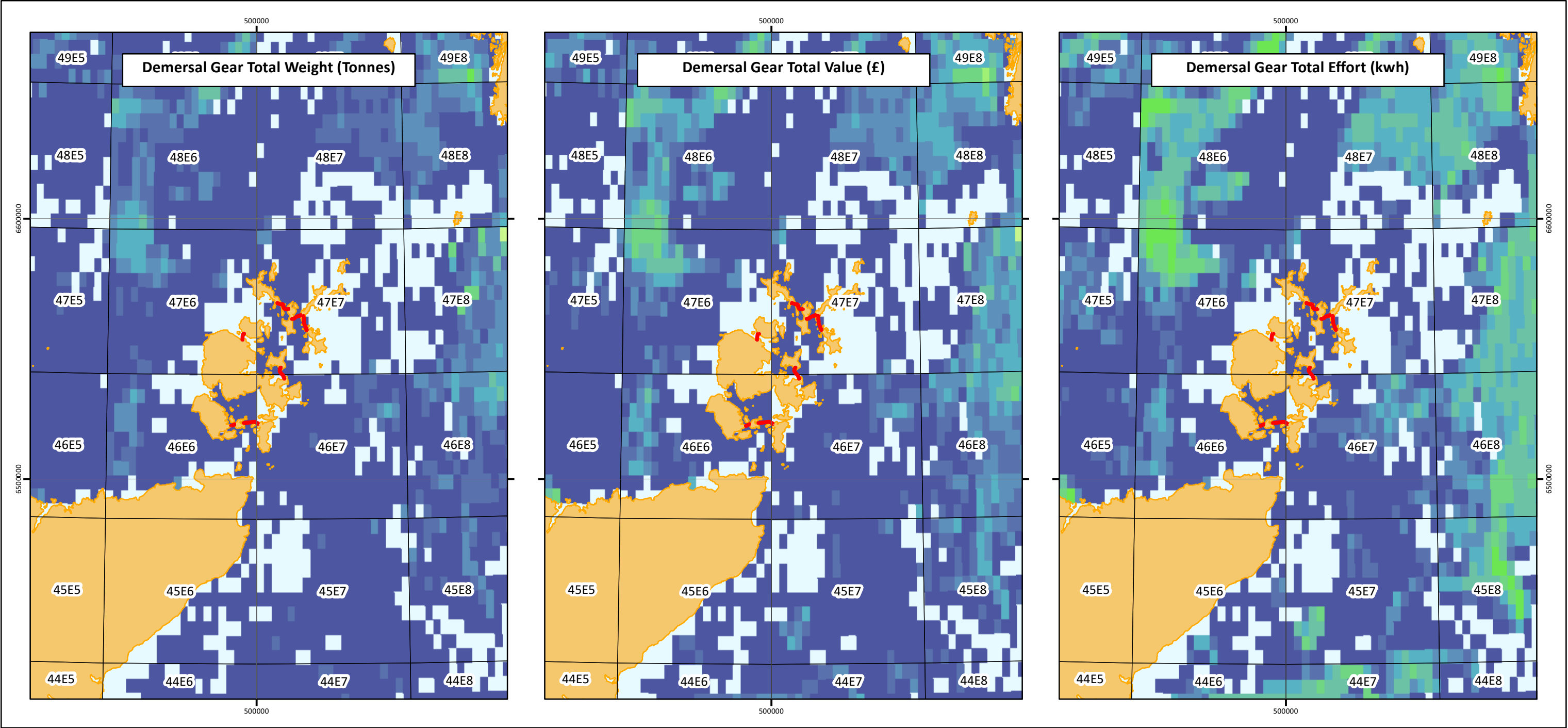
**Table 6-5 Summary of fisheries seasonality by cable corridor**

Fishing Activity	Peak season	Cable Corridor
Shellfish	August - October	North Orkney 2.5 Eday – Westray 2.6 Eday – Sanday 2.7 Sanday-Stronsay 2.9 Orkney Mainland – Rousay 2.10 Orkney Mainland - Shapinsay
	October - December	South Orkney 2.10 Orkney Mainland – Shapinsay 2.11 Hoy – Flotta 2.12 Flotta – South Ronaldsay
Demersal	August - October	North Orkney 2.5 Eday – Westray 2.6 Eday – Sanday 2.7 Sanday-Stronsay 2.9 Orkney Mainland – Rousay 2.10 Orkney Mainland - Shapinsay
	December - January	South Orkney 2.10 Orkney Mainland – Shapinsay 2.11 Hoy – Flotta 2.12 Flotta – South Ronaldsay

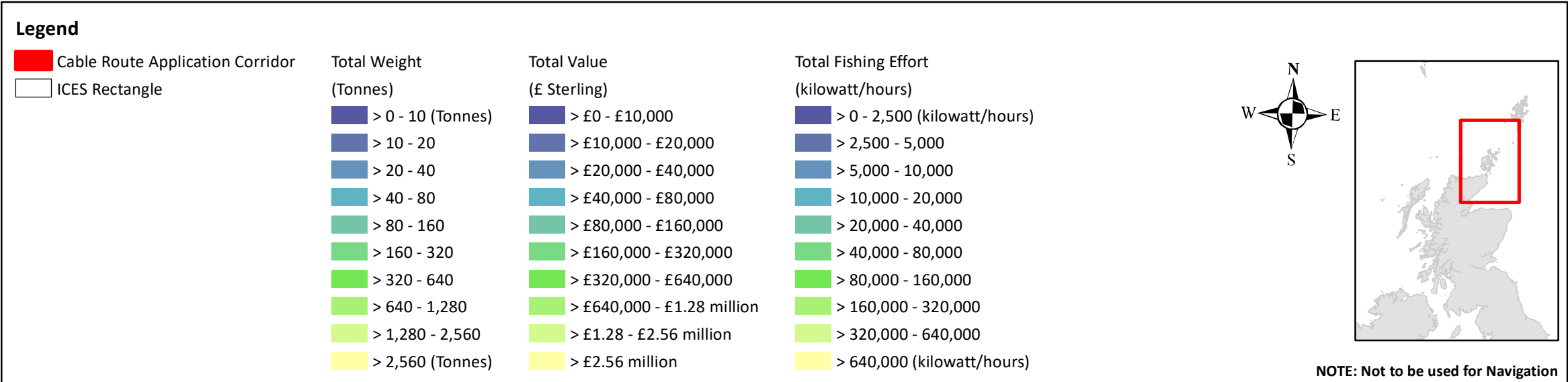
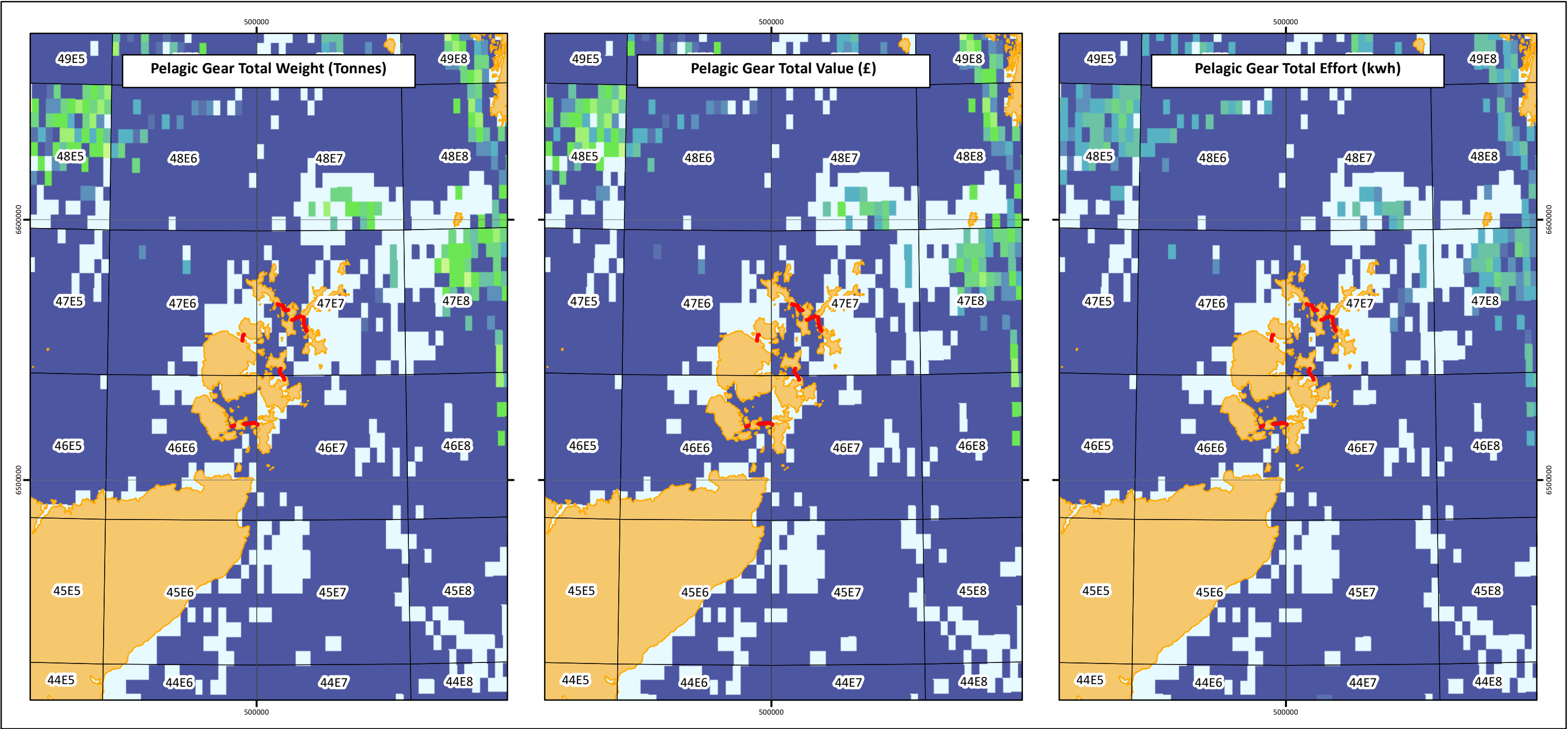
The Project Fishing Liaison Officer (FLO) is in regular communication with fishing stakeholders in Orkney and has held pre-application meetings and workshops to seek the opinion of the fishing industry. These communications will continue through the Marine Licence determination and into the installation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

