Scottish Hydro Electric Power Distribution plc

Sanday-North Ronaldsay Replacement Marine Licensing Support

Project Description

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CONTENTS

ABBREVIATIONS

ABBREVIATION	DEFINITION
3D	Three-Dimensional
CBA	Cost Benefit Analysis
CEMP	Construction Environmental Management Plan
CLMP	Cable Lay and Monitoring Plan
CLV	Cable Lay Vessel
CPMP	Cable Protection and Monitoring Plan
DP	Dynamic Positioning
DSV	Dive Support Vessel
EPS	European Protected Species
FLMAP	Fisheries Liaison Mitigation Action Plan
HDPE	High Density Polyethylene
HVAC	High Voltage Alternating Current
kg	Kilograms
kg/m	Kilograms per Metre
km	Kilometre
kV	Kilovolt
LAT	Lowest Astronomical Tide
m	Metre
MBES	Multibeam Echosounder
MCA	Marine and Coastguard Agency
MEA	Marine Environmental Appraisal
MHWS	Mean High Water Springs
MLA	Marine Licence Application

ABBREVIATION	DEFINITION
MLWS	Mean Low Water Springs
mm	Millimetres
OCT	Open-Cut Trench
OHL	Overhead Lines
OIMD	Operation, Inspection, Maintenance and
OoS	Out of Service
PLGR	Pre-Lay Grapnel Run
pUXO	Potential UXO
RHIB	Rigid-Hulled Inflatable Boat
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SHEPD	Scottish Hydro Electric Power Distribution plc
SSS	Side-Scan Sonar
TJP	Transition Joint Pit
t	Tonne
UK	United Kingdom
USBL	Ultra Short Baseline
UXO	Unexploded Ordnance
XLPE	Cross-linked polyethylene

1 INTRODUCTION

1.1 Overview

Scottish Hydro Electric Power Distribution plc (SHEPD) holds a licence under the Electricity Act 1989 for the distribution of electricity in the north of Scotland including the Islands. It has a statutory duty to provide an economic and efficient system for the distribution of electricity and to ensure that its assets are maintained to provide a safe, secure and reliable supply to customers.

In February 2026 SHEPD identified a fault within the subsea cable connecting Sanday to North Ronaldsay in Orkney. An initial solution was trialled to reconfigure the faulted circuit, but this too faulted soon after, making this an unviable option for repairs. After a subsequent options evaluation, the recommended approach is to carry out a full replacement of the faulted cable. The proposed cable replacement ('the Project') will involve the installation of a new 11 kilovolt (kV) subsea cable, associated cable stabilisation and protection and removal of the faulted cable at both shore ends and in subtidal sections. Installation of this cable is required to replace the existing faulted cable and restore a grid connection to the community on North Ronaldsay. Mobile diesel generation is currently being utilised to provide power to customers on a temporary basis, however, this is logically challenging and as such, an urgent replacement is required. The proposed cable and nearshore tubular cable protection system installation activities are currently planned to take place in Autumn 2026 and cable protection installation in Spring / Summer 2027.

The proposed replacement cable will be approximately 11 kilometres (km) long (including 5% contingency) from Transition Joint Pit (TJP) to TJP and will be located within a proposed cable corridor in the vicinity of the existing faulted cable. The proposed cable corridor extends between the Bay of Sandquoy on Sanday and South Bay on North Ronaldsay (Figure 1-1). The final cable route has not yet been determined. Therefore, to provide flexibility for final route engineering, a 9.2 km^2 cable installation corridor is proposed. The final route selection will be based on further preinstallation surveys and detailed design parameters, while taking environmental and any additional constraints into account.

This Project Description is constructed to provide a consolidated point of reference for all proposed Project installation activities. The Project Description should be read in combination with the following documents:

- Marine Environmental Appraisal (MEA) (Document Ref: A-200853-S00-A-REPT-001);
- Marine Licence Application (MLA) Form;
- Inshore European Protected Species (EPS) Licence Application Form;
- Basking Shark Derogation Licence Application Form;
- Marine Construction Environmental Management Plan (CEMP) (Document Ref: A-200853-S00-A-PLAN-001);
- High Level Navigational Risk Assessment (Document Ref: A-200853-S00-A-REPT-003);
- Cable Lay and Monitoring Plan (CLMP); and
- Cable Protection and Monitoring Plan (CPMP) (*applicable to the 2027 campaign*);
- North Coast and Orkney Fisheries Liaison Mitigation Action Plan (FLMAP);
- How SHEPD co-exists with other marine users document[1];

[1] *https://www.ssen.co.uk/globalassets/about-us/projects-and-live-works/subsea-cables/how-shepd-co-exists-with-other-marine-users.pdf.*

- Operation, Inspection, Maintenance and Decommissioning Strategy (OIMD); and
- Cost Benefit Analysis (CBA) Summary Report.

