Orkney - Mainland Subsea Cable Link

Report identifying additional studies required to support Orkney – Mainland subsea cable marine licence application

Scottish and Southern Energy plc

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1 INTRODUCTION

1.1 Introduction

In line with Part 4 of the Marine (Scotland) Act 2010, Scottish Hydro Electric Transmission plc (SHE Transmission) is planning to submit an application for a Marine Licence for the planned installation of a 220 kV Alternating Current (AC) cable system between Orkney and Caithness on the Scottish mainland (Orkney – Mainland Subsea Link). The project is intended to transmit energy produced by a number of marine renewable schemes situated off the west coast of mainland Orkney to Caithness as well as wind farm developments. The purpose of this report is to determine the type, and scope of studies to be undertaken to support the application for the Marine Licence.

1.2 Background

SHE Transmission, part of the SSE plc group of companies, is the licensed electricity Transmission Owner (TO) in the north of Scotland. It owns the 5,000 km network of high voltage underground cables and overhead lines that provides electricity to people across northern Scotland, and connects northern Scotland to central and southern Scotland and the rest of Great Britain. SHE Transmission is also responsible for maintaining and investing in this transmission network, which covers around 70% of Scotland.

SHE Transmission is currently looking at taking forward a number of strategic projects which are aimed at expanding the transmission network across northern Scotland. These projects, which involve both network reinforcements and upgrades, have been identified as being required to facilitate the substantial increase in renewable generation in the north of Scotland and the subsequent increasing demand for renewable energy connections and hence to support the growth of the low carbon economy. The Orkney to Mainland Scotland Transmission Connection is one of these projects.

1.2.1 Orkney Connection Project

The aim of the Orkney Connection Project is to develop the transmission network in Orkney in order to provide increased capacity to accommodate increased generation from renewable energy projects (onshore and offshore/marine) in the Orkney area. This involves:

- Development and reinforcement of the onshore grid including substations.
- Development of subsea connections between Orkney and Mainland Scotland to enable the export of increased generation connecting on Orkney.

It should be noted that SHE Transmission will also develop a number of inter-island connections (cables and overhead lines) as a separate project to enable the various generation projects to connect to the 220 kV link. The extent of this infrastructure will depend on which generation projects progress to construction and the design is currently being finalised.

1.2.2 Orkney to Mainland Scotland Transmission Connection

The need for a transmission link to Orkney is centred around the development and connection of a significant volume of new renewable generation on the archipelago. The area benefits from abundant wind, marine and tidal energy resources which have long been the subject of development as far back as the 1980s.

At present there is no transmission infrastructure with the local demand and existing renewable generation being connected via the distribution network owned and operated by Scottish Hydro Electric Power Distribution (SHEPD). The local network is connected to the transmission system on the Scottish mainland at Thurso Grid Supply Point (GSP) via two 33 kV circuits which are at present fully utilised in providing export for local renewable generation. The renewable export potential has been maximised by the use of an innovative Active Network Management (ANM) system as part of what is known as the Orkney Registered Power Zone (RPZ). The system acts to curtail participating generator outputs based on measured power flow constraints within the Orkney network and on the two circuits to the Scottish mainland. Due to the heavy constraints that now

exist within the Orkney RPZ, SHEPD is not currently permitting any new generation to connect to the distribution network.

However, given the highly attractive renewable resources there remains much interest in developing generation projects on both a large and small scale across the Orkney archipelago. These projects include both onshore wind schemes and the development of large scale marine and tidal projects. The scale of the generation seeking to connect extends into the 100s of MW which drives the development of a transmission solution to facilitating large scale renewable generation export to the Scottish mainland and onwards towards the major demand centres in the South.

SHE Transmission has therefore sought to find an optimal solution to the connection of all contracted generation and in order to provide a transmission connection that will facilitate the connection of renewable generation, a marine cable linking Mainland Orkney and Mainland Scotland is required.

The main elements of the project are as follows:

- A new substation at Finstown.
- An underground cable linking Finstown substation to a cable landing site west of Stromness.
- A marine cable linking Mainland Orkney and Mainland Scotland.
- A new cable route between the Dounreay marine cable landing point and the new substation at Dounreay.
- Construction of a new substation at Dounreay.

Public Consultation took place in November 2017 regarding the above elements and further consultation will take place during the Summer 2018.

1.2.3 Project Needs and Developers

As described above at present there are two 33 kV distribution connections between Orkney and the Scottish mainland. Orkney possesses attractive renewable resources which have been targeted by developers seeking to invest, in particular in marine and onshore wind project. There is no spare capacity on the existing Orkney network to connect additional generation. Therefore, a higher capacity link is proposed to facilitate export form Orkney to the Scottish mainland.

1.3 Route Development

1.3.1 Strategic Route Selection

A five-stage process was followed in 2017 for the selection of strategic route options for a marine cable connecting mainland Orkney to mainland Scotland as follows:

1. Baseline information and connection components reviewed.
2. Rationalisation of technically feasible components utilising key assumptions.
3. Identification of strategic options based on the above.
4. Assessment of strategic options.
5. Identification of a preferred option.

Strategic Route Options were built upon geographic combinations of the following components:

- New Substation Location in Orkney (including Grid Supply Point).
- Onshore Transmission infrastructure on Orkney.
- Subsea Cable Corridor between landfall options.

- Landfall Options in Caithness.
- Onshore Transmission infrastructure on Caithness.
- Upgraded or new substation on Caithness.

1.3.2 Broad scale routing areas

Four broad scale routing areas were considered as part of the route development as shown in Figure 1.1. The main routing constraints and considerations for each area are outlined in Table 1.1.

Figure 1.1 Broadsale routing areas considered as part of route development

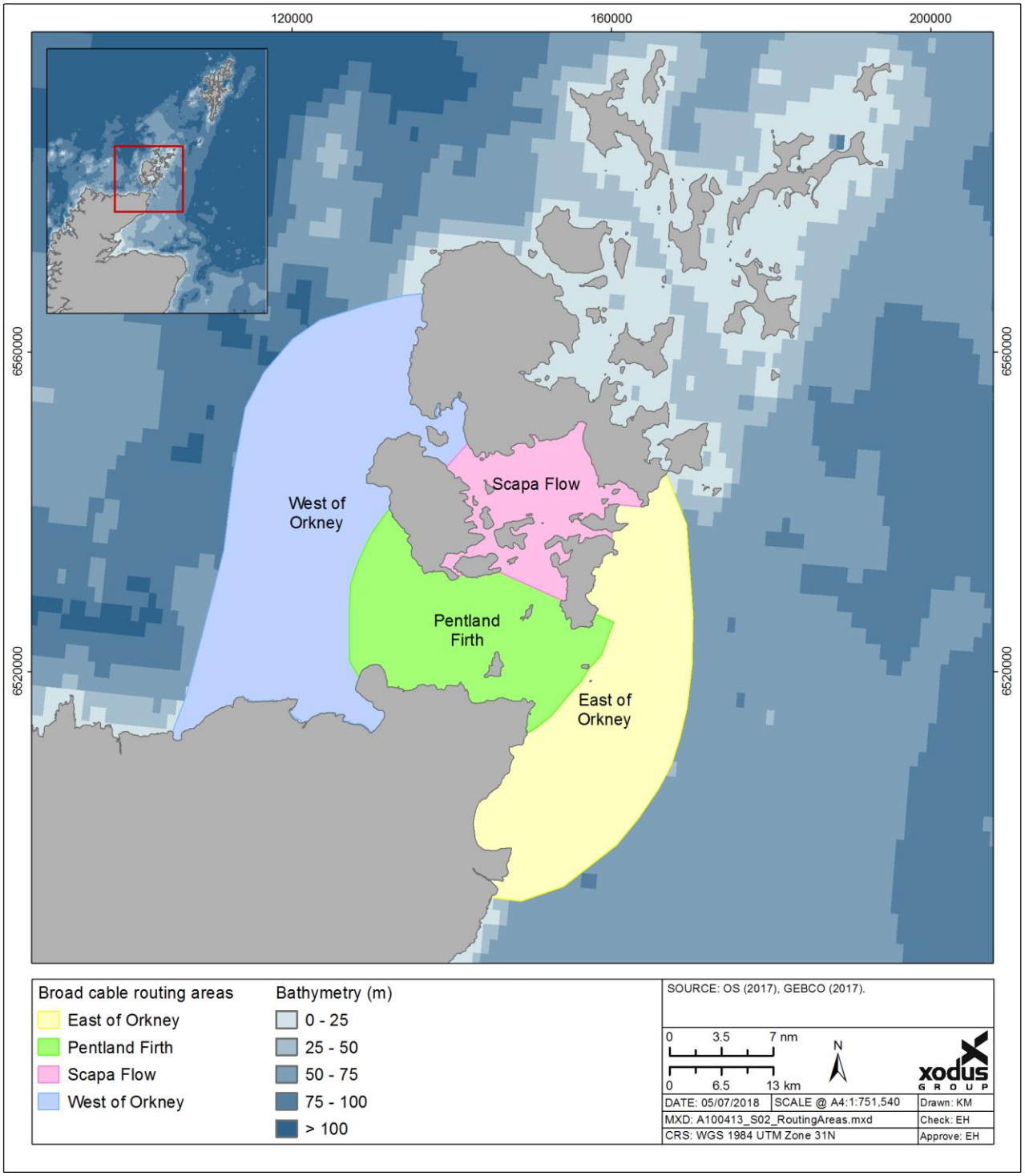


Table 1.1 Routing constraints and considerations for each of the four broad scale routing areas

East of Orkney	Scapa Flow
> Would require additional onshore infrastructure in Caithness > Important trawl and dredge fisheries in the area > Seabed on east coast scoured from tidal outflow leading to primarily rocky seabed with thin gravel or sandy veneer	> World renowned site of cultural heritage and the former British Admiralty base the flow contains many significant wrecks, including blockships, The German Grand Fleet, the war graves of HMS Royal Oak and HMS Vanguard, as well as numerous merchant vessels and aircraft, and the Churchill barriers > Internationally significant anchorage, safe harbour and ship-to-ship transfer area. > Numerous additional obstructions, including submarine cables, pipelines and aquaculture sties in the flow. > Priority Marine Features present, including Maerl beds, flame shell beds, horse mussel beds, seagrass bed and seapens. > World renowned SCUBA diving location
Pentland Firth	**West of Orkney**
> Contains some of the strongest tidal flows in the UK > Recognised International Shipping Lane > Within the core area of the Pentland Firth, between Hoy, South Ronadsay and Caithness, there is limited to no potential to bury the cable > Seabed primarily comprises gullied and fissured bedrock > Absence of sediment would require significant rock armouring to protect cable from tidal load and emergency anchoring. > Mobile sandwaves on the periphery of the Pentland Firth present additional technical challenges to cable installation	> Existing infrastructure at Dounreay has sufficient capacity, reducing the cost, time and environmental impact of the proposed connection. > Seabed conditions more favourable for cable burial (gently sloping seabed comprising mainly sandy and gravelly sediments). > Limited environmental constraints. > High levels of shipping traffic passing through the area (en-route to and from the Pentland Firth). > Relatively short route between Orkney Mainland and Caithness

1.3.3 Desk study and site visits

The initial landfall and cable route options identified as part of the Orkney Connection Project were subject to high level appraisal as part of a Geographical Information System (GIS) desk based study. Findings from this desk based appraisal were then used to inform a more detailed appraisal of the potential landfall locations during a site visit by the project team to Orkney held between the 10 and 13 October 2017.

Based on findings from the desk study and additional information acquired during the site visits it emerged that there were a number of potential challenges associated with some of the proposed landfall locations / areas of search and associated subsea cable routes. For the subsea cable route corridors between Orkney and mainland Scotland these included:

- Challenges with installing a cable within, or across, the Pentland Firth due to very strong currents, the presence of solid bedrock across most of the seabed and high levels of shipping activity at landfall locations.
- Challenges with installing a cable within, or across, Scapa Flow due to high levels of shipping activity, including large oil and gas tankers and other cargo vessels, presence of moorings for semi-submersibles and oil and gas tankers and other cargo vessels, presence of a number of protected wrecks and presence of a number of Priority Marine Features (PMFs), potential Annex 1 Habitat and designated sites.
- Challenges with shallow water (e.g. less than 5 m depth in certain locations), strong tidal currents, environmental designations, ferry routes, wrecks and existing infrastructure on the seabed (cables) between Hoy and Orkney mainland south coast (around Stenness and Bay of Ireland).

Based on the challenges, it emerged during the site visits that wider areas of search needed to be investigated with respect to potential landfall locations in order to facilitate development of alternative subsea cable route options.

1.4 Workshop

A workshop was held on 02 November 2017 in order for the project team to review the findings from the desk studies and site visits (from both a marine and onshore perspective) in order to identify a preferred shortlist of options to be taken forward for more detailed appraisal.

Drawing on experience from other SHE Transmission Projects a RAG (Red Amber Green) approach to evaluating the potential Strategic Options was adopted. This approach allows a high-level assessment to be made on key criteria and identifies key areas of risk and relevant constraints associated with each Strategic Option.

The Strategic Options to be assessed were agreed based on the key assumptions below:

- Utilise High Voltage Alternating Current (HVAC) technology for the connection.
- Avoid the core area of the Pentland Firth.
- Minimising the need for additional infrastructure on Caithness by the utilisation of existing infrastructure.
- Centrally located substation on Mainland Orkney.
- Landfall options on Caithness and Orkney drive the strategic option locations.
- Utilise a cable solution for the connection on Orkney mainland.