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

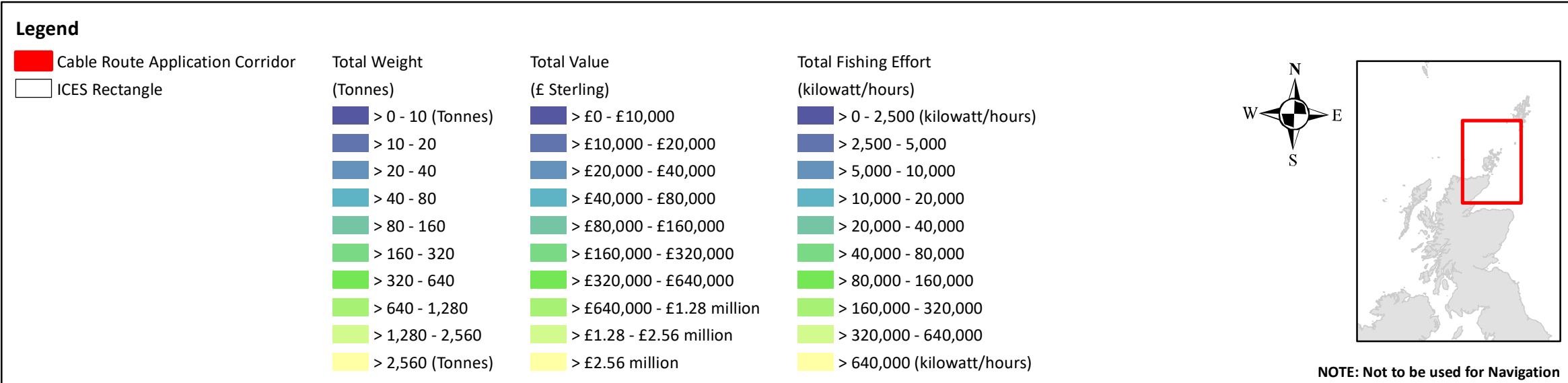
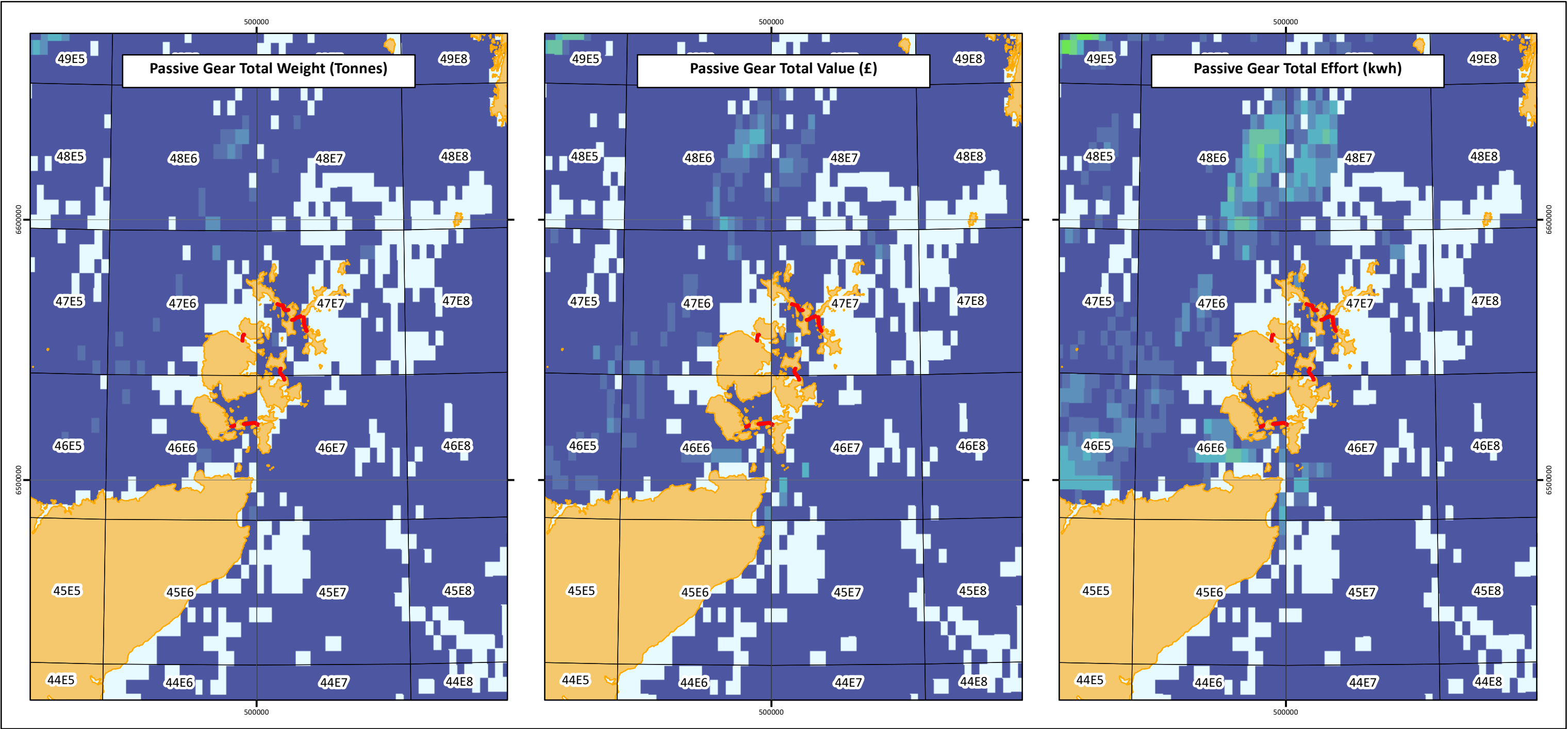




Date	19 May 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	MarineRegions; UKHO; MMO; OSOD; ICES; ESRI;
File Reference	J:\P2308\Mxd\03_FISH\ P2308-FISH-003_OR.mxd
Created By	Chris Dawe
Reviewed By	Chris Carroll
Approved By	Nick Archibald



Date	19 May 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_OR.mxd
Created By	Chris Dawe
Reviewed By	Chris Carroll
Approved By	Nick Archibald



## 6.2.4 Other Sea Users

### 6.2.4.1 Military Practice Areas

Cable Corridor 2.11 Hoy-Flotta and Cable Corridor 2.12 Flotta – South Ronaldsay are located within an Air Force Department Military Practice area, (Figure 6-6, Drawing reference: P2308-INFR-002\_OR). There are no other military practice areas located within 5km of the other Orkney 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 closed Kirkwall spoil disposal site is located 4.3km west of Cable Corridor 2.10 Orkney Mainland – Shapinsay and the disused Scapa disposal site is located 4.4km from Cable Corridor 2.12 Flotta-South Ronaldsay (Figure 6-6, Drawing reference: P2308-INFR-002\_OR). There are no other disposal sites located within 5km of the other Orkney cable corridors.