Figure 1-1 Sanday to North Ronaldsay Proposed Cable Corridor

1.2 Summary of Work

This document outlines the detail of the following activities and scopes of work:

- Pre-installation surveys to identify debris / obstructions;
- Pre-Lay Grapnel Run (PLGR);
- Removal of Out of Service (OoS) cable(s) to facilitate installation of the replacement cable, where required;
- Landfall establishment;
- Cable installation;
  - The subsea cable will be surface laid below Mean Low Water Springs (MLWS),
  - In the intertidal zone, cable installation will be via Open Cut Trench (OCT) between MLWS and Mean High Water Springs (MHWS) at each landfall location;
- Cable protection and stabilisation installation;
  - Cable protection measures will include tubular cable protection systems and rock bags,
  - Sea earths and associated protection will also be required;
- Landfall re-instatement; and
- Post-installation surveys.

1.3 Project Need

On February 2026, a fault was identified on one core of the 11 kV Sanday – North Ronaldsay cable which supplies electricity to the island of North Ronaldsay. An initial solution was trialled to reconfigure this circuit to run on a 2-core supply which faulted soon after and was deemed an unviable solution. Customers are currently being supplied through mobile diesel generation and as such, an options appraisal has recommended end-to-end replacement of the faulted cable is the preferred option to restore a grid connection to customers affected on North Ronaldsay. SHEPD therefore proposes to install a replacement subsea cable that will connect the Bay of Sanquoy on Sanday and South Bay on North Ronaldsay to tie into the existing network. The project will benefit approximately 87 customers.

1.4 Consideration of Alternatives

Following the subsea cable fault, the following options were considered in order to restore grid connection to North Ronaldsay:

Option 1: Do Nothing. This was discounted as a viable option due to customers currently relying on temporary diesel generation. Due to limited ferry service, with unreliable crossing times to North Ronaldsay during wintertime when demand would be highest, there would be significant logistical issues around refuelling the generators and significant costs associated with it. This option would not support SHEPD's island decarbonisation ambitions and would produce a significant increase in carbon output whilst also reducing the network security for these customers.

Option 2: 11 kV Piece In Repair. This option has been discounted due to historic survey information showing cable serving and armour corrosion throughout the length of the cable. In addition, lifting the cable in its current condition to facilitate the repair may cause further damage which could lead to a secondary fault.

Option 3: Replacement with flexible solution. Given no distributed generation is currently present or expected on North Ronaldsay, this is not deemed as a feasible solution at this time

Option 4: 11 kV End-to-End Replacement. This is the preferred option to be carried forward. This option involves carrying out a full end-to-end cable replacement / installation. Stock 11 kV cable will be installed from a suitable Cable Lay Vessel (CLV) and connected into TJPs at both shore ends. The cable will then tie into the existing overhead line (OHL) networks at each landfall via short sections of overhead line and underground cable.

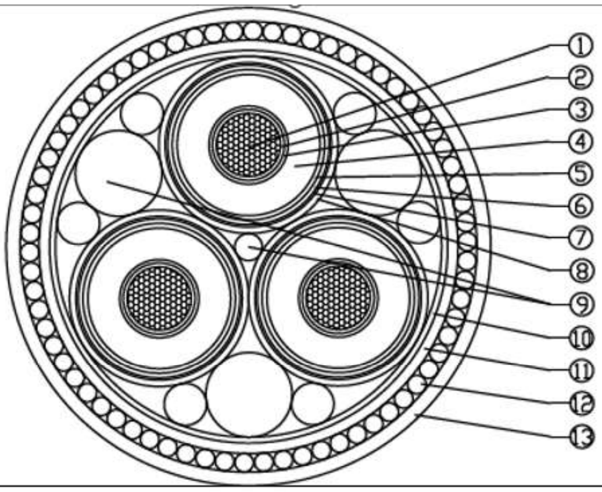
Option 4 has been determined to be the most cost-effective solution in this situation, despite the expectation that it will be more expensive than a cable repair. This is due to the current condition of the existing cable and the likelihood of success of a repair being low. There is a high probability that even if a repair is successful, a failure may occur within the next three to five years. This will incur further repair or replacement costs, meaning the overall cost of rectifying the issue for the long term is higher.

It has been determined that it will be more beneficial to invest in a full cable replacement that is likely to operate for a minimum of 25 years. There is also the added advantage of being a more robust solution as no new subsea joints are introduced into the system. This option will improve the security of supply to the customers on North Ronaldsay.