1.4.1 Detailed Appraisal

Based on the outcome from the detailed appraisal of the shortlisted options it was concluded that the following subsea cable route option would be subject to a marine survey (geophysical, geotechnical and environmental):

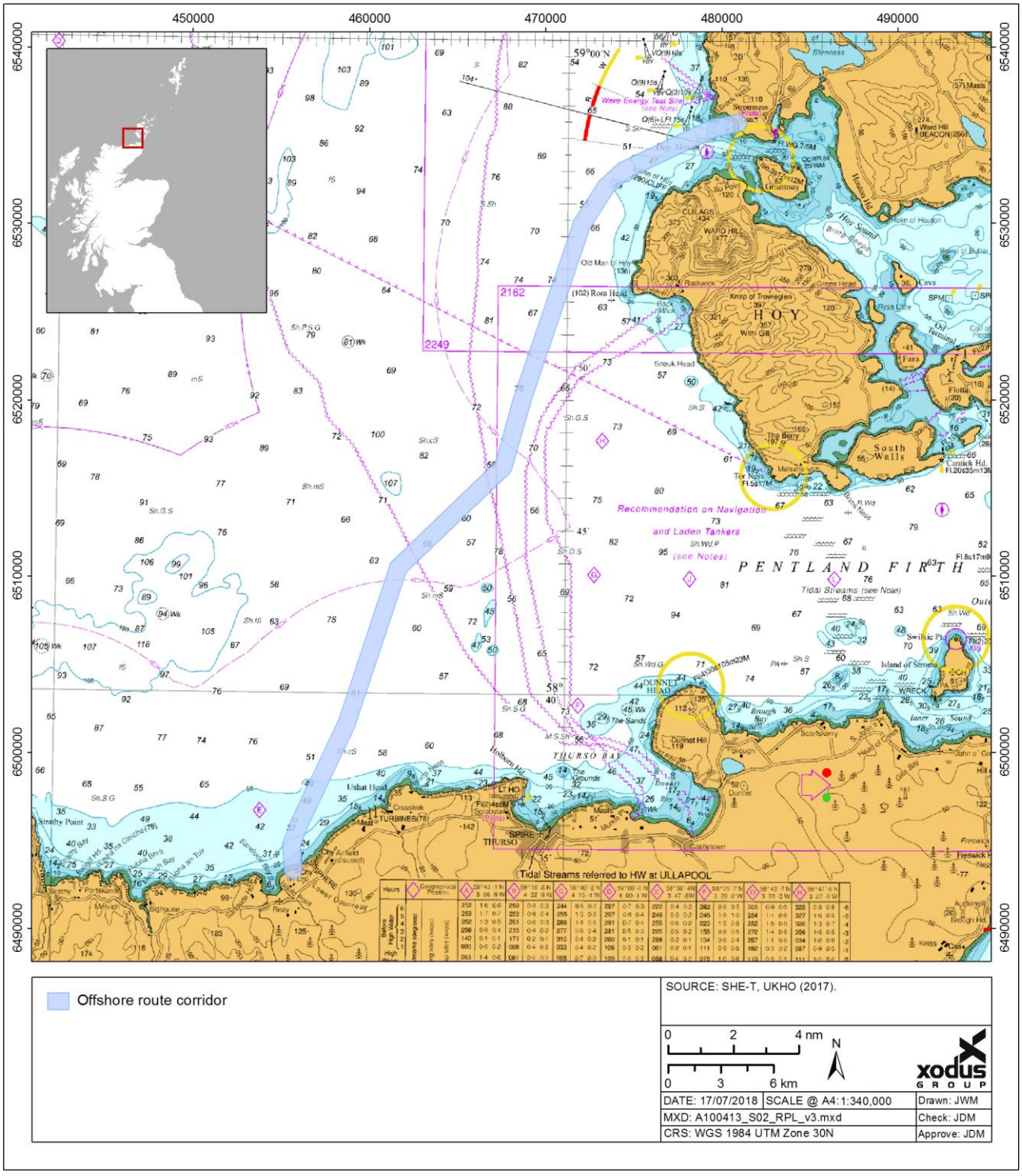
- West coast route option:
    - Dounreay to Billia Croo (Warebeth).

1.4.2 Preferred route option

The preferred route option between Dounreay and landfall at Warebeth (Billia Croo) is shown in Figure 1.2 and was selected on the following basis:

- It achieves the maximum potential for cable burial.
- It avoids major seabed hazards (e.g. sand wave fields, areas of exposed bedrock).
- It requires a limited number of cable crossings.
- Potential impacts on marine wildlife are limited.
- Potential interactions with other sea users (fisheries, shipping and navigation) are also minimised.

Figure 1.2 Preferred Route Option for Orkney – Mainland Subsea Cable Link



1.5 Marine Survey

A marine survey of the preferred Dounreay to Warebeth subsea cable route option was conducted between February and May 2018. The objective of the survey was to acquire geophysical, geotechnical and environmental data from a 1,000 m wide corridor along the full extent of the preferred cable route.

The scope of the surveys included the following:

- Nearshore geophysical survey (multibeam echo sounder (MBES), side scan sonar (SSS)/sub-bottom profiler (SBP) and towed magnetometer.
- Offshore geophysical survey (surveyor remote operated vehicle (SROV), MBES, SSS/SBP.
- Offshore Unexploded Ordnance (UXO) survey (work class ROV (WROV) - gradiometer).
- Nearshore UXO survey (towed magnetometer).
- Environmental Survey (benthic grab samples and drop-down video (DDV)).
- Geotechnical Survey (Vibrocore (VC) and Cone penetration test (CPT).
- Cable Crossings Surveys (WROV – gradiometer).
- Shallow water survey (MBES).
- Landfall topographic survey.
- Landfall magnetometer survey.

1.6 Cable Burial Risk Assessment

Having carried out initial re-routing bases on results and data from the marine survey, a Cable Burial Risk Assessment (CBRA) was carried out for the refined subsea cable route.

The main objective of for the CBRA was to ensure that, based on information from both the desk based study and survey data, cable burial can be achieved, using a variety of installation tools, if necessary, along as much as possible of the preferred cable route. Where the CBRA identified that due to seabed conditions, cable burial is not possible, where it is necessary to lay the cable directly on the seabed alternative options for protecting the cable were also considered. These additional protection measures include, for example, rock placement, concrete mattressing, Uraducting or cast iron half shells.

1.7 Project Description

1.7.1 Cable Specification

Electricity will be transmitted using HVAC submarine technology. The proposed submarine cable consists of a three core design with copper round compacted stranded conductors, cross-linked polyethylene (XLPE) insulation, copper polyethylene laminated tape, polyethylene sheath, galvanized steel wire armour and a single interstitial armoured optical fibre wire.

The three core design minimises the resultant electric and magnetic fields produced from the cable during operation.

1.7.2 Installation

SHE Transmission intend to bury the subsea cable along the majority of the route, apart from where this is not possible, for example at crossings with existing cables, or where the seabed characteristics are inappropriate for burial. The exact details of the installation technique will be confirmed when the contract for installation is awarded. It is envisaged that a variety of installation and burial techniques will be required due to the variable nature of the seabed along the proposed cable corridor.

1.7.2.1 Seabed Preparations

Prior to offshore cable installation the contractor will clear the seabed of any obstacles from the path of the planned cable. This will be undertaken with a grapnel. Areas of boulders may also be cleared and along the route where areas of sandwaves cannot be avoided pre-sweeping may be required in order for the burial techniques to be employed effectively.

1.7.2.2 Cable burial

The main construction options available for cable burial are:

- Separate cable lay and burial campaigns – cable buried by cable plough or trencher after it has been laid on the seabed (post-lay burial).
- Simultaneous lay and burial with cable plough or trencher.
- Separate trenching and burial campaigns – trench pre-cut by a large plough or trencher and cable laid into an open trench followed by backfill by plough, natural backfill or rock placement.

1.7.2.3 Cable burial tools

There are a diverse range of cable burial machines available on the market capable of burying and protecting offshore cables. These include:

- Cable Burial Ploughs.
- Jetting systems.
- Mechanical Rock Wheel Cutters.
- Mechanical Chain Excavators.

1.7.3 Additional Cable Protection Methods

Cable routing is the principal method of avoiding hazards and sensitive features. Once the routes have been identified any remaining hazards to the cables, and the impact to other seabed users from the cables can be accurately identified. This then allows for further protection by burial.

In areas where insufficient sediment cover, or burial cannot be achieved, or for cable crossings, additional cable protection may be required. Options include:

- Rock placement – this technique, one of the most established methods of cable protection, is likely to be suitable in the areas of cable crossings, subject to detailed design. This procedure can also be utilised along lengths of cable as well as crossings with existing cables.

1.7.4 Cable Landfalls

The onshore cables will be connected with the marine cables in a transition jointing pit (TJP) buried in the ground above the high water mark. In all areas the cables will be buried below the surface.

Various options are available for installation across the landfall area. If an ‘open cut’ installation is considered this would be restricted to the intertidal area only and would involve using mechanical diggers to construct a trench across a section of the beach. Alternatively, conduits will be installed beneath the landfall area using a trenchless technique such as horizontal directional drilling (HDD).

1.7.5 Operations, Maintenance and Repair

Once buried, submarine cables do not require routine maintenance. However, it is likely that regular inspection surveys will be undertaken using standard geophysical survey equipment and/or Remotely Operated Vehicles (ROVs) to monitor the cables buried depth. Maintenance activities will be required to ensure the integrity of the cable is maintained through sufficient cable burial and or cable protection such as rock or mattress

placement. For example, maintenance works may be required to re-bury any sections of cable that have become exposed and or to reinstate cable protection that has become displaced.

1.7.6 Decommissioning

Cables in Scottish territorial waters are installed on Crown Estate Scotland (CES) land and therefore a lease or licence is generally entered into for a set term, in this case, 40 years. An Initial Decommissioning Plan (IDP) will be developed and appended to the Crown Estate's licence agreement entered into by SHE Transmission for this project.

The case for cable recovery will need to be the subject of an environmental and economic assessment in the years leading up to decommissioning, and will follow industry best practice at the time.

1.8 Consent requirements

1.8.1 Marine Licence and EIA requirements

Under Part 4 of the Marine (Scotland) Act 2010, a Marine Licence is required for the installation and operation of submarine cables in Scottish waters. However, submarine cables do not require a formal Environmental Impact Assessment (EIA) as they are not listed on either Schedule 1 or Schedule 2 of the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended).

Although a formal EIA is not required for submarine cables, Marine Scotland advises, in their Guidance for Marine Licence Applicant Version 2 June 2015 that "*applicants for marine licences for submarine cables should consider the scale and nature of their projects and give consideration to the need for a proportionate environmental assessment*".

For larger projects, where there is potential for the subsea cable to impact key environmental receptors, it is recommended by Marine Scotland (Marine Scotland, 2015) that an assessment of potential impacts on these receptors is carried out. Results from this assessment along with other relevant information about the Project should then be provided to support the Marine Licence application.

The purpose of this report is to determine the type, and scope, of studies to be undertaken to support the application for a Marine Licence for the Orkney – Mainland Subsea Cable Connection.

1.8.2 Scottish National Marine Plan

The Scottish Government adopted the National Marine Plan in early 2015 (Scottish Government, 2015) to provide an overarching framework for marine activity in Scottish waters, in an aim to enable sustainable development and the use of the marine area in a way that protects and enhances the marine environment whilst promoting both existing and emerging industries. This is underpinned by a core set of general policies which apply across existing and future development and use of the marine environment; policies of particular relevance to the marine components of the Orkney Reinforcement Project include:

- General planning principle: There is a presumption in favour of sustainable development and use of the marine environment when consistent with the policies and objectives of the Plan;
- Economic benefit: Sustainable development and use which provides economic benefit to Scottish communities is encouraged when consistent with the objectives and policies of this Plan;
- Natural heritage: Development and use of the marine environment must:
    - Comply with legal requirements for protected areas and protected species.
    - Not result in significant impact on the national status of Priority Marine Features.
    - Protect and, where appropriate, enhance the health of the marine area.
- Noise: Development and use in the marine environment should avoid significant adverse effects of manmade noise and vibration, especially on species sensitive to such effects;

- Engagement: Early and effective engagement should be undertaken with the general public and interested stakeholders to facilitate planning and consenting processes; and
- Cumulative impacts: Cumulative impacts affecting the ecosystem of the Marine Plan area should be addressed in decision-making and Plan implementation.

Sectoral policies are also outlined in the Plan where a particular industry brings with it issues beyond those set out in the general policies. With respect to submarine cables, the Marine Plan sets out a number of key objectives. Those that are relevant to the Orkney Reinforcement project include:

- 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;
- Safeguard and promote the global communications network; and
- Support the generation, distribution and optimisation of electricity from traditional and renewable sources to Scotland, UK and beyond.

Key marine policies underpinning work carried out as part of this project include:

- Stakeholder engagement – this should be undertaken before routes are selected and agreed;
- Cable developers are required to provide evidence that they have taken a joined up approach to development and activity to minimise impacts on the environment and other sea users;
- Cables should be suitability routed to provide sufficient requirement for installation and protection;
- Cables should be buried to maximise protection where there are safety or seabed stability risks and to reduce conflict with other marine users and to protect the assets and infrastructure;
- Where burial is demonstrated to be not feasible, cables may be suitability protected through recognised and approved measures (such as rock placement, concrete mattresses or cable armouring) where practicable and cost-effective and as risk assessments direct; and
- When selecting locations for cable landfalls consideration should be given to flooding and coastal protection and align with policies in Scottish Planning Policy and Local Development Plans.