### 6.2.4.3 Renewable Energy

The following tidal farm agreements are located within 5km of the Orkney cable corridors (Figure 6-6, Drawing reference: P2308-INFR-002\_OR):

- Scotrenewables Tidal Power Ltd – Lashy Sound tidal farm agreement/option is located within Cable Corridor 2.6 Eday-Sanday r, 3.2km to the east of Cable Corridor 2.5 Eday-Westray and 1.5km northwest of Cable Corridor 2.7 Sanday-Stronsay .
- The European Marine Energy - EMEC Fall of Warness tidal farm lease is located 3.6km to the southwest of the Cable Corridor 2.6 Eday-Sanday.
- The European Marine Energy - EMEC Shapinsay Sound tidal farm lease is located 1km to the west of Cable Corridor 2.10 Orkney Mainland-Shapinsay.
- Orbital Marine Power (Orkney) - Seabed at Deer Sound, Orkney tidal farm lease is located 2.5km to the south of Cable Corridor 2.10 Orkney Mainland-Shapinsay.

### 6.2.4.4 Pipelines

The Repsol Sinopec - P/C Tee to Flotta pipeline is located 4.9km from Cable Corridor 2.11 Hoy – Flotta and this pipeline is located on the boundary of Cable Corridor 2.12 Flotta-South Ronaldsay (Figure 6-6, Drawing reference: P2308-INFR-002 OR).

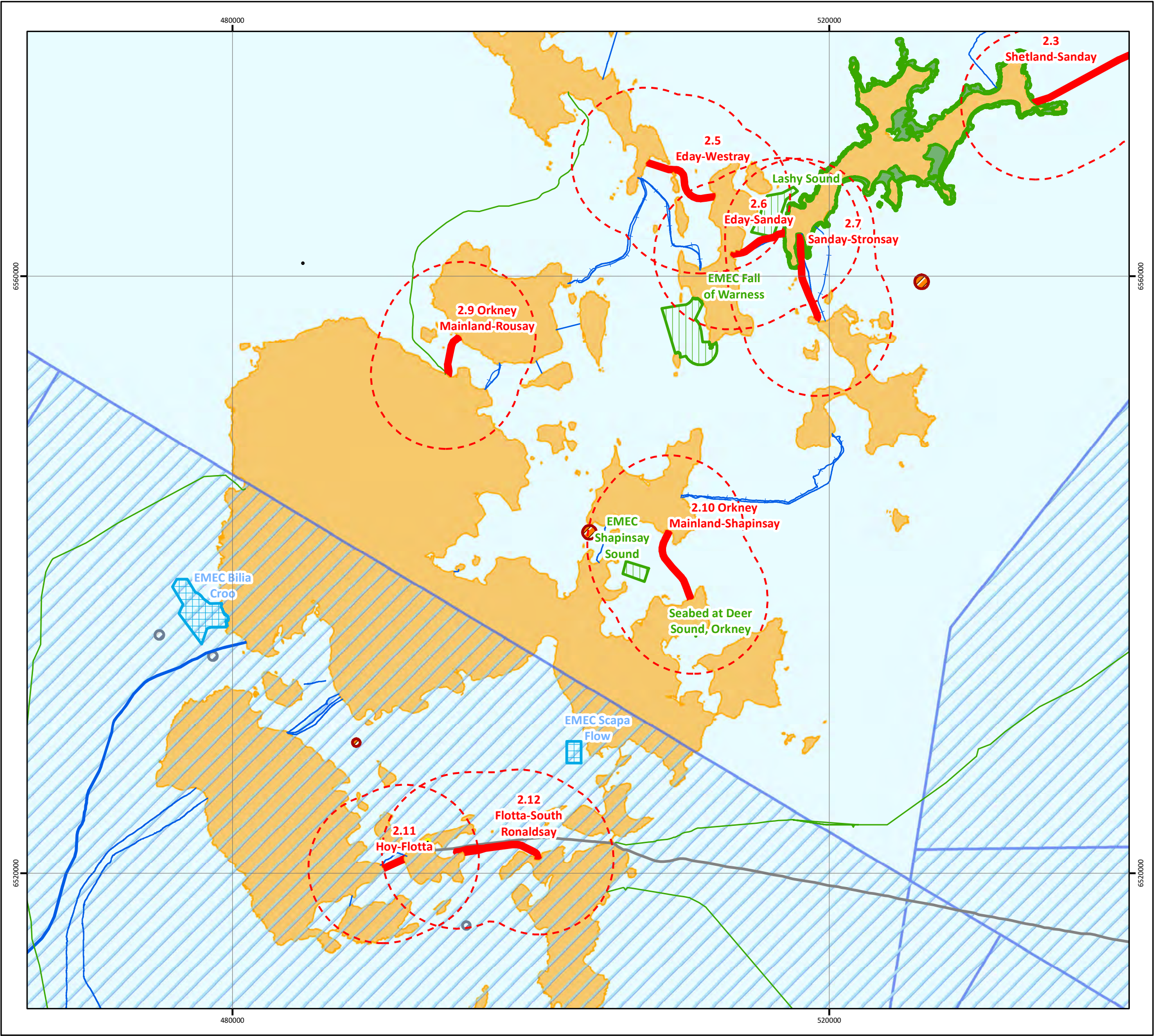
### 6.2.4.5 Cable Infrastructure

There are a number of existing power and telecommunications cables located within 5km of the Orkney cable corridors, (Figure 6-6, Drawing reference: P2308-INFR-002\_OR). Of these cables there are four which are in close proximity (within the Orkney cable corridors), but the proposed cables will not cross these assets, see Table 6-6 below.

**Table 6-6 Existing cables within the proposed Orkney cable corridors**

Proposed Orkney cable corridors	Asset	Owner	Type	Estimated proximity to proposed installation
2.6 Eday-Sanday	EDAY-SANDAY	Scottish and Southern Electricity Networks	Power	73m
2.7 Sanday-Stronsay	SANDAY to STRONSAY	Scottish and Southern Electricity Networks	Power	57m
2.9 Orkney Mainland-Rousay	BT-HIE Seg1.19	BT	Telecoms	18.8m
2.11 Hoy-Flotta	HOY-FLOTTA	Scottish and Southern Electricity Networks	Power	Approx. 230m





SCOTTISH ISLES  
FIBRE OPTIC CABLE PROJECT  
INFRASTRUCTURE  
Other Marine Users  
Orkney

Drawing No: P2308-INFR-002\_OR

A

Legend

R100 Application Corridor

5km Zone of Influence

Terminal

Subsurface Infrastructure

Pipelines

Active

Cables

Power

Power (Disused)

Telecom

Seaweed Licence

Energy Agreement

Tidal Farm

Wave Farm

Disposal Sites

Closed

Disused

Military Practice Area

Air Force Department

N

W

E

S

NOTE: Not to be used for Navigation

Date

16 September 2021

Coordinate System

WGS 1984 UTM Zone 30N

Projection

Transverse Mercator

Datum

WGS 1984

Data Source

ONS; MS; KISCA; OGA; CES; CEFAS; UKHO; ESRI;

File Reference

J:\P2308\Mxd\13\_INFR\ P2308-INFR-002\_OR.mxd

Created By

Emma Kilbane

Reviewed By

Chris Dawe

Approved By

Paula Daglish

BT

Global Marine

intertek

0

4

8

12

16

km

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## 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 6-7 below.