2 PROPOSED CABLE

The purpose of this section is to provide a description and drawings of the proposed 11 kV High Voltage Alternating Current (HVAC) submarine power cable.

The proposed submarine cable consists of a three-core design with copper round compacted stranded conductors, cross-linked polyethylene (XLPE) insulation and copper laminated tape, polyethylene sheath, polypropylene and a double layer of galvanized steel wire armour. The cable is rated at 11 kV with an outer diameter of approximately 82 millimetres (mm) and weight of approximately 9.3 kilograms per metre (kg/m) in water. The proposed cable cross section is shown in Figure 2-1.



1 - Copper round stranded compacted class 2 according to BS EN 60228 of nominal cross-section equal to 95 sq.mm, longitudinally water sealed.
2 - Semiconductive waterblocking tape (s) applied helically with overlap.
3 - Conductor non-metallic extruded screen: Extruded semiconducting compound with nominal thickness of 0.7 mm.
4 - Insulation: XLPE water-tree retardant type GP8 according to BS 6622, which satisfies the two years long duration test according to HD 605 Test No 5.4.15 (without 5.4.15.3.4.c)), of 3.4 mm min average thickness.
5 - Core non-metallic extruded screen: Extruded semiconducting compound firmly bonded to the insulation with nominal thickness of 0.8 mm.
6 - Semiconductive waterblocking tape(s) applied helically with overlap.
7 - Metallic screen and radial watertightness:
Cu/PE laminated tape of 0.2 mm copper nominal thickness, bonded to LLDPE sheath, longitudinally applied with overlap.
8 - Sheath: LLDPE of 1.6 mm min average thickness. Sheath colour: Black
9 - Non-hygroscopic fillers at the interstices between cores in order to give the cable a circular cross-section.
10 - Binding tape (one or two at manufacturer's option) helically applied with overlap.
11 - One layer of polypropylene yarns of approximate thickness of 1 mm.
12 - Armour consisting of one layer of helically applied bitumen compounded galvanized round steel wires of grade 34, class A, 6.0±0.09 mm diameter, according to EN 10257-2.
13 - Two layers of polypropylene yarns with total approximate thickness of 3.0 mm. Over the inner (first) layer bitumen is applied. Over the outer (Second) layer no bitumen is applied, but after winding of cable some bitumen will be transferred to the outer layer too.

Figure 2-1 Proposed Cross Section of the XLPE Submarine Cable

3 SEABED SURVEYS

SHEPD has appointed a contractor to conduct subtidal geophysical and drop-down video benthic surveys of the proposed cable corridor. An intertidal walkover survey will also take place for habitat characterisation. The main objectives of the marine surveys are to:

- Provide data (both technical and environmental) to form the basis for the route engineering for the proposed cable; and
- Assess potential risks to the cable from local seabed influences including boulders, crossings, debris, freespans, trawl scars, etc.

These surveys and associated data analysis are ongoing and the results will be made available once completed. The results will be used to inform the final cable routing within the proposed cable corridor, including the final amount of cable protection required. The surveys are being undertaken within and in the immediate vicinity of the proposed cable corridor. A CLMP that details how the survey information will be used to inform cable lay operations and routing will be developed and issued post seabed survey completion and submitted to Marine Directorate – Licensing Operations Team (MD-LOT) and relevant stakeholders (e.g., NatureScot). A separate CPMP for the Spring / Summer 2027 cable protection installation activities will be prepared and submitted following completion of the Autumn 2026 cable laying campaign. The aim of these plans is to ensure environmental impacts from the cable and cable protection installation are minimised as far as practicable through micro routing and cable installation techniques, and the amount of cable protection required will be refined and reduced where possible.

4 PROJECT OVERVIEW

4.1 The Proposed Cable Corridor

The maximum length of the proposed cable will be approximately 11 km (including 5% contingency) from TJP to TJP or 10.4 km from MHWS to MHWS (including 5% contingency) . This cable length allows for obstacle avoidance during the cable lay and tolerances with the cable lay operations. If required, debris or obstructions may be cleared as discussed in Section 4.3.2 however, the cable will be micro-routed if debris or obstructions cannot be removed or avoided from the planned route. At all times the works and final cable placement will remain within the proposed cable corridor.

The proposed cable corridor is presented in Figure 1-1 with landfalls located at Bay of Sandquoy on Sanday and South Bay on North Ronaldsay. The selection of the proposed cable corridor was based on the avoidance of environmental constraints, whilst ensuring it will be technically feasible to install a cable within it. Furthermore, assessments are currently underway to investigate the cable on-bottom stability within the proposed cable corridor in order to inform detailed route engineering. Cable on-bottom stability will be assessed by reviewing the Side-Scan Sonar (SSS) and Multibeam Echosounder (MBES) survey data.