With respect to sea fisheries, the NMP sets out several policies. Those relevant to the Project include:

- Account should be taken of the EU's common Fisheries Policy, Habitats Directive, Birds Directive and Marine Strategy Framework Directive.
- Key factors should be taken into account when deciding on uses of the marine environment and potential impact on fishing such as; the cultural and economic importance of fishing, in particular to vulnerable coastal communities.
- In the event that fishing opportunities or activities cannot be safeguarded, a Fisheries Management and Mitigation Strategy should be prepared by the proposer of development or use.

With respect to submarine cables, the NMP sets out a number of key objectives. Those relevant to the Project include:

- 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 generation, distribution and optimisation of electricity from traditional and renewable sources to Scotland, UK and beyond.

1.8.3 Pilot Orkney Waters and Pentland Firth Marine Spatial Plan (MSP)

The pilot Pentland Firth and Orkney Waters Marine Spatial Plan (MSP) sets out an integrated planning policy framework to guide marine development, activities and management decisions, whilst ensuring the quality of the marine environment is protected. It is anticipated that this pilot MSP will provide a useful basis for the preparation of two separate regional marine plans for Orkney and the North Coast Scottish Marine Regions.

The pilot MSP has been prepared to align closely with the Scottish National Marine Plan, National Planning Framework 3 and Scottish Planning Policy. This is reflected in the plans guiding principles, aims and objectives all of which underpin the overarching vision to ensure that the Pentland Firth and Orkney Waters is a clean, healthy, safe, attractive and productive marine and coastal environment that is rich in biodiversity and managed sustainable to support thriving and resilient local communities.

Section 4 of the plan sets out a number of general policies which have been developed specifically to ensure that the Plan is contributing to both high-level government targets and helps meet our commitment to local sustainable development as outlined in the objectives. Those policies that are most relevant to this project include: supporting sustainable social and economic benefits; safeguarding the marine ecosystem; climate change; nature conservation designations; protected species; wider biodiversity; landscape and seascape; geodiversity; water environment; coastal processes and flooding; historic environment; integrating coastal and marine development; noise and marine non-native species.

There are also a number of sectoral policies which are specifically relevant to particular types of development or activity. Of direct relevance to this project is Sectoral Policy 8: Pipelines, Electricity and Telecommunications Infrastructure which includes specific reference to the Orkney 132 kV reinforcement works. Specific policy requirements relating to the development of subsea cables reflect those outlined in Scottish National Marine Plan discussed above.

1.8.4 Other legislative requirements

Where there is potential for a project have an adverse effect on a Natura site (Special Area of Conservation (SAC) or Special Protection Area (SPA)) including proposed or candidate sites e.g. pSPAs or cSACs, an appropriate assessment is required in accordance with the Habitats Directive to ascertain whether a project will adversely affect the integrity of a site in view of the conservation objectives of the site.

The requirements of the Habitats Directive are transcribed in Scotland by the Conservation (Natural Habitats, &c.) Regulations 1994 as amended. In accordance with these regulations, and as part of the HRA process, where it is identified that there is potential for a Likely Significant Effect (LSE) on a Natura site, the applicant is required to provide information on the effects of the project on the integrity of a European site to the competent authority to enable them to undertake an appropriate assessment of the project.

In addition to requirements for an HRA, where a project has the potential to impact either a designated or possible Nature Conservation Marine Protected Area (NCMPA or possible NCMPA) designated under the Marine (Scotland) Act 2010, applicants are also required to provide specific information on the potential impacts of the proposed project on the conservation objectives of these sites.

2 OVERVIEW OF KEY ENVIRONMENTAL CONSIDERATIONS

2.1 Overview of proposed cable route area

A detailed description of key environmental features associated with the area covered by the Orkney to Mainland Scotland subsea cable, and the sensitivity of those features to the installation and operation of a subsea cable is provided in the Final Routing Report (Xodus, 2017). Further detailed information is also provided in the geophysical and environmental survey reports prepared by MMT (2018a and 2018b).

The proposed subsea cable route extends in a north to south direction from Billia Croo in Orkney to Caithness across the Pentland Firth.

The maximum recorded water depth along the proposed cable route was 91 m lowest astronomical tide (LAT) (MMT, 2018a).

The Pentland Firth supports a variety of marine wildlife such as marine mammals, birds and fish. The nearest conservation site is the Hoy Special Protection Area (SPA) protecting a range of birds.

Fisheries within this area of the Pentland Firth targets predominantly haddock, crabs, scallops and cod, with passive gear (i.e. traps) representing the largest part of the fishing effort. Fishing effort for passive gear is generally high in the Pentland Firth. The Pentland Firth is also an international shipping lane, and the proposed cable route crosses a number of ferry routes.

Existing infrastructure in the Pentland Firth and along the proposed cable route is fairly limited, although the proposed route crosses a number of telecommunication cables.

The coastal waters near the landfalls also contain wreck sites and dredge disposal sites.

Some of the key environmental features and human factors associated with the proposed subsea cable route and landfalls are discussed in more detail below.

2.2 Protected sites

2.2.1 Baseline overview

Throughout Caithness (north coast Mainland) and Orkney there are a number of sites designated for the protection of coastal and marine features of biodiversity and geodiversity importance. These include:

- **Special Protection Areas (SPAs)** designated under the Birds Directive for the protection of rare, threatened or vulnerable bird species listed in Annex I of the Birds Directive, and also for regularly occurring migratory species. With respect to the coastal and marine environment, in 2009, marine extensions were classified for a number of SPAs located along the Caithness and Orkney coasts that are designated for seabird breeding colonies. The size of the extension depends on key qualifying features of the site and range from 1 km seaward extensions for SPAs with razorbill, guillemot and puffin, 2 km extensions for SPAs with gannet and fulmar and 4 km extensions for SPAs with Manx shearwater. Specific SPAs are listed in Table 2.1;
- **Proposed SPAs (pSPAs)**. More recently, the Scottish Government has identified a suite of an additional 15 proposed SPAs (pSPAs) for marine birds. These pSPAs have been identified specifically for the protection of at sea territories for 45 species of rare and vulnerable seabirds which depend on the marine environment for a large part of their lifecycle. With regard to the proposed cable route area there are three pSPAs: Pentland Firth pSPA, Scapa Flow pSPA and North Orkney pSPA;
- **Special Areas of Conservation (SACs)** designated under the Habitats Directive for marine and coastal habitats and species of European importance, although most of the SACs in the south of Orkney are designated for land features;
- **Nature Conservation Marine Protected Area (NCMPAs)** designated under the Scotland (Marine) Act 2010 for the protection of nationally important habitats, species, geology and undersea landforms not

covered under existing and proposed marine SPAs and SACs. With regard to the proposed cable route area, the North-West Orkney offshore NCMPA is of relevance;

- **Sites of Special Scientific Interest (SSSIs)** designated under the Nature Conservation (Scotland) Act 2004 for nationally important habitats, species, rocks and landforms, or a combination of such natural features that are considered to best represent Scotland's natural heritage. Specific SSSIs are listed in Table 2.1.

In addition to nature conservation designations, there are a number of other protected sites and areas that require consideration with respect to subsea cable routing and identification of potential landfall locations. These include:

- **National Scenic Areas (NSA)** are areas of outstanding scenic value that are representative of Scotland's finest landscapes. There is only one NSA in the project study area, the Hoy and West Mainland NSA. This designation extends across most of Hoy except areas in the south east of the Island and across a large area of western Mainland Orkney;
- **World Heritage Sites (WHS) -** These are recognised areas of global outstanding natural and/or cultural heritage value made by the United Nations Education, Science and Culture Organisation (UNESCO). The Heart of Neolithic Orkney WHS includes the four monuments of Neolithic Orkney, Skara Brae, Ring of Brodgar, Standing stones of Stenness and Maeshowe;

Other protected sites include Ramsar sites designated under the Convention on Wetlands of International Importance for wetland habitats and wetland species, and sites of special scientific interest (SSSI). However, given that there are none in the immediate vicinity of the proposed cable route no further reference is made to these sites.

The distances between the proposed cable route area and the key conservation areas and protected sites are listed in Table 2.1 and their locations are mapped in Figure 2.1.

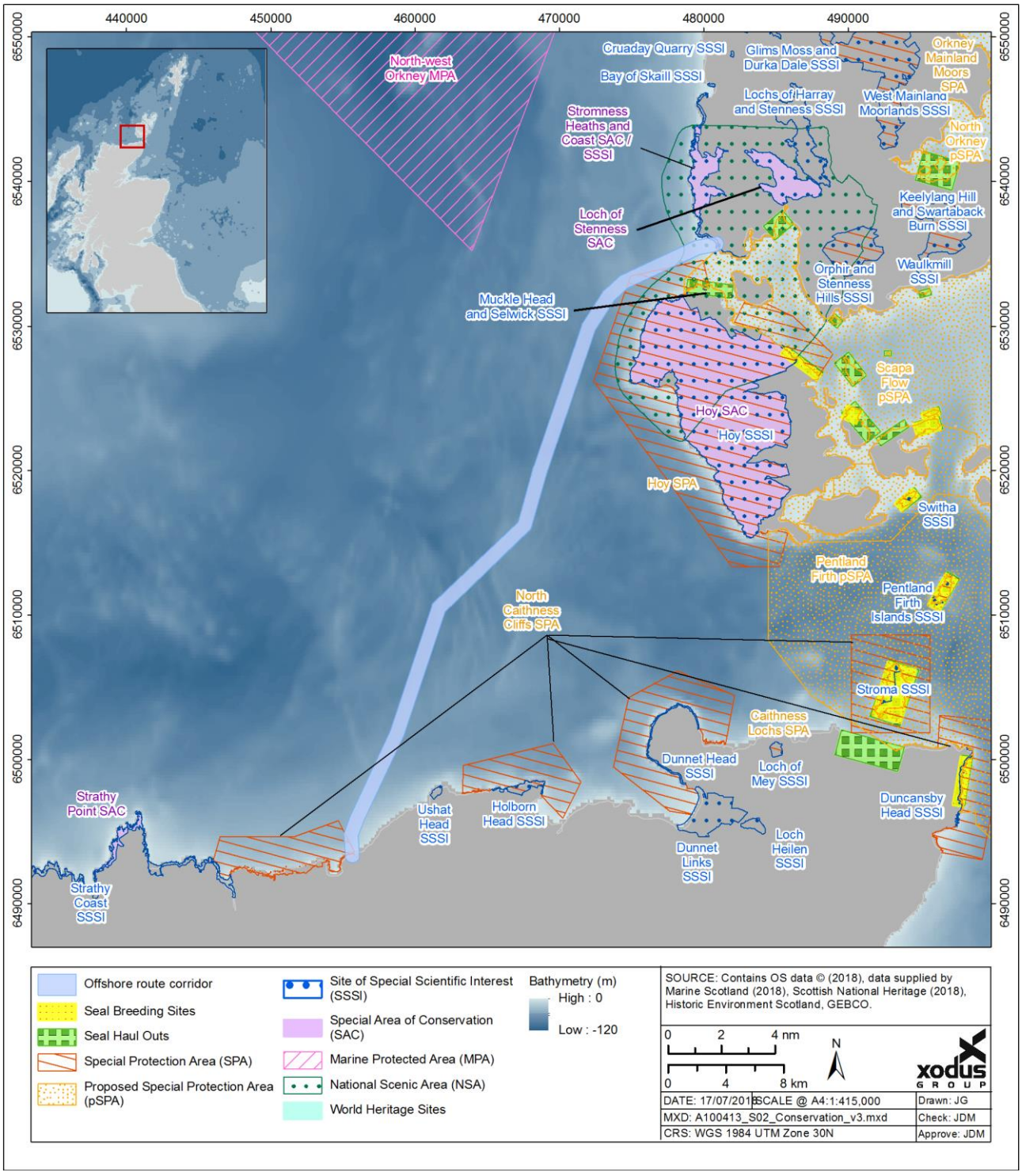
Table 2.1 List of protected sites with marine components located within the vicinity of the proposed cable route

Site name	Designation	Description	Approximate distance (km) from proposed subsea cable route (at closest point)
NCMPA			
North-west Orkney	NCMPA	This site has been designated for the following features: - Sandeels (PMF); and - Sand banks, sand wave fields and sediment wave fields representative of the Fair Isle Strait Marine Process Bedforms Key Geodiversity Area.	9.5 km
SAC/SSSI			
Hoy	SAC and SSSI	This site protects the following Annex I habitats: - Vegetated sea cliffs of the Atlantic and Baltic coasts; - Natural dystrophic lakes and ponds; - Northern Atlantic wet heaths with *Erica tetralix;* - Alpine and boreal heaths; and Blanket bogs.	2.2 km

Site name	Designation	Description	Approximate distance (km) from proposed subsea cable route (at closest point)
Stromness Heaths and Coast	SAC	This site has been designated for the following habitats: > Vegetated sea cliffs of the Atlantic and Baltic coasts; and > European dry heaths (Annex I habitat)	2.2 km
Loch of Stenness	SAC	Coastal lagoons (Annex I habitat)	4.9 km
Muckle Head and Selwick	SSSI	Quaternary earth science interest, with raised beach deposits underlying a glacial till.	0 km
SPA/pSPA			
Hoy	SPA	Supports the following species during the breeding season: > Peregrine *Falco peregrinus*; > Red-throated diver *Gavia stellata*; > Great skua *Catharacta skua.* Supports a seabird assemblage of international importance during the breeding season, composed of puffin *Fratercula arctica,* guillemot *Uria aalge*, kittiwake *Rissa tridactyla*, great black-backed gull *Larus marinus*, Arctic skua *Stercorarius parasiticus*, fulmar *Fulmarus glacialis* and great skua.	0 km
North Caithness Cliffs	SPA	Supports the following species (breeding season): > Peregrine (Annex I); and > Guillemot (migratory). Supports a seabird assemblage of international importance during the breeding season, including puffin, razorbill *Alca torda*, kittiwake, fulmar and guillemot.	0 km

Site name	Designation	Description	Approximate distance (km) from proposed subsea cable route (at closest point)
Scapa Flow	pSPA	Supports the following Annex I species (breeding season): > Great northern diver *Gavia immer*; > Red-throated diver; > Black-throated diver *Gavia arctica*; and > Slavonian grebe *Podiceps auritus*. Supports migratory populations of European importance of the following species: > European shag *Phalacrocorax aristotelis*; > Common eider *Somateria mollissima*; > Long-tailed duck *Clangula hyemalis*; > Common goldeneye *Bucephala clangula*; and > Red-breasted merganser *Mergus serrator*.	0 km
Pentland Firth	pSPA	The proposed qualifying features are: > Arctic skua (breeding); > Arctic tern *Sterna paradisaea* (breeding); > Guillemot (breeding); and Breeding seabird assemblage.	15.2 km
Seal haul-out			
Selwick	Seal Haul Out	This site protects both grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina.*	1.8 km
Bay of Ireland	Seal Haul Out	This site protects both grey seal and harbour seal.	3.5 km
NSA			
Hoy and West Mainland	National Scenic Area	The site has been designated for its geology, topography, archaeology and land use.	0 km

Figure 2.1 Conservation sites in the vicinity of the Orkney to Mainland subsea cable link



2.2.2 Potential impacts

Potential impacts on these sites and associated qualifying features / features of interest are discussed in the following specific sections of this report relating to the relevant receptors, e.g. benthic ecology, ornithology and marine mammals.