**Table 6-7 Potential effects and zones of influence**

Project Phase	Operation	Potential Pressure	Receptor	Zone of Influence
Pre-Installation	Pre-Lay Grapnel Run	<ul style="list-style-type: none"> <li>Abrasion/disturbance at the surface of the substratum</li> </ul>	Archaeology, Commercial shipping, recreational boating and fishing vessels	Requested Safe working distance and up to 18km in any 12-hour period
	Route Clearance	<ul style="list-style-type: none"> <li>Penetration and disturbance below the substratum including abrasion</li> </ul>		
Installation	Cable lay and burial	<ul style="list-style-type: none"> <li>Physical change to another seabed type</li> </ul>		Requested Safe working distance and up to 7.2km in any 12-hour period
	Surface Laid cable	<ul style="list-style-type: none"> <li>Local water flow (tidal current) changes</li> <li>Displacement of vessels due to the avoidance of Project vessels</li> </ul>		Requested Safe working distance and up to 24km in any 12-hour period
	Post-lay inspection and burial (PLIB)	<ul style="list-style-type: none"> <li>Collision risk</li> </ul>		Requested Safe working distance and to 2.4km in any 12-hour period
	Diver/ROV pre installation survey at Shore ends	<ul style="list-style-type: none"> <li>Accidental anchoring on unburied cable</li> <li>Accidental snagging of fishing gear on unburied cable</li> </ul>		Requested Safe working distance at shore end survey operations (1 day per landing)
	Diver/ROV post installation survey and Shore End Burial	<ul style="list-style-type: none"> <li>Project Vessels blocking navigational features and anchorages</li> <li>Change in water depth - affecting safe navigation</li> </ul>		Requested Safe working distance at shore end burial operations (7 days per landing)
		<ul style="list-style-type: none"> <li>Extreme weather conditions</li> <li>Reduced visibility</li> </ul>		
Contingency/ Change in water depth*	Boulder relocation			Requested Safe working distance for vessels carrying out contingency operations (if required)
	Concrete Mattressing			
	Rock Bags			
	Rock Placement			
No MLV installation - Multicat or subaqueous solution	Cable lay and burial including surface lay			Requested Safe working distance for vessels carrying out contingency operations (if required)

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

### 6.3.1.2 Compliance Mitigation

The Compliance measures outlined in Table 6-8 below are required to be undertaken to meet environmental and health and safety legislation. The assessment assumes these measures will be implemented.

**Table 6-8 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 6-9 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 6-9 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 Possible (ALARP).

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

## 6.3.2 Archaeology

### 6.3.2.1 Potential pressure identification and zone of influence

Key potential impacts on archaeology have been identified following searches of publicly available data and liaison with curators in the region. All potential effects to archaeology are identified in Table 6-9 below.

**Table 6-10 Potential impacts and zone of influence**

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

### 6.3.2.2 Compliance Mitigation

The Compliance measures outlined in Table 6-11 below will be implemented during the final route design process to further ensure the protection of marine archaeological receptors:

**Table 6-11 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 6-9), the Best Practice project mitigation relevant to archaeology are the same as those presented for shipping and navigation (Table 6-9).

### 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 Orkney 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 6-12 below.

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

**Table 6-12 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 km <sup>2</sup> (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 6-8).

#### 6.3.3.3 Best Practice Mitigation

With the exception of BP9 (Table 6-9), the Best Practice project mitigation relevant to commercial fishing are the same as those presented for shipping and navigation (Table 6-9).

#### 6.3.3.4 Impact assessment

##### **Temporary displacement/ restricted access to fishing grounds**

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

During the proposed installation period (April 2022 - December 2023) key fishing activities within the Orkney geographical area are focussed on shellfish, demersal and aquaculture fishing, with shellfish being the key component. As discussed in Section 6.2.3 the seasonality of fishing activity within the vicinity of the proposed cable corridors varies between north of Orkney and south of Orkney. However, should installation of the cable coincide with the peak season, the disturbance will be very localised and short term (2-3 days).



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

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

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

Cable burial to 1m is targeted for all routes, subject to seabed conditions. Clearance of 1NM (1.852km<sup>2</sup>) 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 Orkney geographical area cable installation. However, in areas where cable burial is not possible due to seabed conditions or crossing points, remedial protection may be required to help protect both the cable and other seabed users. The locations and types of potential external cable protection are not confirmed at the time of writing the MEA however, the potential options are described in Section 2 and include:

- Concrete mattresses;
- Rock bags; and

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

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

Should contingency cable protection be required for corridors within the Orkney 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 6-13) 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 6-13 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 6-8).

### 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 6-9).

### 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 Orkney cables in the intertidal zone at the landfall sites will be undertaken by trenching across the beach, with the exception of Cable Corridor 2.5 Eday – Westray and Cable Corridor 2.6. Eday- Sanday where rock cutting for a short section in the intertidal area may be necessary.

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

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

#### **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:

- M7 - 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 Orkney 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 Orkney geographical area the following information sources have been reviewed and plotted on to GIS (Figure 7-1, Drawing: P2308\_CUMU-001-OR-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 Orkney 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 Orkney 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 Orkney 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\_INFR-002-OR-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. (Note: Cumulative impacts for the cable corridor 2.3 Sanday to Shetland has not been assessed within this chapter, but has been included in Chapter 7 Cumulative impacts for the Shetland geographical area (Reference: P2308-R5367-Rev0).

Only projects taking place between 01/04/22 and 31/12/23 have been included. The application period is to December 2023, there may be further projects during that time that would fall into the assessment. Therefore, if the project 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 Orkney 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 Orkney geographical area assessment search area (Marine Scotland 2021a)**

Project Category	Name	MS LOT Reference Number	Distance to cable corridor (km)							Does project category induce similar pressures to R100?	Projects to be taken forward to assessment?
			Cable 2.5	Cable 2.6	Cable 2.7	Cable 2.9	Cable 2.10	Cable 2.11	Cable 2.12		
Cable	BT Openreach Telecoms Subsea Cable - Cables to H&I Active	5077				0				Yes	No – Cable is operational with no planned maintenance. Therefore there will be no impact on the environment from this project.
Mooring	Orkney Seafood Ltd - Mooring for Marine Farm	9349				1.3				Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has a limited seabed footprint. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts.
Fish (including shellfish) farm	Marine Farm - Pegal Bay, Orkney	00008892							4.2	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 - Eday Sound, Orkney	00009016		3.5	4.3					No	No - project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Renewables - Tidal	Marine Licence - Construction, Deployment and Removal of Gravity Based Anchors - Shapinsay Sound Test Site	00009060					2.6			Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has a limited seabed footprint and has included mitigations to avoid damage to any priority marine features. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts.

Project Category	Name	MS LOT Reference Number	Distance to cable corridor (km)							Does project category induce similar pressures to R100?	Projects to be taken forward to assessment?
			Cable 2.5	Cable 2.6	Cable 2.7	Cable 2.9	Cable 2.10	Cable 2.11	Cable 2.12		
Renewables - Tidal	Marine Licence - Deployment of Test Support Buoy - Shapinsay Sound Test Site	00009061					2.6			Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has a limited seabed footprint and has included mitigations to avoid damage to any priority marine features. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts.
Construction, alteration or improvement of any works	Faray Slipway Extension and Landing Jetty	00009361	0	2.7						Yes	Yes – Further assessment is required
Construction, alteration or improvement of any works	Capital Dredging and Sea Disposal - Scammalin Bay	00009362	0	2.7						Yes	Yes – Further assessment is required
Renewables - Wave	Marine Licence – Construction and operation of tidal energy convertor – EMEC, Fall of Warness, Berth 6	06266		3.7						Yes	Yes – Further assessment is required
Renewables - Wave	Marine Licence – Construction and operation of tidal energy convertor – EMEC, Fall of Warness, Berth 7 & 8	06282		3.7						Yes	Yes – Further assessment is required
Renewables - Wave	Marine Licence – Construction and operation of tidal energy convertor –	06437		3.7						Yes	Yes – Further assessment is required