The route options are being considered within the proposed cable corridor. This Project Description is based on the worst-case scenario, i.e. the longest route and greatest associated engineering and material requirements.

4.2 Vessels

4.2.1 Cable Lay Vessel (CLV)

The Zwerver V (Figure 4-1) or a similar vessel will be the primary CLV for this project. This is a multi-purpose vessel suitable for renewable energy and cables projects, built in 2023. She is a dynamic positioning (DP) 2 class vessel which can hold station using thrusters, so there is no requirement for anchoring. Specifications for this vessel are outlined in Table 4-1.

Table 4-1 Key Information

PARAMETER	MEASUREMENT
Gross Tonnage	1,250 tonnes (t)

PARAMETER	MEASUREMENT
Dimension – Length	80 m
Dimension - Beam	20 m

Figure 4-1 Image of Zwerver V

4.2.2 Dive Support Vessel (DSV)

The Forth Warrior (Figure 4-2) or a similar vessel or a similar vessel will be used as the DSV for this Project and will help in conducting PLGR should it be required. Forth Warrior is a general utility vessel and the specifications for this vessel are detailed in Table 4-2.

Table 4-2 Key Information

PARAMETER	MEASUREMENT
Gross Tonnage	296 t
Dimension – Length	27 m
Dimension - Beam	12 m

Figure 4-2 Image of Forth Warrior

Station Keeping

If the Forth Warrior is used, this vessel may stay on location using DP, although not during diving operations where she will use her spud legs or anchor spread. It is most likely that the DSV will be Forth Warrior, however, included in Table 4-3 are some spud dimensions of some larger vessels in the instance that these are required instead of the vessel described above.

Due to the differing length of the spud legs, depth limits for each vessel (assuming flat calm conditions) are also noted in Table 4-3.

The precise number of spud placements on the seabed is challenging to determine for the following reasons:

- Weather may interrupt a period of work, so multiple days of spud leg deployment may be required for a single task;
- Vessel may not achieve good hold of the seabed on the first attempt so may require repeat pudding down; and
- Once in position, vessel may need to change heading, therefore requiring to-lift and lowering of at least one spud.

Table 4-3 Example Vessels Spud Leg Parameters and Working Limits

VESSEL	SPUD DIAMETER (mm)	DEPTH LIMIT (m AT LOWEST ASTRONOMICAL TIDE (LAT))
Forth Warrior	610 mm with spiked tip	< 13 m
Forth Drummer	508 mm with spiked tip	< 10 m
Harry McGill	914 mm with spiked tip	< 14 m
Forth Atlas	914 mm with spiked tip	< 15 m

A DSV may alternatively be positioned using a two or four-point mooring spread. A diagram of the mooring design is presented in Figure 4-3.