With regard to potential impacts on the sites listed in Table 2.2, in accordance with the Habitats Directive and the Marine (Scotland) Act 2010, it will be necessary to undertake further assessment on seabirds as the proposed cable route crosses the Hoy SPA, the North Caithness Cliffs SPA and the Scapa Flow pSPA. Together, they protect a number of bird species, including the following seabird species: red-throated diver *Gavia stellata*, great skua *Stercorarius skua*, puffin *Fratercula arctica*, guillemot *Uria aalge*, kittiwake *Rissa tridactyla*, great black-backed gull *Larus marinus*, Arctic skua *Stercorarius parasiticus*, Arctic tern *Sterna paradisaea*, fulmar *Fulmarus glacialis*, great northern diver *Gavia immer*, black-throated diver *Gavia arctica*, Slavonian grebe *Podiceps auritus*, European shag *Phalacrocorax aristotelis*, common eider *Somateria mollissima*, long-tailed duck *Clangula hyemalis*, common goldeneye *Bucephala clangula*, red-breasted merganser *Mergus serrator* and razorbill *Alca torda*.

Detail on the additional information to be provided in support of the Marine Licence with respect to potential effects on these protected sites is provided in Section 3.

Table 2.2 Potential impacts on features designated within the protected sites

Potential impact	Relevant phase of cable installation		
	Cable installation	Cable operation (Maintenance and Repair)	Decommissioning
Disturbance from underwater noise	✓	✓	✓
Barrier to mobile species movement	✓	✓	✓
Death or injury by collision with vessels	✓	✓	✓
Non-synthetic compounds contamination (heavy metals, hydrocarbons)	✓	✓	✓
Physical change in seabed type (e.g. associated with cable protection)	×	×	×

Note: Tick symbol denotes there is a potential impact for the given phase of cable works, and that it will be assessed further.

Conclusion: protected sites
Further assessment work is required to support an application for a Marine Licence

2.3 Physical environment and seabed conditions

2.3.1 Baseline overview

Strong winds are the main characteristic of the Orkney climate. Prevailing winds come from between the west and south-east for 60% of the year, with the windy months being October to March. Wind speeds greater than 8 m/s occur 30% of the year, with an hourly mean speed of 4 m/s recorded during the period 1965-1973 (Barne *et al*., 1997).

The North Atlantic and the North Sea tidal systems influence the tides in Orkney, producing a net flow of water from west to east. Tidal current speeds are between 1 to 2 m/s around Orkney, with higher velocity in the Pentland Firth and Hoy Sound of up to 4.5 m/s (Barne *et al*., 1997). The tidal range at mean spring tide varies between 2.5 and 3 m, with variations in tidal estuaries and bays. The mean wave height in the east coast of Orkney is higher than 0.5 m for 75% of the year and higher than 1.5 m for 10% of the year while the west of Orkney is characterised by a mean wave height exceeding 1 m for 75% of the year.

The channels between the Orkney islands are relatively shallow with water depths of less than 20 m. The sea floor gradient is steep from the west of Mainland and the south west of Hoy, but the slope is gentler to the north and east of the Orkney islands (Barne *et al*., 1997).

The seabed between the Orkney islands is composed of bedrock, boulders, gravel, sand and occasional deposits of mud, while in tide-scoured sounds it is bedrock, shell gravel and sand. Shores consist of bedrock and boulders, with sand in the bays (Barne *et al*., 1997).

SHE Transmission commissioned MMT to undertake a geophysical survey along the proposed cable corridor between February and May 2018. The scope of the surveys included nearshore and offshore geophysical surveys, using multi-beam echo sounder (MBES), side-scan sonar (SSS)/sub-bottom profiler (SBP), towed magnetometer, and remotely operated vehicle (ROVs). Geotechnical surveys were also conducted using a vibrocore and core penetration test (PCT). Shallow water surveys were undertaken via an autonomous surface vehicle (ASV).

The maximum recorded water depths along the proposed cable route was 91 m Lowest Astronomical Tide (LAT) at Kilometre Point (KP) 32.02 (MMT, 2018a). In the offshore sections between KP2.0 and KP49.2, water depth ranged between 28.9 m and 91 m LAT (MMT, 2018b). The slope is mostly gentle throughout the survey corridor along the cable route, with some moderate slope over sandy features between KP30 and KP40. The slope reached a maximum of 49.6° on the rocky Scottish mainland landfall at KP 52.05, and some steep slopes were also present near the Orkney landfall (MMT, 2018a). Depths generally increase southwards to about KP20. Several larger seabed features are present, generating some moderate and steep slopes, particularly between KP28.7 and KP35.5. Towards the southern end of the surveyed corridor, from KP35.5 onwards, depths gradually decrease, with mostly very gentle and gentle slopes. Throughout the survey corridor, there are small seabed features such as ripples and boulders.

The southern section of the proposed cable route, offshore of the Caithness landfall, crosses an area presenting potential Annex I sandbank features. However, MMT did not identify any sandbank features throughout the survey corridor (MMT, 2018a).

2.3.2 Potential impacts

There are no seabed features of conservation importance in the vicinity of the proposed cable route, and sediment resuspension and settlement is expected to be highly localised, therefore the proposed cable route is not anticipated to cause any impacts on the physical environment and seabed conditions. Potential impacts on benthic and intertidal ecology are covered in Section 2.4.

Conclusion: physical environment and seabed conditions
No further assessment work is required to support an application for a Marine Licence

2.4 Benthic and intertidal ecology

2.4.1 Baseline overview

The area in the vicinity of the proposed cable route supports a rich and diverse range of benthic habitats and species. Of greatest significance are those identified by Scottish Natural Heritage (SNH) and Joint Nature Conservation Committees (JNCC) as Priority Marine Features (PMFs). In total 81 PMFs have been identified in the seas around Scotland, 33 of which are benthic or intertidal (SNH, 2016a).

The list of PMFs is derived from an evaluation of Scotland marine biodiversity interests that are on existing conservation lists including Annexes I and II of the Habitats Directive, the OSPAR[1] list of threatened or declining habitats and species and UK Post-2010 Biodiversity Framework (2012) priority species (JNCC, 2016a). It also forms the basis of the list of 41 Marine Protected Area (MPA) search features (SNH & JNCC, 2012). These are marine features that have been identified as requiring protection through the designation of NCMPAs under the Marine (Scotland) Act 2010.

The nearest conservation site with habitat features is the Hoy SAC (0 km), however this site is designated for land habitat features. The North-West Orkney NCMPA, located 9.5 km from the proposed cable route, is designated for sandeels and for seabed features including sandbanks, sand wave fields and sediment wave fields. The proposed cable route is also crossing areas of potential Annex I sandbanks directly offshore of both the Orkney and the Caithness landfalls (JNCC, 2017a). However, there are no conservation sites with benthic features in the immediate vicinity of the proposed cable route.

The EUSeaMap broad-scale seabed habitat classification, which uses the EUNIS classification, shows that the seabed in the offshore section of the cable is mostly composed of coarse sediments, with an area of 'deep circalittoral sand' (A5.27) (Figure 2.2). Offshore of the Orkney landfall, the seabed habitat is a high energy infralittoral/circalittoral rock (A3.1 and A4.1). The section of cable towards the Caithness landfall crosses an area of fine sand and muddy sand (A5.25 and A5.26), and the seabed nearer the landfall is classified as 'moderate energy infralittoral rock' (A3.2) (Figure 2.2).

MMT was commissioned to undertake an environmental survey along the proposed cable route between Orkney and the Scotland mainland between February and May 2018. The survey involved seabed imagery sampling, sediment grab sampling, particle size analysis (PSA), and hydrocarbons and metals analyses (MMT, 2018b).

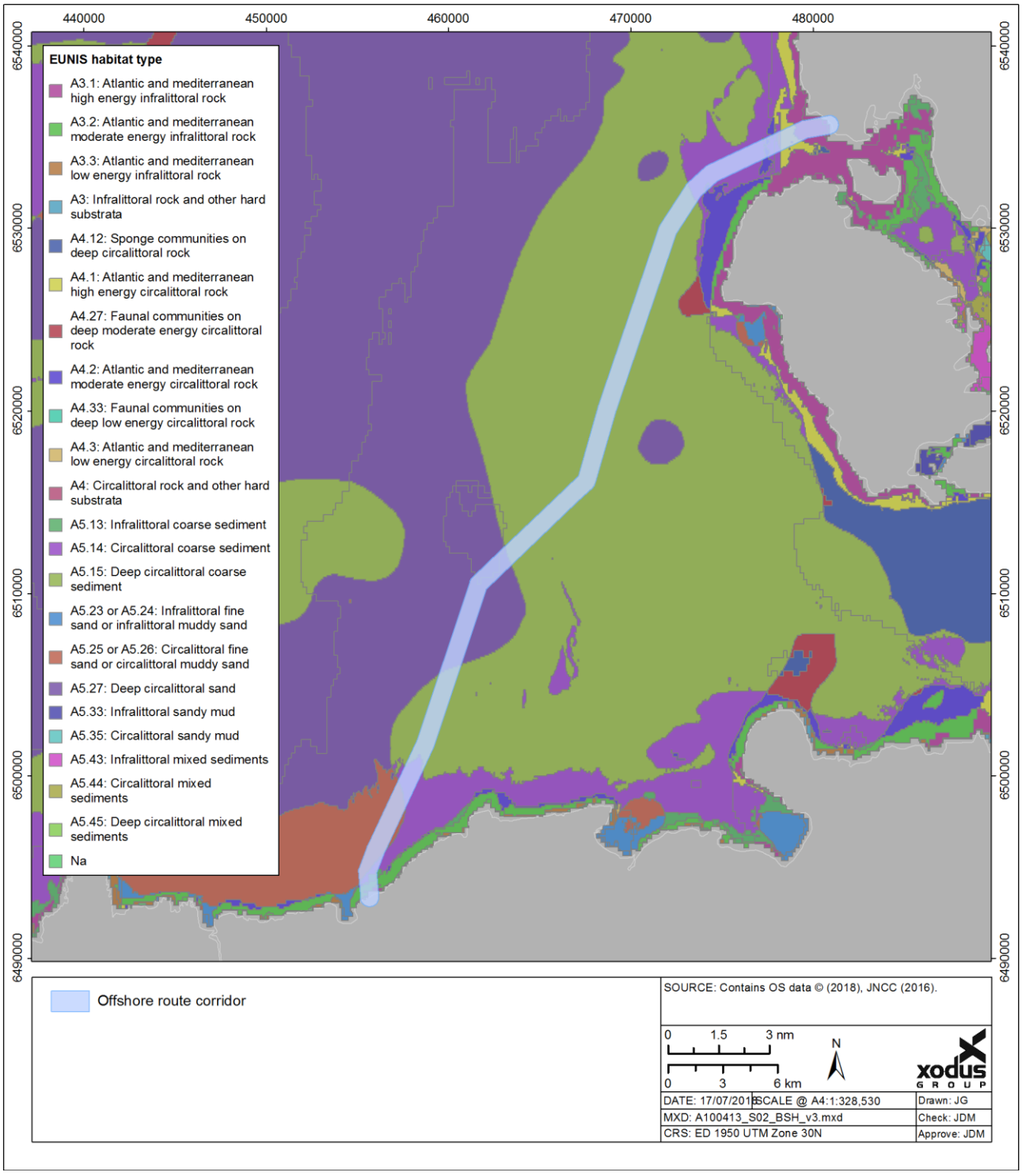
A total of 21 habitats were identified along the survey corridor, with two listed on the Annex I of the EC Habitats Directive, bedrock and stony reefs.

At the Orkney landfall, the seabed consisted of high energy, bedrock pavement with an occasional thin veneer of sandy coverage with occasional cobbles and boulders. The habitat 'mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock' (reference A3.125 of the EUNIS classification) which met the criteria for Annex I bedrock reefs of the EC Habitats Directive, was the dominant habitat found in the nearshore area at the Orkney landfall (MMT, 2018b).