Project Category	Name	MS LOT Reference Number	Distance to cable corridor (km)							Does project category induce similar pressures to R100?	Projects to be taken forward to assessment?
			Cable 2.5	Cable 2.6	Cable 2.7	Cable 2.9	Cable 2.10	Cable 2.11	Cable 2.12		
	EMEC, Fall of Warness, Berth 4										
Renewables - Tidal	Marine Licence- Construction, Operation and Deposit of a Tidal Energy Device - Fall Of Warness, Test Berth 5	06818/181 025		3.7						Yes	Yes – Further assessment is required
Fish (including shellfish) farm	New Marine Farm – Scapa Flow	06823							0	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Chemotherapeut ant	Marine Licence - Wellboat Discharge - Lober, Scapa Flow, Orkney	07034							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 - Hunda, Orkney	07080							4	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Pontoon	Marine Licence - Pontoon - Various Locations	07105						2.3		No	No, project category does not induce similar pressures to Scot-NI, therefore there is no potential for inter-project effects
Chemotherapeut ant	Marine Licence – Wellboat Discharge – Eday, Orkney	07137		3.4	3.9					No	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Fish (including shellfish) farm	Marine Licence Application- Marine Farm- North Bay, Hoy	07160						4.9		No	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects

Project Category	Name	MS LOT Reference Number	Distance to cable corridor (km)							Does project category induce similar pressures to R100?	Projects to be taken forward to assessment?
			Cable 2.5	Cable 2.6	Cable 2.7	Cable 2.9	Cable 2.10	Cable 2.11	Cable 2.12		
Mooring	Marine Licence - New Mooring - Deer Sound, Orkney	07168					2.4			Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has assessed that it will not have any effect on the receiving environment and will have a limited seabed footprint. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts.
Fish (including shellfish) farm	Marine Licence - Marine Farm - Carness Bay, The String	07176					4.1			No	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects
Renewables - Tidal	Installation of rock anchors, Fall of Warness and Shapinsay Sound	07373/000 08851					2.1			Yes	No – The main impact of this project is the potential for seabed habitat loss. However, this project has a limited seabed footprint and has included mitigations to avoid damage to any priority marine features. Therefore, there will be negligible effects on the seabed and thus no cumulative impacts.

### 7.4.1 Marine Scotland NMPi

A review of the NMPi tool did not identify any other proposed projects or plans that would induce similar pressures and/or that were located within the assessment search area of the Orkney 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 Orkney 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-A) below (Note: Cumulative impacts for the cable corridor 2.3 Sanday to Shetland has not been assessed within this chapter, but have been included in Chapter 7 Cumulative impacts for the Shetland geographical area (Reference: P2308-R5367-Rev0).

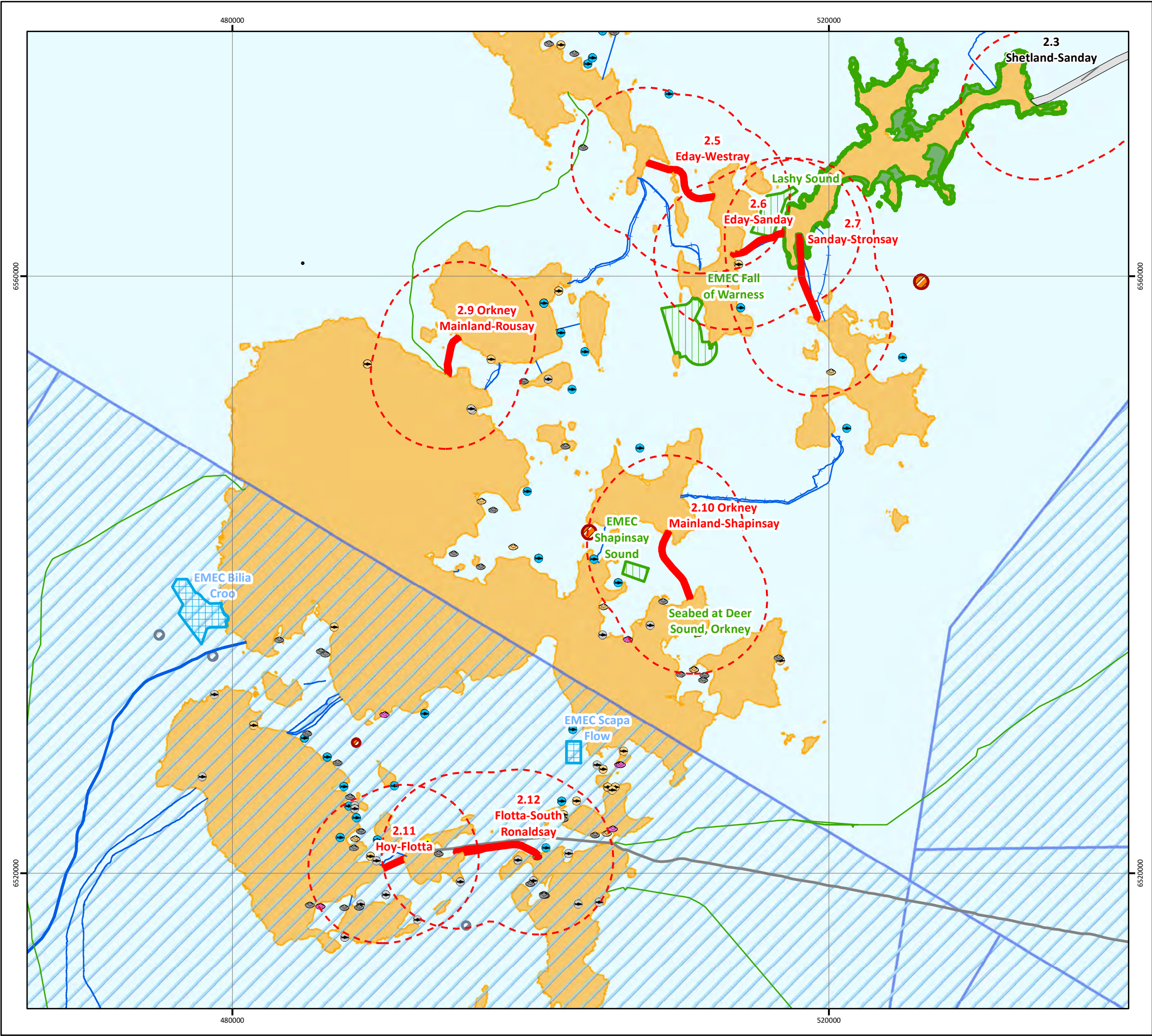
**Table 7-2 Projects identified using GIS analysis within Orkney geographical area assessment search area**

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	11	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	5	Yes	No – Cables are already installed and have been marked as disused therefore no other maintenance will be carried on the existing cables.
Renewables – Tidal	1	Yes	Yes- Further Assessment Required
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	1	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	19	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	15	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	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 – Re-registered	2	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects



Project Category	No. of Applications	Does project category induce similar pressures to R100?	Are there any other to be taken forward to assessment?
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	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) – Disused	1	No	No, project category does not induce similar pressures to the Project, therefore there is no potential for inter-project effects





# SCOTTISH ISLES

## FIBRE OPTIC CABLE PROJECT

### CUMULATIVE IMPACT

#### Other Marine Users

#### Orkney

Drawing No: P2308-CUMU-001\_OR

A

#### Legend

R100 Application Corridor

Not assessed

5km Zone of Influence

Terminal

Subsurface Infrastructure

Aquaculture Site

Fish, Active

Fish, Inactive

Fish, De-Registered

Shellfish, Active

Shellfish, Inactive

Shellfish, De-Registered

Pipelines

Active

Cables

Power

Power (Disused)

Telecom

Seaweed Licence

Energy Agreement

Tidal Farm

Wave Farm

Disposal Sites

Closed

Disused

Military Practice Area

Air Force Department

N

W

E

S

NOTE: Not to be used for Navigation

Date	28 September 2021
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	ONS; MS; KISCA; OGA; CES; CEFAS; UKHO; ESRI;
File Reference	J:\P2308\Mxd\14_CUMU\ P2308-CUMU-001_OR.mxd
Created By	Emma Kilbane
Reviewed By	Chris Dawe
Approved By	Paula Daglish

BT

Global Marine

intertek

0

4

8

12

16

km

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### 7.4.3 Relevant Projects

A total of 28 projects were identified using MS-LOT and 94 projects identified using GIS analysis that were within the assessment search area. Of these, seven projects were identified from MS-LOT and one project was identified from GIS analysis 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 Orkney geographical area assessment search area**