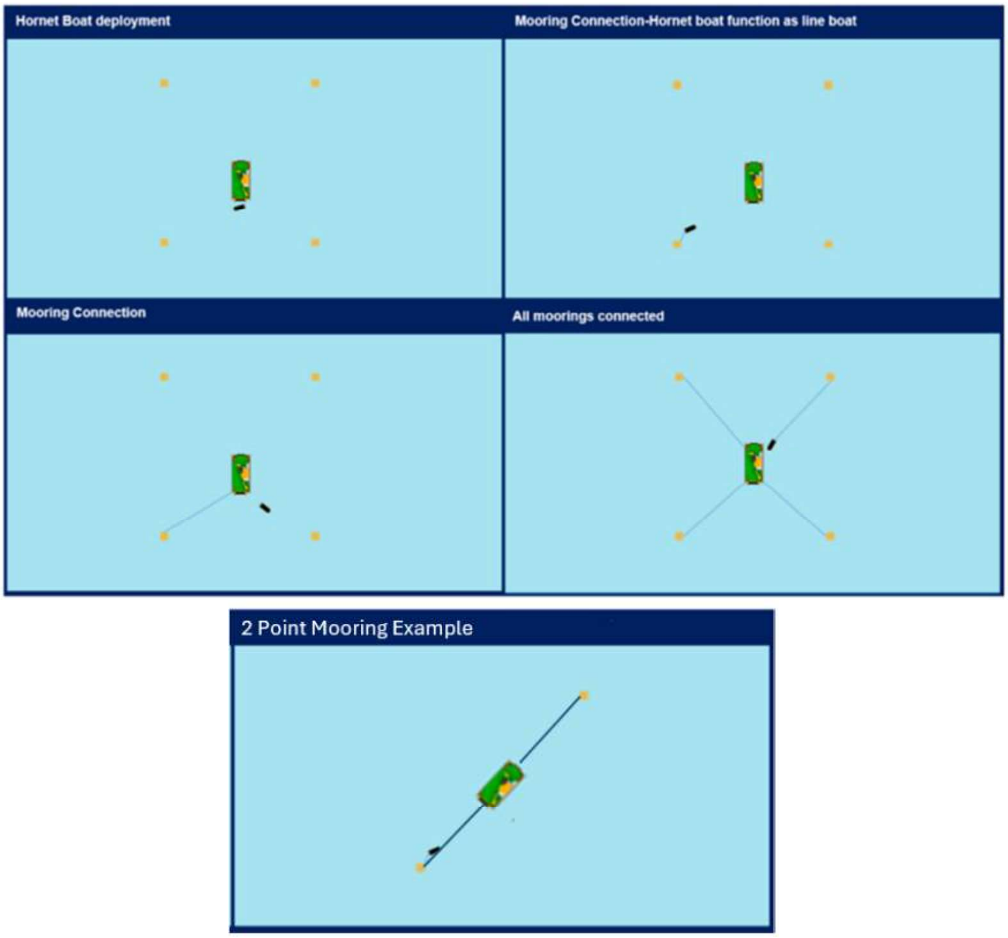


Figure 4-3 Example of Layout of Temporary Moorings for a Four- and Two-Point Spread

The anchoring areas for the DSV within the proposed cable corridor are presented in Figure 4-4.

Figure 4-4 Anchoring Areas for DSV Within the Proposed Cable Corridor

4.2.3 Other Support Vessels

General Support Vessels

The Celtic Guardian, Spanish John or a similar vessel may be used to provide general support to the installation activities. Furthermore, the Forth Constructor (Figure 4-5) or a similar vessel may be used as a Construction vessel, which is a DP 2 CLV. The specifications for these vessels are outlined in Table 4-4.

Table 4-4 Key Information On Additional Vessels That May Be Used During the Project

VESSEL NAME	PARAMETER	MEASUREMENT
Celtic Guardian	Gross Tonnage	9.5 t
	Dimension – Length	13.9 m
	Dimension - Beam	4.3 m
Spanish John	Gross Tonnage	498 t
	Dimension – Length	19.9 m
	Dimension - Beam	6.5 m
Forth Constructor	Gross Tonnage	6363 t
	Dimension – Length	39.99 m
	Dimension - Beam	12.4 m

Figure 4-5 Image of Forth Constructor

Landing Craft

The Toplander, or similar, landing craft (see Figure 4-6) may be required for potential delivery of shore end plant equipment. Key vessel information for the Toplander landing craft is detailed in Table 4-5.

Table 4-5 Key Information

VESSEL NAME	PARAMETER	MEASUREMENT
Toplander	Gross Tonnage	540 t
	Dimension – Length	22.1 m
	Dimension - Beam	7.5 m

Figure 4-6 Image of Toplander

Overall, a summary of the number of vessels which may be required for cable installation are summarised in Table 4-6 below.

Table 4-6 Vessels Used During Cable Installation

PHASE	VESSELS
Pre-installation	• 1 Multicat; • 1 Support Rigid-Hulled Inflatable Boat (RHIB); and • 1 Landing Craft.
Cable lay	• 1 CLV; • 2 Pontoons; • 7 Support RHIBs; and • 2 DSVs.
Post-installation	• 1 Construction vessel; • 1 Survey vessel; • 1 DSV; and • 2 Support RHIBs.

4.3 Pre-Installation Activities

4.3.1 Pre-Installation Survey

Before cable installation commences, a pre-installation survey may be conducted using a Remotely Operated Vehicle (ROV) to assess seabed conditions and the presence of debris. If required, survey operations will likely be conducted from a small vessel before the CLV arrives (Figure 4-7).

The objectives of the survey will be to:

- Identify and investigate possible debris; and
- Identify any obstructions and environmental and other sensitivities within the proposed cable corridor.

During installation a similar survey spread may also be utilised to monitor the installation process. Alternatively, an ROV may be deployed from the CLV or other support vessel and operate touchdown monitoring and ROV surveys from this platform. The below ROV and survey equipment are examples of the type of gear that may be used – exact models may vary; however, all equipment used will fall within the requirements set out within the EPS Licence Application for the Project. Table 4-7 summarises details of other survey equipment which may be used in the proposed cable installation activities.