The seabed in the Caithness nearshore area consisted mainly of the habitat 'Atlantic and Mediterranean moderate energy infralittoral rock' (A3.2), which met the criteria for Annex I bedrock reefs, with an area of infralittoral fine sand (A5.23). Further offshore of the Caithness landfall, the habitat circalittoral fine sand (A5.25) covered an extensive area, with a section of circalittoral mixed sediments (A5.44) at the outermost edge of the survey corridor to the west of the cable route (MMT, 2018b).

[1] The Convention for the Protection of the Marine Environment of the North East Atlantic

Figure 2.2 EUSeaMap 2016 Broad-scale seabed habitat classification (JNCC, 2017b)



2.4.2 Potential impacts

There are no designated sites with benthic features in the vicinity of the cable route, the nearest being the North-West Orkney NCMPA, located 9.5 km from the proposed cable route. However, the environmental survey conducted along the route in 2018 (MMT, 2018b) revealed the potential presence of Annex I reefs habitats.

Potential impacts associated with cable installation, operation and decommissioning are presented in Table 2.3. This assumes the cable will either be buried using recognised cable trenching methods or protected using recognised cable burial / protection techniques (e.g. concrete mattresses, rock placement etc.) where trenching is not possible. Key potential impacts include direct physical disturbance of the seabed and associated seabed habitat loss and disturbance; smothering due to sediment suspension and resettlement; and physical changes to the character of the seabed due to the presence of cable protection measures (e.g. concrete mattresses or rock placement).

This information has been used to identify those features that are most sensitive to impacts associated with cable installation activities and therefore will require more detailed assessment as part of an application for a Marine Licence to determine potential level and extent of impact once preferred methods of installation have been determined.

Table 2.3 Potential impacts summary

Potential impact	Relevant phase of cable installation		
	Cable installation	Cable operation (Maintenance and Repair)	Decommissioning
Direct disturbance and removal of feature due to substratum abrasion	✓	✓	✓
Smothering of benthic and intertidal habitats and species from sediment suspension and re-settlement	✓	✓	✓
Physical change in seabed type (e.g. associated with cable protection)	✓	✓	✓
Introduction of marine non-native marine species	✓	✓	✓
Accidental fuel release	✓	✓	✓

Note: Tick symbol denotes there is a potential impact for the given phase of cable works, and that it will be assessed further.

Conclusion: Benthic and intertidal ecology
Further assessment work is required to support an application for a Marine Licence

2.5 Fish ecology

2.5.1 Baseline overview

Most fish species are highly mobile. It is therefore highly unlikely that cable installation activities and cable presence would have any impact on the majority of fish species. It is only those species that are either directly dependent upon the seabed environment for important life-stages (e.g. spawning) or are considered to be sensitive to noise generated during cable installation or from electromagnetic fields (EMF) emitted from the installed cable that could potentially be impacted by the project.

2.5.1.1 Spawning and nursery grounds

There are two key species that are of commercial and conservation importance that depend on the seabed either throughout, or at key stages, in their life-cycle: herring and sandeels. Although, data from Coull *et al.*

(1998) and Ellis *et al.* (2012) indicates that there is potential for sandeel to spawn throughout the Pentland Firth, the intensity of spawning is considered to be low (Ellis *et al.,* 2012). This spawning ground is one of the two protected features of the North-West Orkney NCMPA (the other feature being sandbanks, sand wave fields and sediment wave fields). The North-West Orkney NCMPA is located to the northwest of the project study area. This site extends across 4,365 km^2 of shallow water lying to the north and west of Orkney on the Scottish continental shelf, and has been identified as an important export ground for sandeels (JNCC, 2016b). The area is characterised by a mixed ground type (areas of rough substrate within the areas of sediment) which make it suitable for sandeel colonisation. The NCMPA plays an important role in supporting wider populations of sandeels in Scottish waters. Specifically, newly hatched sandeel larvae from this region are exported by currents to sandeel grounds around Shetland and the Moray Firth. This is supported by a time series of data on larval abundance that date back to the 1950s, illustrating the continued importance of this area as an export ground for sandeels (JNCC, 2016b).

With regard to herring, Coull *et al*. (1998) indicate that there is potential for this species to spawn in the area within the vicinity of the proposed cable route and throughout the Pentland Firth, however, the Updated Fisheries Sensitivity Maps Report (Scottish Government, 2014), suggests that the probability of the presence of 0 group fish in the project study area is low.

Other than sandeel, the number of other fish species with spawning grounds in the project study area is limited to lemon sole and whiting. However, a number of other fish species utilise the area of the proposed cable route for nursery grounds including saithe, anglerfish, blue whiting, cod, hake, lemon sole, ling and mackerel. Haddock nursery grounds extend across the southern part of the proposed cable route (waters off north coast Mainland Scotland) only.

2.5.1.2 Noise sensitive species

The ability of fish to detect sound depends on whether or not they have a swim bladder and whether the swim bladder is located near to a fish's ear. Hawkins and Popper (2014) have divided fishes into several different categories based on the structures associated with hearing. The functional groups include:

- Low sensitivity to noise - fishes without a swim bladder (these can only detect kinetic energy – e.g., sharks, common skate complex, mackerel, whiting);
- Medium sensitivity to noise - fishes with a swim bladder that is far from the ear and thus not likely to contribute to pressure reception, so the fishes are primarily kinetic detectors (e.g., salmon, sea trout) and eggs and larvae that are less mobile than adult fish and therefore not able to readily move away from the noise source; and
- High sensitivity to noise - fishes with a swim bladder or other air bubble that is close to the ear and enables sound pressure to be detected, broadening the hearing range and increasing hearing sensitivity (e.g., herring, sprat, cod).

Based on information presented in the Final Routing Report (Xodus Group, 2017) there is potential for a number of noise sensitive species such as cod, herring, whiting and Atlantic salmon to be present along the subsea cable route. Potential impacts on these species are discussed in Section 2.5.2.

2.5.1.3 Elasmobranch and electro-sensitive species

Species of fish that are most vulnerable to the effects of EMF are elasmobranch species (sharks and rays), which possess specialised electroreceptors; and other electro-sensitive species (usually migratory species), which are able to detect induced voltage gradients associated with water movements and geomagnetic emissions (e.g. Atlantic salmon).

There is also potential for a number of elasmobranch species to be present in the project study area. These include common skate complex, spotted ray, spurdog, thornback and tope shark.

There is also potential for a number of electro-sensitive species (migratory) to be present in, or transit through the project study area. Key species include Atlantic salmon, sea trout and European eel. Atlantic salmon and sea trout are diadromous in that they spend most of their lives at sea, only returning to freshwater rivers to spawn. European eels are also diadromous; however, the adults migrate out to sea to spawn with the larvae making the return journey back to freshwater.

There is evidence to suggest that both Atlantic salmon and European eel use the Pentland Firth as a key migration route between freshwater rivers on the north and east coast of Scotland and deeper offshore waters around Iceland and the north Atlantic Ocean (Malcolm *et al.,* 2010). More recent research (Godfrey *et al.,* 2014a, 2014b and Guerin et al., 2014) suggests that Atlantic salmon may also migrate through waters to the north and east of Orkney in addition to the Pentland Firth.

2.5.1.4 Basking sharks

Basking sharks are the second largest fish in the world, reaching up to 12 m in length (average length is usually 6 - 8 m). They are widely distributed in cold and temperate waters and feed predominately on plankton and zooplankton e.g. barnacles, copepods, fish eggs and deep-water oceanic shrimps by filtering large volumes of water through their wide open mouth. They typically move very slowly (around 4 miles per hour). In the winter they dive to great depths to get plankton while in the summer they are mostly near the surface, where they appear to be basking (Orkney.com, 2016). Hotspots for basking shark sightings include Eynhallow and off the Old Man of Hoy.

Basking sharks were hunted in Scotland up to 1995. However, they are now protected in UK waters principally under Schedule 5 of the Wildlife and Countryside Act 1981 and under the Nature Conservation (Scotland) Act 2004. The biggest risk of the project to basking sharks is potential collision with vessels involved in cable installation. Given that basking sharks are slow to mature and have a long gestation period, the species can be slow to recover if populations are rapidly depleted.

2.5.2 Potential impacts

As described above, given the mobile nature of fish, potential impacts associated with cable installation and operation are expected to be minimal on the basis that fish can readily move out of, or avoid the main area of potential impact.

With respect to direct impacts on spawning habitat (direct disturbance or smothering), data from Coull *et al.* (1998), Ellis *et al.* (2012) and the Scottish Governments Updated Fisheries Sensitivity Maps indicates that although there could be sandeel spawning grounds along the subsea cable route, it is unlikely that these are key spawning grounds. Potential impacts on any spawning grounds associated with direct seabed disturbance during cable installation will be limited to the working corridor. Given the limited potential for significant sandeel spawning grounds along the subsea cable route and the localised nature and small scale of direct seabed disturbance the potential for significant impacts to occur is unlikely.

With respect to underwater noise, given the limited number of vessels expected to be involved in any seabed preparation and cable installation activities (maximum two vessels – cable lay vessel and guard vessel) and the short duration and temporary nature of cable installation activities, the potential for significant impacts on fish is considered to be minimal.

Electromagnetic field (EMF) emissions are generated from the transmission of electricity through subsea cables. The cables produce electromagnetic fields which have both electric (E) measured in volts per metre (V m-1) and magnetic components (B) measured in micro tesla (µT). While the direct electric field is mostly blocked with the use of conductive sheathing, the magnetic field penetrates most materials and therefore are emitted into the marine environment with the resultant induced electric (iE) field.

It is commonly recommended that cable burial is used to increase the distance between the cable and the electro-sensitive species (Gill *et al.,* 2005; DECC, 2011). However, where burial is not an option due to nature of seabed cable protection, e.g. concrete mattresses or rock placement can also be used to increase the distance between marine species sensitive to EMF and the EMF source.

Where cables are buried to a depth of 1 m, the predicted magnetic field strength at the seabed is expected to be below the earth's magnetic field (assumed to be 50 µT) (MORL, 2012) and not detectable by elasmobranch or electro-sensitive species (fish and crustaceans). Given that the cable will be buried or protected for the majority of its length (in line with SHE Transmission overarching objective for installation of subsea cable) the potential for significant impacts due to EMF emissions are minimal and unlikely to occur.

Potential collision risk between basking shark and cable installation vessels is also limited and unlikely to occur due to the limited number of vessels involved in cable installation (cable lay vessel and guard vessel), the slow

speed of the vessels (maximum of a few knots) and the short duration and temporary nature of cable installation activities.

Sediment disturbance will be limited to the direct vicinity of cable trenching operations and no impacts from the low levels of sediments disturbance by trenching activity are expected, including to diadromous fish or shellfish species. Any disturbed sediment is expected to be rapidly dispersed by tidal currents.

Due to the seabed in the area covered by the proposed cable route being a low intensity spawning ground for both sandeel and herring, and that these are the only species that are reliant on the seabed to spawn, along with the nearest protected site for sandeels being located 9.5 km away (North-West Orkney NCMPA) and the mobile nature of fish, it is highly unlikely for fish ecology to be impacted by the proposed works.

Conclusion: fish ecology
No further assessment work is required to support an application for a Marine Licence

2.6 Ornithology

2.6.1 Baseline overview

As outlined in Section 2.2.1, the proposed cable route crosses the Hoy SPA, the North Caithness Cliffs SPA, and the Scapa Flow pSPA. Together, they protect a number of bird species, including the following seabird species: red-throated diver, great skua, puffin, guillemot, kittiwake, great black-backed gull, Arctic skua, Arctic tern, fulmar, great northern diver, black-throated diver, Slavonian grebe, European shag, common eider, long-tailed duck, common goldeneye, red-breasted merganser and razorbill.

Important breeding seabird colonies in the Orkney region include razorbill, fulmar, shag, kittiwake, guillemot, little tern *Sternula albifrons*, common tern, black guillemot *Cepphus grylle*, leach's storm petrel *Oceanodroma leucorhoa*, storm petrel *Hydrobates pelagicus*, gannet *Morus bassanus*, great skua, puffin, Manx shearwater *Puffinus puffinus*, great black-backed gull, Arctic tern, great cormorant, Arctic skua and European shag *Phalacrocorax aristotelis* (DECC, 2016).

With regards to birds on the shore at the cable landfalls, all wild birds in the UK are protected under the Wildlife and Countryside Act 1981 (as amended) and under this Act it is an offence to intentionally or recklessly: kill, injure, take, damage, interfere, disturb or harass wild birds listed on Schedule 1 and 1A. This applies to their nests, eggs and young.

The breeding season for the most common seabird species found in the Scottish marine environment are listed in Table 2.4.

Table 2.4 Seabirds breeding seasons and nest occupancy periods in the Scottish marine environment (SNH, 2017)

Protected seabird species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Arctic Tern												
Common guillemot								M M	M	M		
Kittiwake												
Arctic Skua												
Fulmar												
Great skua												
Red-throated diver									M	M	M	M
Razorbill								M	M	M	M	
European shag												
Slavonian grebe												
Common eider							M	M	M			
Long-tailed duck												
Velvet scoter												
Red-breasted merganser								M	M	M		
Black-headed gull												
Great black-backed gull												
Black guillemot								M	M	M	M	
Common gull												
Lesser black-backed gull												
Cormorant												
Puffin		M	M									
Black-headed gull												
Northern gannet												
Common tern												
Storm petrel												

Key:

Black = breeding season

Dark blue = breeding site attendance

Light blue = non-breeding period

White = not present in significant numbers

M = flightless moult period

2.6.2 Potential impacts

Due to the proposed cable route crossing the Hoy SPA, the North Caithness Cliffs SPA and the Scapa Flow pSPA, impacts on protected sites will be covered in further assessment work. Potential impacts on these protected sites are presented in Table 2.2 in Section 2.2.2.