Project Category	Project Name	Distance of Cable Corridor from project (km) or intersect (Int)						
		Cable Corridor						
		2.5	2.6	2.7	2.9	2.10	2.11	2.12
Construction, alteration or improvement of any works	Orkney Islands Council - Faray Slipway Extension and Landing Jetty	Int	2.7					
Construction, alteration or improvement of any works	Orkney Islands Council - Capital Dredging and Sea Disposal - Scammalin Bay	Int	2.7					
Renewables - Wave	Tocado Tidal Energy Ltd - Marine Licence – Construction and operation of tidal energy convertor – EMEC, Fall of Warness, Berth 6		3.7					
Renewables - Wave	OpenHydro Site Development Ltd - Marine Licence – Construction and operation of tidal energy convertor – EMEC, Fall of Warness, Berth 7		3.7					
Renewables - Wave	Scotrenewables Tidal Power Ltd - Marine Licence – Construction and operation of tidal energy convertor – EMEC, Fall of Warness, Berth 8		3.7					
Renewables - Wave	OpenHydro Group Ltd - Marine Licence – Construction and operation of tidal energy convertor – EMEC, Fall of Warness, Berth 4		3.7					
Renewables - Tidal	Orbital Marine Power (Orkney) plc - Marine Licence- Construction, Operation and Deposit of a Tidal Energy Device - Fall Of Warness, Test Berth 5		3.7					
Renewables - Tidal	Scotrenewables Tidal Power Ltd- Lashay Sound	3.3	Int	1.6				

### 7.4.4 Fishing Activity

Dredging for shellfish and demersal trawling are two of the key fishing activities employed within the Orkney geographical area. Dredging, particularly for scallops, involves teeth being raked through the seabed to disturb and collect scallops within the seabed sediments. Both scallop dredging and demersal fishing induce the pressures penetration and/or disturbance to the substratum on the surface of the seabed including abrasion, and abrasion/disturbance of the substratum below the

surface of the seabed. As a result, there is the potential for the Orkney geographical area cable installations to have inter-project effects with demersal fishing activity. Despite this, the Orkney cable installation will be a temporary and one-off disturbance. Furthermore, the installation of the Orkney 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 Faray Slipway Extension and Landing Jetty (009361) – Orkney Islands Council / Capital Dredging and Sea Disposal - Scammalin Bay (009362) – Orkney Islands Council

Orkney Island Council have proposed a new extended slipway construction at the current slipway located at Scammalin Bay, south-east coast of the Island of Faray. This will include capital dredging and sea disposal of the dredged material to provide access to the slipway. The works are located within the Faray and Holm of Farray SAC/SSSI. They are (indicatively) scheduled to commence on the 1<sup>st</sup> of April 2025, with completion expected on the 30<sup>th</sup> of April 2026.

The project is located approximately 2.7km from Cable Corridor 2.6 Eday to Sanday at the closest approach.

Environmental assessment for the project identified the potential to disturb the priority marine feature (PMF) kelp bed. However, the assessment concluded that impacts on the PMF will be minor and not significant (Orkney Islands Council, 2021). This was due to the abundance of the PMF along the coast, the recoverability rate of kelp following disturbance (medium to high), and the small area of impact.

The R100 cable installation is expected to be completed by the end of 2022 or worst case scenario end of 2023, with the best-case scenario activities commencing in April and completion by July 2022 (however this timeframe is subject to change within the year). The installation activities for both projects will not occur at the same time.

Kelp bed PMF have been identified as present within the Cable Corridor 2.10 Orkney Mainland to Shapinsay and Cable Corridor

2.11 Hoy to Flotta. Section 5 concluded that the impacts on the PMF from cable installation will be negligible and not significant due to the small footprint of the surface laid cable across the PMF and the use of pinning to avoid surface abrasion.

Although both projects have the potential to effect kelp bed PMF it is concluded that there will be no potential cumulative impacts, given the small cumulative area of impact and the recovery rate of kelp following disturbance.

### 7.5.2 EMEC - Fall of Warness Tidal Test Site

European Marine Energy Centre (EMEC) Ltd. hold a section 36 consent under the Electricity Act 1989 in the Fall of Warness tidal site covering generation of electricity for the whole site. The site is located west of the island of Eday and partly overlaps with the assessment search area for Cable Corridor 2.6 Eday to Sanday (distance of 3.7km from the cable corridor). There are currently eight cable test berths in an approximately 8km<sup>2</sup> area occupied by different developers.

Marine Licence applications have been submitted for five of the eight berths, although limited information is available with the applications for Berths 4, 6, 7 and 8. Information supplied for Berth 5 has been used to inform the assessment. Table 7-4 provides details of the applications associated with each Berth.

**Table 7-4 EMEC Fall of Warness Total Site - Berth details**

Berth no.	Occupant	MS-LOT Reference	MS-LOT Status	Licence Expiry	ORJIP Status	Potential installation dates	Source
Berth 4	Open Hydro	06437	Application	2023	Prototype testing completed	2006	(Tethys, 2021), (ORJIP, 2021)
Berth 5	Orbital Marine Power Orkney PLC	06818/181025	Application	2039	Installed	2020	(ORJIP, 2021), (Orbital Marine Power Ltd., 2018)
Berth 6	Tocado	06266	Licence	2037		2017	(Tethys, 2021)
Berth 7	Sustainable Marine Energy	06282	Licence	2043	Cancelled installation of PLAT-O#2, PLAT-O#1 potentially still installed at site	2016	(EMEC, 2021b) (ORJIP, 2021), (Sustainable Marine Energy Limited, 2017)
Berth 8	Orbital Marine Power Ltd.	06282	Licence	2023		Not listed however confirmation of a second berth occupancy (number not confirmed) was made in 2020 suggesting installation date in 2022. EMEC suggests installation of a second turbine in 2023.	(reNEWSBIZ, 2020; EMEC, 2021a)

The Tethys website lists all developers who have occupied a berth at the Fall of Warness site. Considering the developers linked to the Berths relevant to these applications are listed only once it is assumed that they are occupying the corresponding berths as the applicant has no other information to suggest installation at different berths.

The common pressure-receptor pathway with Cable Corridor 2.6 Eday to Sanday is noise effects on marine mammals and seabirds. The noise output of the Orkney 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 as minor localised disturbance and no significant effects are expected. Characterisation of the acoustic levels of turbines at the Fall of Warness site 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.

Spatially the impacts from Cable Corridor 2.6 Eday to Sanday and the Fall of Warness site will not overlap given the distance between the two areas (3.7km) and therefore will not lead to a cumulative noise impact. 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. Mitigation has been put in place within the Fall of Warness tidal site to reduce the effects of disturbance on marine mammals and sea birds, specifically adherence to The Scottish Marine Wildlife Watching Code (SMWWC), capped vessel speed and radius buffers of 50m near breeding seabird cliffs. Neither project will have a significant effect on marine mammals, fish or seabirds. In addition, the R100 Project is limited in duration to 20 days or less and therefore there will be no significant cumulative impacts.

### 7.5.3 Scotrenewables Tidal Power Ltd - Lashay Sound

The Lashay Sound Tidal Array was proposed by Scotrenewables Tidal Power Ltd. (now Orbital Marine Power Ltd.), currently the site is still at the option for lease stage according to the Crown Estate GIS shapefile and there is no information on MS-LOT regarding any immediate plans to develop the site. Offshore Renewables Joint Industry Programme (ORJIP) has identified the Lashy Sound Tidal Array site as "planned" (ORJIP, 2021). Written evidence submitted by Scotrenewables Tidal Power Ltd. in 2011 to the House of Parliament stating that while the application was received the bid ultimately failed due to the high monetary bond required by the Crown Estate (Parliament.UK, 2011). Orbital Marine Ltd. do not have any information about further developing Lashy Sound and specified in a document for Berth 6 that similar proposals for developments such as Lashy Sound have not continued (Marine and Risk Consultants Ltd, 2021). The applicant is not aware of any other installation activities planned or active at the site therefore there will be no significant cumulative impacts.