Figure 4-7 Example of Possible Survey Vessel and (2) Example ROV That May Be Used During the Project

Table 4-7 Examples of Proposed Survey Equipment That May Be Used During the Project

SYSTEM / SURVEY EQUIPMENT	DESCRIPTION
Geophysical Survey	
Ultra-Short Baseline (USBL)	USBL systems are used to determine the position of subsea survey items, including ROVs, towed devices, grab samplers, etc. This involves the emission of sound from a vessel-mounted transducer to a subsea transponder, thereby introducing sound into the marine environment. A USBL system consists of a transducer, which is mounted on the vessel and a transponder attached to the ROV. The transducer transmits acoustics through the water and the transponder sends a response which is detected by the transducer. The USBL calculates the bearing and time taken for the transmissions to be completed and thus the position of the subsea equipment is determined. These systems can either be used continuously or intermittently through the operation they are supporting.
MBES	MBES are used to obtain detailed three-dimensional (3D) maps of the seafloor which show water depths. They measure water depth by recording the two-way travel time of a high frequency pulse emitted by a transducer. The beams produce a fanned arc composed of individual beams (also known as a swathe). MBES can, typically, carry out 200 or more simultaneous measurements.
SSS	SSS is used to generate an accurate image of the seabed, which may include 3D imagery. An acoustic beam is used to obtain an accurate image of a narrow area of seabed to either side of the instrument by measuring the amplitude of back-scattered return signals. The instrument can either be towed behind a ship at a specified depth or mounted on to a ROV. The frequencies used by SSS are generally very high and outside of the main hearing range of marine species. The higher frequency systems provide higher resolution but shorter-range measurements.
Seabed Imagery	
Hi-Resolution Camera	An ROV mounted camera will be utilised to acquire imagery of the cable and adjacent seabed.

4.3.2 Pre-Lay Debris Removal

Any obstructions or debris identified during the surveys which cannot be avoided may be removed. This may be achieved by conducting a PLGR in order to remove debris from the proposed cable corridor; however, no PLGR will be undertaken in areas where designated benthic habitats and species of the Sanday Special Area of Conservation (SAC) are found throughout the proposed cable corridor:

- Reef; and
  - Including discord mussel (*Musculus discord*) beds.
- Intertidal mudflats and sandflats and subtidal sandbanks;
  - Including seagrass beds.

Any boulders within the working area will be avoided where possible. If boulder clearance is however required, the boulders will be removed from the cable route using a boulder grab and placed within the proposed cable corridor (generally ± 25 m from the route). If large boulders are relocated within the proposed cable corridor, appropriate notifications to marine users will be provided.

The PLGR will aid to clear the proposed cable corridor of debris such as OoS cables, chains, wires, ropes, and fishing gear. If PLGR is required, it is expected that this activity will be completed shortly in advance of the cable installation activities to ensure that the proposed cable corridor remains free of debris prior to installation. The PLGR will be carried on along the centre line of the new cable route, and as such no seabed disturbance beyond the cable installation footprint is anticipated.

When on site, the vessel will manoeuvre into the start position and overboard the appropriate grapnels for the reported seabed conditions. When in position, the vessel will proceed along the designated cable route at a slow speed (≤1 knot). Tow tensions will be monitored during the PLGR, if a steady increase in tow tension is observed, the vessel will be brought to a stop, and the grapnels recovered to deck. Debris will be cleared from the grapnels and stored onboard the vessel, before redeploying and resuming the PLGR. All recovered debris will be taken ashore and sent for appropriate recycling or disposal at a licenced waste handling facility. Typical grapnel trains are shown in Figure 4-8.

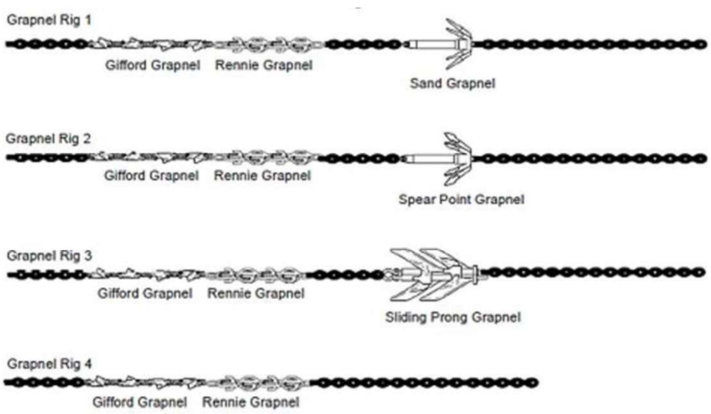


Figure 4-8 PLGR train

If required in the intertidal areas, debris removal is likely to be conducted at low water, when the area is exposed, either by hand or using mechanic plant depending on the size and nature of the debris. It is possible that a diver may be required to remove debris if tidal working from shore is not possible.