There is potential for localised disturbance at each of the landfalls. Potential impacts associated with the onshore area at the landfall (above Mean High Water Spring (MHWS)) are addressed as part of a separate planning application and study.

A summary of the potential impacts on protected sites with seabird features and protected sites in general is presented in Table 2.2.

Conclusion: ornithology
Further assessment work on designated sites with seabird features is required.

2.7 Marine mammals

2.7.1 Baseline description

Marine mammals are afforded varying levels of protection under different international and national legislation depending upon their genus. Within UK waters, cetaceans (whales, dolphins and porpoises) and otters *Lutra lutra* are protected through the listing of European Protected Species (EPS) under Annex IV of the Habitats Directive and are provided full protection within Scottish territorial waters through the Conservation (Natural Habitats, &C.) Regulations 1994 (as amended). Bottlenose dolphin, harbour porpoise, grey and harbour seals, and otters gain additional protections through Annex II of the Habitats Directive, which requires their consideration in the designation of Special Areas of Conservation (SACs). Pinnipeds (seals) are protected through provisions set out in Annex V of the Habitats Directive, which defines them as species of community interest, in addition to their required consideration for the designation of SACs as defined in Annex II. Additionally, all marine mammal species which regularly occur within Scottish waters are designated as Priority Marine Features by Scottish Natural Heritage (SNH, 2016).

There are two seal haul outs near the proposed cable route, approximately 1.8 km and 3.5 km from the Orkney landfall.

2.7.1.1 Cetaceans

Several species of cetacean occur in the vicinity of the proposed cable route in the northern North Sea, these include: harbour porpoise *Phoecoena phocoena*, bottlose dolphin *Tursiops truncatus*, minke whale *Balaenoptera acutorostrata*, killer whale *Orcinus orca*, Atlantic white-sided dolphin *Lagenorhynchus acutus* and white-beaked dolphin *Lagenorhynchus albirostris*. Of these, minke whales, white-beaked dolphin, harbour porpoise, Risso's dolphin and bottlenose dolphin have been observed within the vicinity of the proposed cable route (Reid *et al.*, 2003; Paxton *et al*., 2014).

Survey data shows the encounter rate for these species was very low for bottlenose dolphins and white-beaked dolphins, and low for minke whales and harbour porpoise (NMPI, 2018). Density estimates from the most recent Small Cetaceans in the European Atlantic and North Sea (SCANS-III) surveys indicated harbour porpoise as the most abundant species within the vicinity of the proposed cable route with an estimated density of 0.152 animals/km^2 (Hammond *et al*., 2017). This value is high in comparison to the other cetacean species which were observed during these surveys: white-beaked dolphins (0.021 animals/km^2), minke whales (0.010 animals/km^2) and bottlenose dolphins (0.004 animals/km^2). However, it is generally quite low when scaled across the 52 km cable length, with potentially only 2 – 8 animals likely to be around or near the cable-lay route (JNCC, 2016).

Based on the available information, the area in which the proposed cable route is located has low to very low cetacean density and is not considered to be significant for feeding, breeding, nursery or migrating cetaceans (Hammond *et al*., 2004; NMPI. 2018; Reid *et al*., 2003). The mobile nature of cetaceans means it is unlikely there will be any potentially significant impacts to marine mammals from the proposed works.

2.7.1.2 Pinnipeds

There are two species of pinniped which occur in UK waters: grey and harbour seals. Grey and harbour seals forage in both inshore and offshore waters depending on the seasonal distribution of their prey. However, both species tend to be concentrated close to shore, particularly during the pupping and moulting seasons which occur between May and August (Hammond *et al.*, 2004). Harbour seals haul out every few days on tidally exposed areas of rock, sandbanks or mud.

Orkney and its islands are a stronghold for both grey and harbour seals. Grey seals have much larger foraging ranges than harbour seals, often travelling hundreds of kilometres from their haul out sites, while harbour seals will generally forage within 50 kms of their selected haul out sites. Fine-scale data on the density of seals at-sea indicate that habitat usage is very high (greater than 5 seals/km^2) around where the cable makes landfall in Orkney, and medium (greater than 3 seals/km^2) near where it meets the mainland (Russell *et al*., 2017). As expected from known seal behaviour, seal density is very low (less than 1 seal/km^2) for the majority of the cable route occurring in deeper, offshore waters.

Harbour seal populations in the Orkney islands have been in continued decline due to a variety of factors, including: climate change, increased predation from other species, increased prey competition and potential direct mortality (e.g. shooting). Owing to the conservation significance of harbour and grey seals in the UK and the relative importance of the coastline and inshore waters around Orkney as seal habitat, it is recommended that additional consideration be given to these species in future impact assessments.

2.7.1.3 Otters

Otters are semi-aquatic marine mammals which utilise both marine and freshwater as foraging habitat. They occupy dens (known as holts) situated along coastlines and riverbanks. Although there are no designated sites for otters in the vicinity of the cable route, it is an offence to deliberately or recklessly capture, kill, injure, disturb or harass European Protected Species (EPS) under the Habitats Regulations 1994, including cetaceans, seals and otters. Otters are also protected under the Wildlife and Countryside Act 1981, which also classifies as an offence any act of obstruction of access or destruction to their breeding, resting or sheltering places. For these reasons, further assessment work is required to assess the potential impacts on otters arising from the proposed cable route installation works.

2.7.2 Potential impacts

The main potential impact on cetaceans and pinnipeds is disturbance due to underwater noise from vessels involved in the installation of the subsea cable and cable trenching activities.

As noted above for seabirds, the Pentland Firth is an international shipping lane and therefore marine mammals passing through this area will already be exposed to noise from vessels transiting through this area. Taking this into account, as well as the limited number of vessels expected to be involved in cable installation (cable lay and guard vessel) and the short-term nature of cable installation activities, any potential disturbance impacts from noise will be temporary in duration and are unlikely to lead to any changes in population numbers or affect breeding success of cetaceans or pinnipeds in the vicinity of the proposed cable route.

Although there are no designated sites for cetaceans and otters in the vicinity of the proposed cable route, due to the importance of Orkney waters to these species, further impact assessment work is required.

With regards to pinnipeds, although there are no SACs designated for either grey or harbour seal in the Project area, there are a number of designated haul out sites in which lie 1.8 km and 3.5 km from the proposed subsea cable route.

Table 2.5 presents a summary of the potential impacts on marine mammals associated with the proposed cable route.

Detail on the additional information to be provided in support of the Marine Licence with respect to potential effects on marine mammals is provided in Section 3.

Table 2.5 Potential impacts summary

Potential impact	Relevant phase of Project		
	Cable installation	**Cable operation (maintenance and repair)**	**Decommissioning**
Increased sedimentation affecting ability to forage	✓	✓	✓
Injury and/or disturbance from underwater noise emissions	✓	✓	✓
Disturbance of otter holts at the landfalls	✓	×	×

Note: Tick symbol denotes there is a potential impact for the given phase of cable works, and that it will be assessed further.

Conclusion: marine mammals
Further assessment work is required to support an application for a Marine Licence

2.8 Commercial fisheries

2.8.1 Baseline description

The proposed cable route is located in waters that are exploited by commercial fisheries. Cable-lay activities have the potential to temporarily modify access to fishing grounds and / or the abundance and distribution of target species. As such, it is important to consider the relative commercial importance of the proposed cable route to the fishing industry to determine whether an impact assessment is required.

Commercial fisheries data is geographically divided using the International Council for the Exploration of the Sea (ICES) rectangle grid system to enable comparisons of fisheries productivity on an international scale. The UK Marine Management Organisation (MMO) publishes its fisheries data using the ICES grid system. The proposed cable replacement route falls within ICES rectangle 46E6, extending from the North Coast of Scotland to Orkney.

Marine Scotland uses Vessel Monitoring System (VMS) data to determine fishing effort and landings for each ICES rectangle within Scottish waters and the UKCS. Recently published fisheries effort data suggests that the region along the proposed cable route is particularly important to passive gear fisheries (Scottish Government, 2017). Gear use is dominated by traps (70%), though some demersal and pelagic fishing also occurs within the area in the form of trawls (7%), dredges (3%), hooks and lines (10%) and other miscellaneous gear types (10%) (Scottish Government, 2018).

Fishing takes place year-round within ICES rectangle 46E6, with no clear seasonality in fisheries landings (Scottish Government, 2018). In 2016, haddock, crabs, scallops and cod comprised nearly 75% of the total liveweight (2,414 tonnes) of fisheries landings from the region (Scottish Government, 2017). These four species are of commercial importance due to their high value, particularly scallops and crabs, and landings of those species from this region collectively contributed nearly £3 million to the UK economy in 2016. The most deployed gear type in terms of fishing day effort were traps, deployed for a total of 1,410 fishing days in 2017, representing 68% of the total fishing effort for that year. The remaining effort was associated with miscellaneous gear, hooks and lines, trawls, and dredges mainly.

Preliminary landings data for 2017 reveal that a net of approximately £4.18 million was landed from ICES rectangle 46E6 in 2017 (Scottish Government, 2018). This figure is well above the UK average of roughly £3.5 million per annum per ICES rectangle, suggesting the area's importance to the local and national commercial fishing sector (Scottish Government, 2018).

Given the potential importance of the area of the proposed cable route to commercial fisheries, it is proposed that commercial fisheries is addressed in more detail as part of future impact assessment work for this proposed cable route.

2.8.2 Potential impacts

Key potential impacts on fisheries include possible disruption to fishing activities during cable installation and longer term impacts on fishing activities due to presence of the cable and associated protection measures. Longer term impacts relate specifically to reduced fishing effort within traditional fishing grounds, particularly for trawl fisheries where there is an increased risk of gear being snagged on the subsea cable (if surface laid) and associated cable protection measures (e.g. concrete mattresses or rock placement). Presence of the cable could also lead to localised changes in the abundance and distribution of target species.

With regard to the Orkney to Mainland Scotland subsea cable link, the objective for the proposed cable route is to bury as much of the cable as possible. Based on results from the CBRA (Cathie Associates, 2018), it is expected that most of the cable between Orkney and Caithness will be buried, although the depth of burial will vary depending on seabed sediment type. Potential long-term impacts on fisheries along the proposed subsea cable route are therefore expected to be minimal.

With regard to short term impact during cable installation, there will be a requirement to apply a safety zone around the cable installation vessels. Safety zones are required to ensure the safety of all personnel involved in cable installation and generally cover a 500 m radius from the cable installation vessel. Given that fishing activities will not be permitted in the safety zone, this will lead to a temporary exclusion from fishing grounds within the 500 m radius. However, due to the linear nature of the cable, the location of the safety zone will change as the cable lay vessel moves along the cable route. It is therefore expected that access to certain areas along the route will only be restricted for very short periods of time e.g. a few days to a week, with full access resuming once the cable lay vessel has moved to the next section of the cable route.

Depending on the selected cable installation method, there is potential that, if trenching of the cable route and cable lay activities occur consecutively rather than simultaneously, (e.g. cable trench created first, followed by installation of the cable a few weeks later) then there could be potential restrictions on fisheries activities along the cable route for the period between trenching being completed and cable installation commencing. The potential for these restrictions would be communicated to local fishermen once installation method and programme has been fully defined.

In terms of potential impacts on fisheries, traps were the most used gear in ICES rectangle 46E6, representing 69% of the total fishing effort, which generally are not affected by the presence of subsea cables on the basis that they have the ability to fish around the cable and associated cable protection. Hooks and lines, trawls, dredges and miscellaneous gears were also used in the area, and may be impacted by the presence of the Orkney to Mainland Scotland subsea cable. Therefore, further assessment of impacts on commercial fisheries is required. The potential impacts on commercial fisheries are summarised in Table 2.6.

Detail on the additional information to be provided in support of the Marine Licence with respect to potential effects on commercial fisheries is provided in Section 3.

Table 2.6 Summary of potential impacts

Potential impact	Relevant phase of Project		
	Cable installation	**Cable operation/maintenance**	**Decommissioning**
Loss off access to fishing grounds	✓	✓	✓
Snagging risk	✓	✓	✓
Sediment redistribution (aquaculture)	✓	×	✓
Change in distribution of target species	✓	×	✓

Note: Tick symbol denotes there is a potential impact for the given phase of cable works, and that it will be assessed further.

Conclusion: commercial fisheries
Further assessment work is required to support an application for a Marine Licence

2.9 Shipping and navigation

2.9.1 Baseline description

Analysis of Automatic Identification System (AIS) vessel track data (for non-recreational and recreational) collected for the Pentland Firth and Orkney Waters was undertaken by Cathie Associates (Cathie Associates, 2018). The AIS dataset covered the Orkney islands for a 2-year period between 2016 and 2018.