## 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 Orkney 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 Orkney 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 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	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 on birds will be followed where practicable	Global Marine installation requirement

**Table 8-2 Project specific mitigation measures**

ID	Aspect	Project specific mitigation	Source
M1	Pinniped	Installation activities should not occur at Cable Corridor 2.5 during the peak grey seal breeding season October to December (inclusive).	Protected Sites Assessment – Appendix C MEA Chapter 5 – Biological Section
M2	Birds	The 'Guide to Best Practice for Watching Marine Wildlife' guidance on birds will be followed where practicable, for installation Activities for Cable Corridor 2.10 Orkney Mainland-Shapinsay, 2.11 Hoy-Flotta and 2.12 Flotta-South Ronaldsay to prevent LSE to moulting common eider.	Protected Sites Assessment – Appendix C
M3	Pinniped	Installation activities should not occur at Cable Corridor 2.7 during the peak grey seal breeding season in October to December (inclusive).	MEA Chapter 5 – Biological Section
M4	Maerl	Micro-routeing and surface laying will be undertaken to minimise effects to maerl beds identified within the Cable Corridor 2.10 Orkney Mainland to Shapinsay and a method statement to reduce the impact to maerl will be agreed with NatureScot prior to installation.	MEA Chapter 5 – Biological Section

ID	Aspect	Project specific mitigation	Source
M5	Saltmarsh	Micro-routeing will be undertaken to avoid saltmarsh identified within the Cable Corridor 2.11 Hoy - Flotta, Flotta landing point only.	MEA Chapter 5 – Biological Section
M6	Pinniped	Screens should be used to reduce visual disturbance to harbour and grey seal for installation activities for Cable Corridor 2.9 Rousay landing point.	MEA Chapter 5 – Biological Section
M7	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 Orkney 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 Orkney 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 seven complete cables within the Orkney 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 an eighth cable (Cable Corridor 2.3 Sanday to Shetland) 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 that landing will be included within a separate appraisal document covering the Shetlands geographical area.

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 Orkney 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.

## 9.2 Cable Corridor 2.5 Eday - Westray

Cable corridor 2.5 Eday - Westray is between Cusbay, Eday and Westray House, Westray and is approximately 6.5km long. The cable will be installed within the corridor using installation plough and 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; 25 rock bags, 3 mattresses (mattress 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 cutting/picking may also be required for a short section at the Eday landing point. The footprint of the installation is approximately 0.015km<sup>2</sup>.

The corridor passes through one protected site (Faray and Holm of Faray SAC), and there is potential for temporary disturbance to grey seal during installation operations at the cable landing site. The overall duration of the installation activities within Corridor 2.5 Eday – Westray may occur over 20.5 days (including contingency) for the route installation and burial from BMH to BMH. However, this time includes significant contingency including transit times to site etc and cable installation activities will only occur for approximately 6 days within this period. Any disturbance will be short term and transient. Vessel traffic within corridor 2.5 Eday – Westray is very low. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.5 Eday to Westray, 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 - Installation activities should not occur at Cable Corridor 2.5 during the peak grey seal breeding season from October to December (inclusive).
- M7 The marine archaeological technical report will be provided to MS-LOT ahead of any licensable activities taking place.

The effects to the physical, biological and human environment once design and project specific mitigation has been applied are summarised in Table 9-1. No lasting residual effects to the environment have been identified from installation operations within Corridor 2.5 Eday - Westray.

## 9.3 Cable Corridor 2.6 Eday - Sanday

Cable Corridor 2.6 Eday - Sanday is between Bay of London, Eday and Gump of Spurness, Sanday and is approximately 4.5km long. The cable will be installed within the corridor using installation plough and 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 25 rock bags, 3 mattresses (mattress will only be installed if required by a third party)). Within the intertidal area the cable will be buried into a trench using excavators, and rock cutting/picking may also be required for a short section at the Eday landing point. The footprint of the installation is approximately 0.01km<sup>2</sup>.

The corridor does not pass through any protected sites however, 12 European protected sites have been considered for potential likely significant effects arising from works within Cable Corridor 2.6 Eday – Sanday. The potential for disturbance to protected breeding birds, harbour seal and grey seal are short term and transient. The overall duration of the installation activities within Cable Corridor 2.6 Eday – Sanday may occur over 22 days (including contingency) for the route installation and burial from BMH to BMH. However, this time includes significant contingency including transit times to site etc and cable installation activities will only occur for approximately 6 days within this period. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.6 Eday to Sanday, to reduce the effects of cable installation to not significant or ALARP are given in Section 8 Schedule of Mitigation. The Project Specific mitigation measures required to minimise the effects of cable installation within Cable Corridor 2.6 Eday to Westray are:

M7 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 2.6 Eday - Westray.

## 9.4 Cable Corridor 2.7 Sanday - Stronsay

Cable Corridor 2.7 Sanday - Stronsay is between Bay of Stove, Sanday and Sands of Odie, Stronsay and is approximately 6.8km long. The cable will be installed within the cable corridor using installation plough and 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 40 rock bags and 3 mattresses (mattress will only be installed if required by a third party)). Within the intertidal area the cable will be buried into a trench using excavators. The footprint of the installation is approximately 0.017km<sup>2</sup>.

The cable corridor does not pass through any protected sites however, 12 European protected sites have been considered for potential likely significant effects arising from works within Cable Corridor 2.7 Sanday - Stronsay. There is potential for disturbance to harbour seal and grey seal during the short term and transient installation operations. The overall duration of the installation activities within Cable Corridor 2.7 Sanday - Stronsay may occur over 21.5 days (including contingency) for the route installation and burial from BMH to BMH. However, this time includes significant contingency for transit to site times etc and cable installation activities will only occur for approximately 6 days within this period. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.7 Sanday to Stronsay, 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 - Installation activities should not occur at Cable Corridor 2.7 during the peak grey seal breeding season from October to December (inclusive).
- M7 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 2.7 Sanday - Stronsay.

## 9.5 Cable Corridor 2.9 Orkney Mainland - Rousay

Cable Corridor 2.9 Orkney Mainland - Rousay is between Evie, Orkney Mainland to Westness, Rousay and is approximately 3.2km long. The cable will be installed within the Cable Corridor using 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 (52 rock bags and 3 mattresses (mattress will only be installed if required by a third party)). Within the intertidal area the cable will be buried into a trench using excavators. The footprint of the surface lay installation is approximately 0.004km<sup>2</sup>.

The corridor does not pass through any protected sites however, 13 European protected sites and one nationally designated site have been considered for potential likely significant effects arising from works within Cable Corridor 2.9 Orkney Mainland - Rousay. There is potential for disturbance to grey and harbour seal, common eider and overwintering birds (during the short term and transient installation operations. The duration of the installation activities within Cable Corridor 2.9 Orkney Mainland - Rousay may occur over 30.5 days (including contingency) for the route installation and burial from BMH to BMH. However, most of this time is contingency or transit time and cable installation activities will only occur for approximately 6 days within this time scale. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.9 Orkney

Mainland - Rousay, to reduce the effects of cable installation to not significant or ALARP are given in Section 8 Schedule of Mitigation and are as follows:

- M6 - Screens should be used to reduce visual disturbance to harbour and grey seal for installation activities for Cable Corridor 2.9 Rousay landing point.
- M7 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 2.9 Orkney Mainland - Rousay.

## 9.6 Cable Corridor 2.10 Orkney Mainland – Shapinsay

Cable Corridor 2.10 Orkney Mainland – Shapinsay is between Kirkwall, Orkney Mainland and Balfour, Shapinsay and is approximately 5.8km long. The route will be installed using installation plough and 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 18 rock bags and 3 mattresses (mattress will only be installed if required by a third party)). Within the intertidal area the cable will be buried into a trench using excavators. The footprint of the installation is approximately 0.014km<sup>2</sup>.

The cable corridor does not pass through any protected sites however, 12 European protected sites have been considered for potential likely significant effects arising from works within corridor 2.10 Orkney Mainland – Shapinsay, with potential for disturbance to maerl habitat, breeding common eider and non-breeding birds during the short term and transient installation operations. The duration of the installation activities within Corridor 2.10 Orkney Mainland - Shapinsay may occur over 25 days (including contingency) for the route installation and burial from BMH to BMH. However, this includes significant contingency including transit to site times etc and cable installation activities will only occur for approximately 6 days within this period. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.10 Orkney Mainland to Shapinsay, to reduce the effects of cable installation to not significant or ALARP are given in Section 8 Schedule of Mitigation and are as follows::

- M2 - The 'Guide to Best Practice for Watching Marine Wildlife' guidance on birds will be followed where practicable, for installation Activities for Cable Corridor 2.10 Orkney Mainland-Shapinsay to prevent LSE to moulting common eider.
- M4 - Micro-routeing and surface laying will be undertaken to minimise effects to maerl beds identified within the Cable Corridor 2.10 Orkney Mainland to Shapinsay.
- M7 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 2.9 Corridor 2.10 Orkney Mainland-Shapinsay.