4.3.3 Removal of OoS cables

OoS cables may be removed in the nearshore (slightly below MLWS) at both shore ends to allow the new cable to be installed in the best approach angle. A PLGR will likely be used to recover any OoS which may require removal below MHWS. Any cable ends will be cut and pulled back and secured with clump weights and left within the proposed cable corridor.

- Sanday shore end 250 m; and
- North Ronaldsay shore end 200 m.

Further discrete sections (~1 km) of the OoS cables may be removed in the subtidal to allow the new cable to cross the route.

4.4 Installation methods – Intertidal

4.4.1 Open Cut Trench (OCT)

In the intertidal areas, the cable will be buried at both landfalls between MHWS and MLWS, with the potential to trench lower than MLWS dependent on site conditions, using an OCT method (see Figure 4-9). This will be conducted using conventional land-based excavators working within a tidal window, i.e. when the intertidal area is exposed, avoiding works below the waterline. A landing craft may be used to access the landfall sites if the shore conditions permit. If required, the vessel will be used to mobilise and demobilise equipment that will be used during the installation works. The excavated material will be placed to one side of the trench and stored for later reinstatement.

The width of the trench is expected to be approximately 1 m, however this may be increased depending on the stability of the soils. The target depth will be to the top of the cable at approximately 800 mm – 1.2 m below ground level, depending on the composition of sub surface sediment. A rock pecker may be utilised to achieve burial depth where the sub-surface is rocky.

One trench will be required at each landfall down to MLWS. This will contain the new power cable plus two earth wires. At MLWS the two earth wires will separate and continue on the surface of the seabed for up to 50 m. It is anticipated that a 20 m wide working corridor will be required for each trench, accounting for the footprint of the excavator and the temporary storage of excavated material. Table 4-8 details the requirements for the trenching activities.

Figure 4-9 Example of OCT methods for intertidal cable installation

Table 4-8 OCT Trench Requirements

LOCATION	TRENCH PURPOSE	WORST-CASE CABLE BURIAL LENGTH (M)	TARGET DEPTH, TOP OF CABLE (M)
Working corridor for all OCT is 20 m wide			
Sanday	Cable + 2 Earth wires	160	0.8 - 1.2
North Ronaldsay	Cable + 2 Earth wires	140	0.8 - 1.2
	Total	300	

4.4.2 Transition Joint Pit (TJP)

The TJP is the location where the subsea cable is split out into its individual cores and terminated to a land cable (Figure 4-10). The TJP at Sanday will be located above MHWS. The TJP at North Ronaldsay may be located either below or above MHWS. The TJP for both shore ends will utilise a sea earth. Should the TJP in North Ronaldsay be located below MHWS, the permanent deposits would include a 10 m x 3 m concrete plinth and a 1 m x 1 m fibre box. The footprint of these deposits will be wholly encompassed within the temporary 20 m wide working corridor (Section 4.4.1). The TJP will be reinstated using the excavated material.