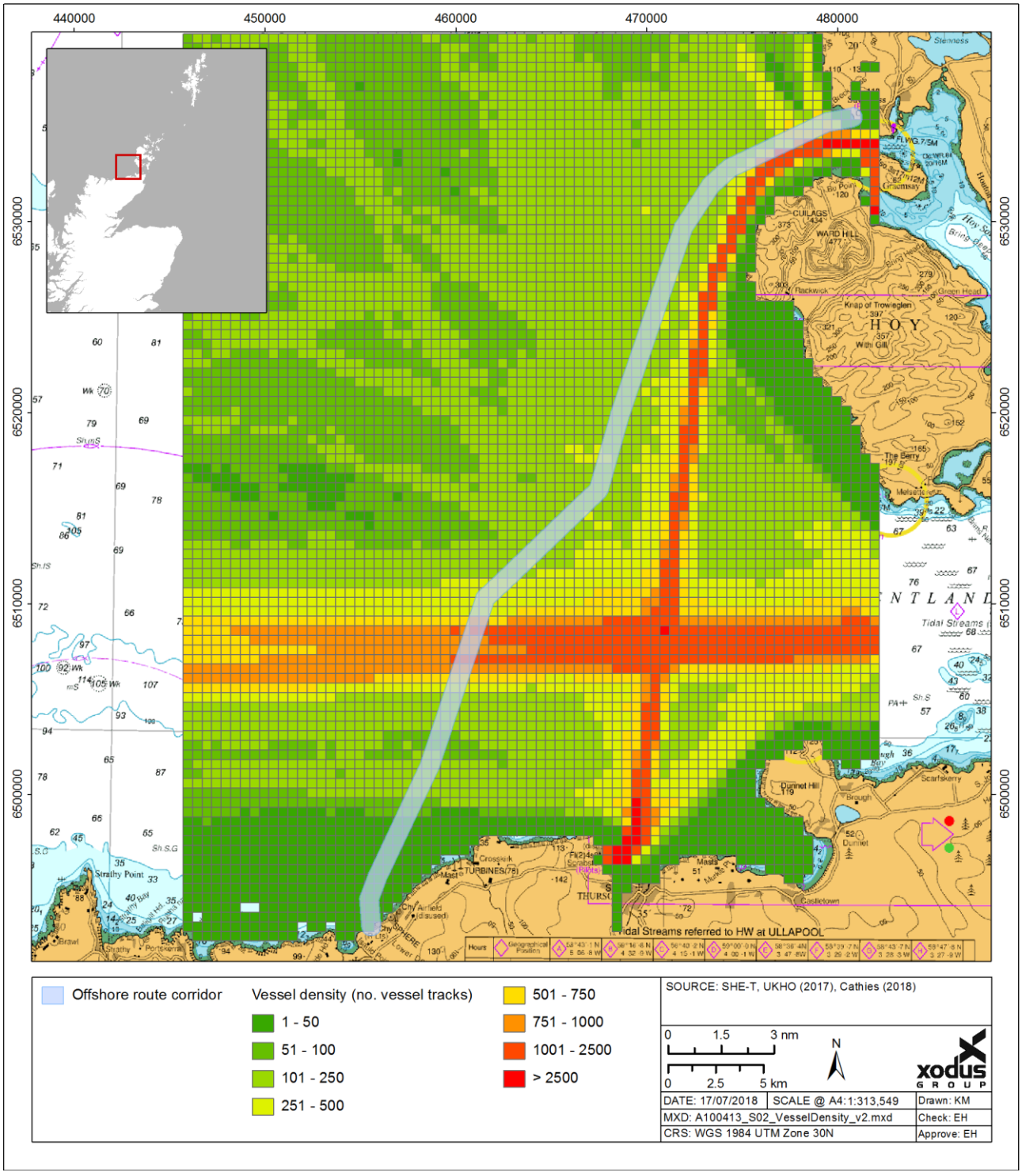
Vessel density was found to be low along most of the route, with between 0 – 50 tracks recorded near the landfalls, 50 – 100 tracks for most of the offshore section, except between KP30 and KP40 where shipping density was high, reaching 1,000 to 2,500 tracks. This is due to fishing and cargo routes running east to west across the Pentland Firth. Shipping was also moderate offshore of Orkney (between approximately KP1 and KP4, with areas associated with 500 – 750 tracks (Figure 2.3).

Cargo and tankers comprised over 45% of the vessels crossing the proposed cable route, whilst fishing vessels and passenger vessels represented 26% and 11% of those, respectively. The remaining vessels included unknown vessel types, offshore industry vessels, government ships and pot/dredging vessels (Cathie Associates, 2018). There are Mainland Scotland to Orkney passenger ferry routes across the Pentland Firth between Scrabster and Stromness (west route) (*Hamnavoe)* and eastern route between Gills Bay and St Margaret's Hope (South Ronaldsay) (*Pentalina*).

There are no designated anchorage areas along the proposed cable route, however there are some areas in the vicinity of the route where vessels have been recorded at anchor between KP35 and KP38 (Cathie Associates, 2018). The Pentland Firth is also recognised as an international shipping lane, and is also a passage route for oil and gas passenger transfer vessels between Aberdeen and Kirkwall (Orkney) and Scrabster (Scottish Mainland).

There are also a number of recreational sailing routes in and around Orkney with yachts visiting main harbours and marinas of Scrabster, Kirkwall, Stronmess and Westray. Recreational sailing trips were significantly higher during the summer months than winter months. There are also a number of local sailing cubs (Orkney Sailing Club based at Kirkwall; Holm Sailing Club based at St Mary's; Stromness Sailing Club based at Stromness; and Pentland Firth Yacht Club based at Scrabster Harbour).

Figure 2.3 Vessel traffic density (Cathie Associates, 2018)



2.9.2 Potential impacts

Given that a moderately high number of vessels pass through the Pentland Firth on a regular basis, there is potential for the presence of a slow-moving cable lay vessel transiting perpendicular to the main flow of traffic to present a potential risk to navigation. However, with the implementation of standard industry practice mitigation measures as outlined below, potential impacts associated with an increased risk of collision between the survey vessel and other vessels transiting the area will be reduced.

- Implementation of safety zones (500 m) around the cable lay vessel;
- Notices to Mariners issued prior to cable installation;
- Ensuring the cable lay vessel is fitted with Automatic Identification System (AIS) so that it can be easily detected by other vessels transiting through the area; and
- Providing details of the scheduel for cable lay activities to local ports, ship operators, fishermen and recreational sailing organisations.

Given the short duration of the cable installation activities, potential impacts in terms of shipping and navigation are considered to be minor and not significant. However, with resepct to navigational safety, it is proposed that a navigational risk assessment (NRA) is carried out to support the Marine Licence application as it will be necessary to agree specific safety measures as described above with the Maritime Coastguard Agency (MCA) and Northern Lighthouse Board (NLB) and for these to be commuicated with the Royal Yachting Association (RYA), Royal National Lifeboat Institute (RNLI) and other mariners.

A summary of the potential impacts on shipping and navigation is presented in Table 2.7.

Detail on the additional information to be provided in support of the Marine Licence with respect to potential effects on shipping and navigation is provided in Section 3.

Table 2.7 Potential impacts summary

Potential impact	Relevant phase of Project		
	Cable installation	**Cable operation**	**Decommissioning**
Loss off access to anchorage areas	✓	✓	✓
Change in shipping/ferry routes during cable installation/maintenance/decommissioning due to the presence of vessels	✓	✓	✓

Note: Tick symbol denotes there is a potential impact for the given phase of cable works, and that it will be assessed further.

Conclusion: shipping and navigation
Further assessment work is required to support an application for a Marine Licence

2.10 Marine archaeology

2.10.1 Baseline description

There are no charted ship or airplane wrecks on the proposed cable route. However, there are a number of wrecks that potentially may be located in the area covered by the proposed cable route, including HMD *Orsino*, which was sunk by U-boat in the Pentland Firth in 1916, and SS *Navarra*, which was sunk by U-boat west of Hoy in 1940.

There is potential for submerged landscapes and deposits to survive close to either end of the route, in shallow waters, shown by the results of other work along the north coast of Caithness and around Orkney.

2.10.2 Potential impacts

A desk-based assessment (DBA) will be undertaken to review key existing data sources within a 1 km wide corridor along the proposed cable route to identify known and the potential for unknown marine historic environment assets.

Geophysical and geotechnical data collected from the marine survey will be analysed to detect and identify potential unknown sites, features or submerged deposits of archaeological importance located along the marine survey corridor.

The intention is to re-route the proposed subsea cable route where at all possible to specifically avoid all potential and known wrecks and features of archaeological importance in the area covered by the proposed cable route identified by the DBA and review of the geophysical and geotechnical survey data.

If by any chance avoidance is not possible, an appropriate mitigation / management strategy will be proposed to eliminate or reduce any adverse impacts to an insignificant level.

In order to manage the potential for impacting unknown heritage, a reporting protocol should be instigated for the discovery of previously unknown marine cultural material during development. The reporting protocol produced by Wessex Archaeology (2014) for the Crown Estate would be sufficient (http://www.wessexarch.co.uk/protocols-archaeological-discoveries-pad).

It is intended that the above process will result in no significant impacts on the marine historic environment.

Conclusion: marine archaeology
Further assessment work is required to support an application for a Marine Licence

2.11 Other sea users

2.11.1 Baseline overview

There are a number of other sea users in the vicinity of the proposed cable route. These include:

- Renewable energy projects (operational / consented / planned);
- Cables and pipelines including SSE assets and telecommunications;
- Other infrastructure – oil and gas;
- Aquaculture sites;
- Aggregate extraction and disposal sites; and
- Potential UXO and munitions.

2.11.1.1 Renewable energy projects

In October 2010, The Crown Estate (TCE) awarded Agreements for Lease (AfL) for a number of commercial scale wave and tidal development sites in the Pentland Firth and Orkney Waters (PFOW). Over the last six years the location and number of AfL area have changed as technologies have developed or changed or as resources have been examined in more detail.

There is currently one AfL area awarded for an offshore wind project in the vicinity of the proposed cable route, the Dounreay Tri project, developed by Dounreay Tri Ltd. This floating wind project has a potential capacity of 5 MW, and the consent for development has been authorised.

The EMEC wave test facility at Billia Croo is connected to the grid via electrical infrastructure located onshore at Billia Croo. While at present there are no wave devices being tested at the wave site, it is understood that Laminaria have signed up for deployment at the site in 2017. This wave test site is located approximately 800 m to the north of the proposed cable route at the nearest point (Figure 2.4).

2.11.1.2 Subsea cables

There are a number of subsea cables located within or passing through the area covered by the proposed cable route. These include both electric and telecommunications cables. A summary of key cables is provided in Table 2.8 below. These cables are illustrated in Figure 2.4.

Table 2.8 Subsea cables in the vicinity of the proposed cable route

Location	Cable	Type	Description
West Orkney	FARICE	Telecommunications	Telecoms cable between Iceland, Faroe Islands and Scotland (Dunnet Bay, Caithness).
West Orkney	Northern Lights	Telecommunications	Telecoms cable between Mainland Scotland and Orkney (Dunnet Bay, Caithness and Bay of Skaill, West Coast Orkney).
West Orkney	SSE Cables	Electricity (33 kV)	Subsea electric cables between Mainland Scotland (Murkle Bay, nr Thurso) and Rack Wick Bay, Hoy).

2.11.1.3 Aquaculture

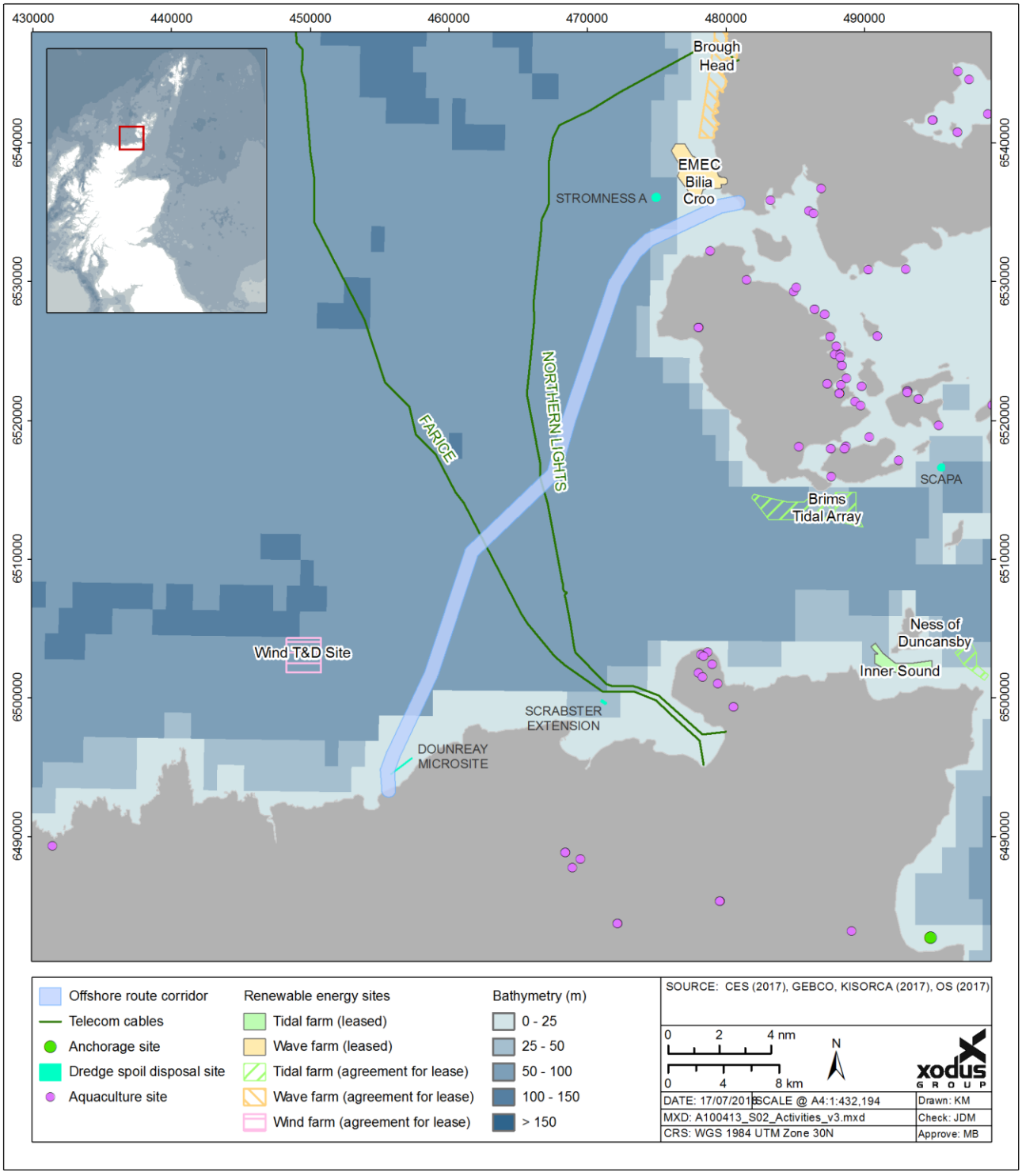
Aquaculture is an important industry in Orkney. The majority of these licenced sites are for finfish (e.g. salmon and trout), although there are some shellfish sites. Most aquaculture sites are located within Scapa Flow (nine sites) and Wide Firth (12 sites) where conditions are considered to be most favourable for aquaculture activities. The location of key aquaculture sites is shown in Figure 2.4. The closest aquaculture site is located 2.7 km south-east of the cable route, in the nearshore area of Hoy.