## 9.7 Cable Corridor 2.11 Hoy – Flotta

Cable Corridor 2.11 Hoy - Flotta is between Runway, Flotta to Ringwall Turret, Hoy and is approximately 1.7km long. The cable will be installed within the cable corridor using installation plough and 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 10 rock bags and 3 mattresses (mattress will only be installed if required by a third party)). Within the intertidal area the cable will be buried into a trench using excavators. The footprint of the installation is approximately 0.003km<sup>2</sup>.

The corridor does not pass through any protected sites however, 13 European protected sites have been considered for potential likely significant effects arising from works within Cable Corridor 2.11 Hoy - Flotta. There is potential for disturbance to a discrete area of saltmarsh, protected breeding and non-breeding birds during the short term and transient installation operations. The duration of the installation activities within Cable Corridor 2.11 Hoy - Flotta may occur over 21.5 days (including contingency) for the route installation and burial from BMH to BMH. However, this time includes significant contingency for transit to site etc times and cable installation activities will only occur for approximately 6 days within this period. The design and project specific mitigation measures proposed for the R100 project and corridor 2.11 Hoy - Flotta, to reduce the effects of cable installation to not significant or ALARP are given in Section 8 Schedule of Mitigation and are as follows:

- M2 - The 'Guide to Best Practice for Watching Marine Wildlife' guidance on birds will be followed where practicable, for installation Activities for Cable Corridor 2.11 Hoy-Flotta to prevent LSE to moulting common eider.
- M5 - Micro-routeing will be undertaken to avoid saltmarsh identified within the Cable Corridor 2.11 Hoy - Flotta, Flotta landing point only.
- M7 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 2.9 Corridor 2.11 Hoy - Flotta.

## 9.8 Cable Corridor 2.12 Flotta – South Ronaldsay

Cable Corridor 2.12 Flotta to South Ronaldsay is between Quoy Ness, Flotta and Dam of Hoxa, South Ronaldsay and is approximately 6.2km long. The cable will be installed within the cable corridor using installation plough and 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 (10 rock bags and 3 mattresses (mattress will only be installed if required by a third party)). Within the intertidal area the cable will be buried into a trench using excavators. The footprint of the installation is approximately 0.016km<sup>2</sup>.

The cable corridor does not pass through any protected sites however, 13 European protected sites have been considered for potential likely significant effects arising from works within Cable Corridor 2.12 Flotta to South Ronaldsay. There is potential for disturbance to protected breeding birds, during the short term and transient installation operations. The duration of the installation activities within Cable Corridor 2.11 Hoy - Flotta may occur over 21.5 days (including contingency) for the cable installation and burial from BMH to BMH. However, this time includes significant contingency for transit to site etc times and cable installation activities will only occur for approximately 6 days within this period. The design and project specific mitigation measures proposed for the R100 project and Cable Corridor 2.12 Flotta to South Ronaldsay, to reduce the effects of cable installation to not significant or ALARP are given in Section 8 Schedule of Mitigation and are as follows:

- M2 The 'Guide to Best Practice for Watching Marine Wildlife' guidance on birds will be followed where practicable, for installation Activities for Cable Corridor 2.12 Flotta-South Ronaldsay to prevent LSE to moulting common eider.
- M7 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 2.12 Flotta to South Ronaldsay.

## 9.9 Cable Corridor 2.3 Shetland – Sanday

Cable Corridor 2.3 Shetland - Sanday landing at Sanday in Orkney is covered by a separate Marine Environmental Appraisal within the R100 Project Shetland Marine Licensing submission, as agreed between Global Marine and MS-LOT

## 9.10 Summary

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

Section	Potential Pressure	Potential Effect	Residual effect of Cable installation						
			Corridor 2.5	Corridor 2.6	Corridor 2.7	Corridor 2.9	Corridor 2.10	Corridor 2.11	Corridor 2.12
Physical Processes	Abrasion/disturbance at the surface of the substratum.	Disturbance to the seabed	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion		Negligible	Negligible	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	Negligible	Negligible
	Physical change (to another seabed type)	Reduction in extent of seabed sediments	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	Local water flow (tidal current) changes	Scour and erosion / deposition of sediments to the seabed	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Benthic and Intertidal Ecology	Abrasion/disturbance at the surface of the substratum.	Mortality, injury or disturbance to benthic habitats and species	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant* (M4)	Not Significant* (M5)	Not Significant
	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	Not Significant	Not Significant	Negligible	Not Significant* (M4)	Not Significant* (M5)	Negligible
	Physical change (to another substratum type)	Reduction in extent of sedimentary habitats – Contingency external cable protection: Rock bags or mattresses	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant* (M4)	Not Significant	Not Significant

Section	Potential Pressure	Potential Effect	Residual effect of Cable installation						
			Corridor 2.5	Corridor 2.6	Corridor 2.7	Corridor 2.9	Corridor 2.10	Corridor 2.11	Corridor 2.12
	Siltation rate changes including smothering (depth of vertical sediment overburden)	Localised and temporary increase in turbidity and depth of sediment overburden.	Not Significant	Not Significant	Not Significant	Negligible	Not Significant* (M4)	Not Significant	Not Significant
Fish and Shellfish	Underwater noise changes	Basking shark / fish species	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	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	Negligible	Negligible
Protected Sites and Species	Visual and above water noise disturbance	Disturbance to protected birds	Not significant	Not significant	Not significant	Not significant	Not significant* (M2)	Not significant* (M2)	Not Significant* (M2)
	Underwater noise changes	Injury to pinniped	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
		Disturbance to pinniped	Not significant* (M1)	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
	Visual and above water noise disturbance	Disturbance to pinniped	Not significant* (M1)	No pressure-receptor pathway	Not significant* (M3)	Not significant* (M6)	No pressure-receptor pathway	No pressure-receptor pathway	No pressure-receptor pathway
Marine Archaeology	Abrasion/disturbance at the surface of the substratum	Damage to archaeological assets	Not Significant* (M7)	Not Significant* (M7)	Not Significant* (M7)	Not Significant* (M7)	Not Significant* (M7)	Not Significant* (M7)	Not Significant* (M7)
	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion.	Damage to archaeological assets	Not Significant* (M7)	Not Significant* (M7)	Not Significant* (M7)	Not Significant* (M7)	Not Significant* (M7)	Not Significant* (M7)	Not Significant* (M7)

Section	Potential Pressure	Potential Effect	Residual effect of Cable installation						
			Corridor 2.5	Corridor 2.6	Corridor 2.7	Corridor 2.9	Corridor 2.10	Corridor 2.11	Corridor 2.12
Shipping and Navigation	Displacement of vessels due to avoidance of Project vessels	Temporary displacement due to the avoidance of Project vessels	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable
	Collision Risk	Damage to vessels and injury to personnel	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable
	Accidental anchoring on surface laid cable	Damage to surface laid cable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable
	Accidental anchoring on surface laid cable	Damage to surface laid cable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable
	Project vessels blocking navigational features	Temporary displacement or restricted access	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable
	Extreme weather conditions	Cable installation risk	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable

Section	Potential Pressure	Potential Effect	Residual effect of Cable installation							
			Corridor 2.5	Corridor 2.6	Corridor 2.7	Corridor 2.9	Corridor 2.10	Corridor 2.11	Corridor 2.12	
	Reduced visibility	Cable installation risk	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	As Low As Reasonably Practicable	
Commercial Fishing	Temporary displacement/ restricted access	Reduction in fishing activity and increase in fishing effort	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	
Other Sea Users	Temporary displacement / restricted access	Disruption to activities	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
	Damage to third-party assets	Physical damage to third-party assets	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
Cumulative Effects	Abrasion/disturbance at the surface of the substratum.	Disturbance to the seabed, support habitats and species	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	
	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion		Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	
	Physical change (to another seabed type)		Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	



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