2.11.1.4 Aggregate extraction and disposal sites

There are currently no aggregate extraction sites located within the project study area. However, there is one dredging disposal site (FI040) offshore of Stromness, located approximately 2 km north-west of the proposed cable route. The build-up of sediment in port areas and navigation channels can lead to a significant reduction in water depths which can adverse effect the safety of operations in these areas. Dredging is therefore important for maintaining safe port operations and keeping waterways navigable by removing sediment from the seabed in these locations and safety disposing of the dredged material in a more suitable location.

The nearest dredge disposal sites are Dounreay and Stromness A, located 304 m east and 2.2 km north-west of the proposed cable route, respectively (Figure 2.4).

Figure 2.4 Other activities in the vicinity of the proposed cable route



2.11.1.5 Coastal defence features and wrecks

Scapa Flow and Orkney have been used since 1816 as a Naval base (Konstam, 2009) and was the UK's main naval base during both World Wars. Up until 1956 it has seen live conflict. As such, a number of coastal historic defence infrastructure was placed in and around Orkney these include: submarine barriers, blockships, Churchill Barriers 1 to 4, among other items. A large number of wrecks including war remains, scuttled ships and block ships are present within Orkney waters. The nearest wrecks to the proposed cable route are the *Marandra* (motor fishing vessel) located less than 1 km south from the Orkney landfall, and the *Arnisdale* (motor fishing vessel), located 1.2 km north-east of the Caithness landfall.

2.11.2 Potential impacts

The telecommunications cables pose a constraint to installation of the cable rather than source of potential environmental impact. Where avoidance is not possible (e.g. with respect to cables), crossing agreements will be put in place to ensure protection of the third-party assets.

Although the proposed installation works will be highly localised and temporary, the EMEC wave test site is located in the vicinity of the proposed route (0.9 km) (Figure 2.4), there is potential for other users to be impacted by the proposed cable works during installation, maintenance and decommissioning, as the presence of additional vessels may limit the access to the waters along the proposed cable route, and may represent a collision risk with the other sea users.

Table 2.9 summarises the potential impacts on other sea users associated with the proposed cable route.

Detail on the additional information to be provided in support of the Marine Licence is provided in Section 3.

Table 2.9 Potential impacts summary

Potential impact	Relevant phase of Project		
	Cable installation	**Cable operation**	**Decommissioning**
Loss off access to other users	✓	✓	✓
Collision risk between installation/maintenance/decommissioning vessels with other sea users	✓	✓	✓

Note: Tick symbol denotes there is a potential impact for the given phase of cable works, and that it will be assessed further.

Conclusion: other sea users
Further assessment work is required to support an application for a Marine Licence

3 ENVIRONMENTAL INFORMATION REQUIRED TO SUPPORT MARINE LICENCE APPLICATION

3.1 Introduction

The following identifies the main receptors, where due to sensitivity of the receptor and potential impact on the receptor, it is anticipated that additional information will be required to support the Marine Licence application.

This section also describes the proposed scope of these supporting studies.

3.2 Additional information requirements

Table 3.1 below summarises the findings from Section 2 and identifies whether, based on those findings, additional information is required to support the Marine Licence application.

Table 3.1 Additional information requirements

Receptor	Potential for significant impacts	Additional information required for marine licence application?	Comments
Protected sites	Yes	Yes	Undertake a Nature Conservation Appraisal to assess potential effects of the project on the integrity of Hoy SPA, North Caithness Cliffs SPA, Scapa Flow pSPA, Pentland Firth pSPA, Hoy SAC and SSSI, Stromness Heaths and Coast SAC, Selwick Seal haul-out and Bay of Ireland Seal haul-out. See Section 3.3.1 for further detail.
Physical environmental	No	No Limited potential for any adverse impacts	Geological features are considered to be a technical constraint or hazard to cable installation. Where present, it is highly likely that the cable will have to be surface laid with additional protection for burial. Potential for any direct impacts on geological features associated with substratum disturbance/removal (e.g. trenching) is very limited.
Benthic	Yes	Yes	There are no designated sites with benthic features in the vicinity of the cable route, the nearest being the North-West Orkney NCMPA, located 9.5 km from the proposed cable route. However, the environmental survey conducted along the route in 2018 (MMT, 2018b) revealed the potential presence of Annex I reefs habitats. A full assessment of impacts to benthic and intertidal ecology will therefore be undertaken.

Receptor	Potential for significant impacts	Additional information required for marine licence application?	Comments
Fish and shellfish	No	No	Limited potential for impacts due to mobile nature of fish and short duration of cable installation activities. Potential impacts associated with EMF will be mitigated through burial and/or protection of the cable along the majority of the proposed route. No impacts to fish and shellfish are expected from low levels of sediment disturbed by trenching activity. Disturbed sediment will be rapidly dispersed by tidal currents.
Birds	Yes	Yes	Limited potential impacts due to short duration of cable installation activities and limited number of vessels involved in cable installation. However, due to the proposed cable route crossing the Hoy SPA, the North Caithness Cliffs SPA and the Scapa Flow pSPA, impacts on protected sites will be covered in further assessment work (see Section 3.3.1)
Marine mammals	Possible	Yes	Nature Conservation Appraisal (EPS risk assessment and HRA screening) to assess potential impacts on marine mammals with respect to underwater noise and determine potential for Likely Significant Effects (LSE) on cetaceans likely to be present in the vicinity of the proposed cable route.
Commercial fisheries	Possible	Yes	Although the cable will be buried where possible along the route, there is potential for some disruption to fishing activities during cable installation. This will be assessed in more detail in support of the Marine Licence application.
Shipping and navigation	Yes	Yes	Although the potential for impacts on navigation safety due to presence of slow moving cable lay vessels in busy shipping lane are limited due to short duration of the cable installation works and low number of vessels (e.g. cable lay and guard vessel), due to the importance of the Pentland Firth as a major shipping route, it is proposed that a desk based Navigational Risk Assessment (NRA) is undertaken.
Marine archaeology	Yes	Yes	A marine historic environment DBA and archaeological review of geophysical and geotechnical survey data will be conducted to inform a technical report supporting the marine licence application

Receptor	Potential for significant impacts	Additional information required for marine licence application?	Comments
Other sea users	Possible	Yes	There is potential for other users to be impacted by the proposed cable works during installation, maintenance and decommissioning, as the presence of additional vessels may limit the access to the waters along the proposed cable route, and may represent a collision risk with the other sea users. Potential impacts on fisheries and aquaculture will be assessed as part of the commercial fisheries assessment. Potential impacts on other sea users will be assessed in the NRA.

3.3 Proposed supporting studies for Marine Licence application

3.3.1 Nature Conservation Appraisal

Based on the information presented in Table 3.1 it is proposed that the following studies are carried out to provide additional information in support of the Marine Licence application:

- Nature Conservation Appraisal.
- Commercial Fisheries Assessment.
- Navigational Risk Assessment (NRA).
- Marine Archaeology Assessment.

The purpose of the Nature Conservation Appraisal will be to carry out an assessment of potential effects on the key protected sites and features identified as being present within the Project area. This will provide Marine Scotland with the information they require in order to undertake a Habitats Regulation Appraisal (HRA) and NCMPA appraisal (if required). It is proposed that the Nature Conversation Appraisal will incorporate the following:

- HRA Screening (as required under the Conservation (Natural Habitats, &c.) Regulations 1994 as amended) to determine whether there is potential for any Likely Significant Effects (LSE) on designated Natura sites;
- Based on findings from HRA Screening, where LSEs are identified, additional information on the potential effects of the Project on the cSAC to provide to Marine Scotland to enable them to carry out an appropriate assessment;
- NCMPA Appraisal as required under the Marine (Scotland) Act 2010 for the North West Orkney NCMPA (if considered to be required given this site is located 9.5 km from the nearest part of the proposed cable route corridor); and
- EPS Risk Assessment (for marine mammals not included in designated sites that could be affected by noise from cable installation activities).

Information to be provided as part of the Nature Conservation Appraisal includes a detailed description of the baseline characteristics associated with the sites and key qualifying / protected features; description of key impacts requiring consideration as part of the appraisal, appraisal criteria (relevant to the various assessments) and results from the appraisal.

3.3.2 Commercial fisheries assessment

Commercial fisheries

Although impacts during operation of the cable will be minimised through burial of the cable, there is still potential for fishermen, both static gear and trawl fisheries, to be affected during cable installation. The focus for the commercial fisheries assessment will be to identify at a higher resolution the type of gear used along different sections of the route and the intensity of fishing effort in different locations.

This will be achieved through continued engagement with local fishermen based both on the Scottish Mainland and in Orkney.

In addition to developing a more detailed understanding of fisheries along the proposed subsea cable route, continued engagement with local fisheries will be critical for helping to develop clear strategies for mitigating potential impacts associated with the temporary exclusion to certain fishing grounds during cable installation. For example, through discussions with local fishermen, it may emerge that potential impacts results from local disruption and reduced access to certain areas along the proposed cable route can be reduced by installing the cable in a south west to north east or north east to south west direction depending on timescales etc.

Engagement with local fisheries will also be critical in terms of being able to provide information on the Project, and advising local fishermen on when certain activities will be carried out and the duration of those activities.

For the commercial fisheries assessment to be successful, it is proposed that the approach to the assessment, including sources of data and plans for engagement e.g. timings and location of meetings, are agreed with fisheries groups and local fishermen in order to try and maximise fisheries involvement in the process.

Aquaculture sites

A more detailed assessment will be carried out to assess the potential impacts on aquaculture sites located in the vicinity of the cable route. This will involve:

> Review of final cable installation method to determine the location and length of cable sections that are to be surface laid, trenched and buried (protection);

> Identification of preferred trenching method / technique (plough, jet trencher etc.) and associated levels of seabed disturbance (trench width, trenching tool footprint on seabed, indicative suspended sediment concentrations (SSC) levels along cable route and in surrounding area, distances over which sediment redeposition will occur and expected thickness of resulting sediment accumulations;

> Identification of distances between aquaculture sites and cable route; and

> Identification of fish / shellfish species being farmed at each site and sensitivity of species to smothering or increased SSC levels.

Conclusions from the assessment will be included in a section of the Commercial Fisheries assessment.

3.3.3 Navigational Risk Assessment (NRA)

In order to assess potential risks associated with the Project in terms of Navigation Safety, it is proposed that a desk based NRA is carried out. This would involve:

> Review of AIS vessel tracking data from past 12 months with a minimum of 2 x 6 week periods analysed from this 12 months of data (summer and winter period);

> Identification of key characteristics for shipping and navigation in the area including:

- Vessel routes;
- Number of vessels transiting the area;
- Types of vessels transiting the area (e.g. cargo, tankers, ferries);
- Vessel draught distributions;

- Recreation vessels (based on review of data from RYA Coastal Atlas);
- Aids to navigation;
- Anchorages; and
- Ports and harbours.

> Assessment of potential risks to navigation with respect to collision risk and anchor strike.

3.3.4 Marine Archaeology

A Marine Historic Environment Appraisal will be conducted by ORCA, the purpose of which will be to carry out an assessment of potential effects on key sites and features identified as being present or potentially present within the vicinity of the proposed cable route. This will provide the statutory authorities with the information they require in order to undertake an appraisal and appropriate assessment for licencing (if required). It is proposed that the Marine Historic Environment Appraisal will incorporate the following:

> Summary review of relevant marine historic environment legislation, policy and guidance;

> Relevant scoping and consultation responses;

> A detailed description of the marine historic environment baseline characteristics as identified by the DBA and geophysical and geotechnical survey data review;

> The criteria used to determine the importance or sensitivity of the identified historic environment assets (which will be industry standard and best practice criteria as used on other marine cable projects by ORCA that met with the approval of Highland Council's Historic Environment Team, Orkney Islands Council Planning Archaeologist and Historic Environment Scotland through MSLOT);

> An appraisal of the potential significant direct, indirect and cumulative impacts of the proposed cable route on both known marine historic environment assets and any potential unknown assets that could be present;

Where potential direct or indirect impacts are identified, and avoidance is not possible, mitigation and/or management strategies to eliminate or reduce any adverse impacts to an insignificant level will be developed in consultation with the clients and statutory authorities.

3.4 Presentation of additional information

It is proposed that the supporting studies described above are presented in a single report that would be titled "Marine Licence Supporting Information Report". SHE Transmission are happy to discuss this approach with MSLOT in order to ensure that the information provided meets MSLOT requirements with respect to the Marine Licence application and to agree the content and structure of the report.

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