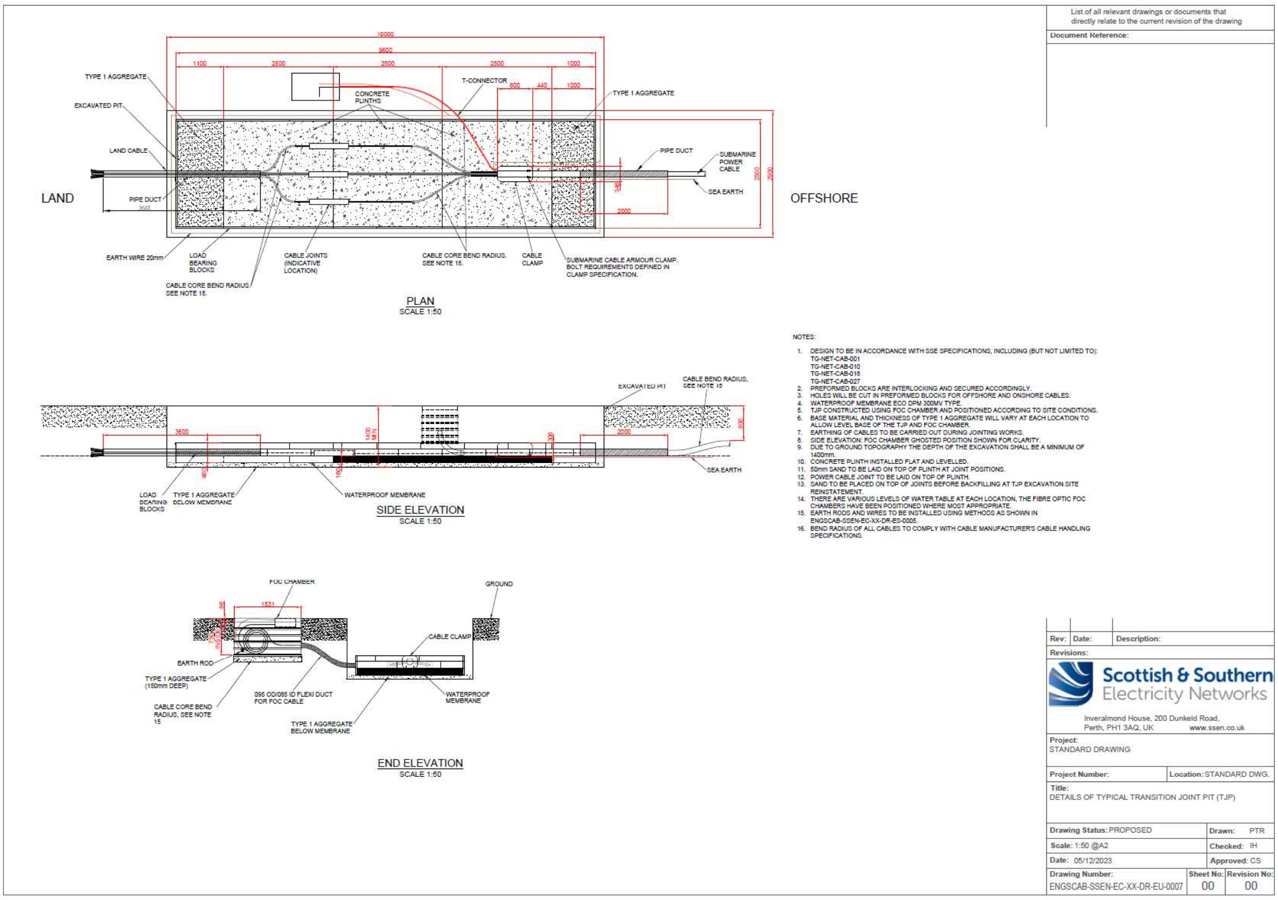


Figure 4-10 TJP layout

4.4.3 Cable Pull-In

Cables will be pulled onto ashore using winches which will be located onshore at landfall locations. These winches will be located onshore above the MHWS. A combination of rollers (Figure 4-11) and quadrants (Figure 4-12) are used to ensure the cable is not damaged and follows the correct alignment during the pull-in process through the intertidal area. Rollers support the cable and reduce friction, while quadrants are used to facilitate changes in direction. They can either be held in position using land plate anchors or anchored on an excavator. The rollers and quadrants are temporary aids to installation, and will be removed entirely following the completion of the pull-ins. Furthermore, if rock anchors may be used to secure equipment to rocks. Anchor plates will be used to secure the rollers and quadrants in place while cable pull in is carried out. Anchor plates are temporary aids for installation which will be buried and removed upon completion of cable pull in.

Figure 4-11 Example of rollers

Figure 4-12 Example of rollers and quadrants

The first end cable pull in will be conducted on a rising tide. A messenger wire will be taken ashore from the CLV by small craft and connected to the shore winch wire at low water. The messenger line will then be used to pull the shore winch wire back to CLV and connected to the cable end. The shore winch will then pull the cable ashore with floats being attached to the cable on CLV and removed as the cable reaches low water. The cable may then be held in position using a multicat or small support RHIBs, ensuring it is installed within the proposed cable corridor. When the cable reaches the TJP it will be secured. At this point, any remaining cable floats can be removed from shore towards the CLV, completing the pull-in operation. A DSV may also be present within the proposed cable corridor to support diving or surface swimmers throughout cable pull-in operations.

At the second end pull-in will be achieved using a floating bight of cable. Upon approach to the second end, floats will be attached to the cable as it is being paid out to float the cable to shore. Once the cable is floated out the cut cable end will be taken on shore using a support craft, ensuring the cable is held securely. The cable will then be connected to a winch which will pull the cable to shore upon the floated cable reaching the landfall site. Surface swimmers will then remove the floats attached to the cable, allowing the shore winch to pull in any slack created to complete the installation process and allow the cable to rest on the seabed.

4.5 Installation Methods – Subtidal

4.5.1 Cable Laying

The cable will be surface laid along the entire length of the subtidal section of the installation corridor (MLWS to MLWS), this will be achieved by using a CLV. The reason for surface laying the proposed cable is that the surveys of the proposed cable corridor indicate that it does not have good burial potential along the majority of its length. Once the pull in is complete (Section 4.4.2), the CLV is set up and catenary established to the sunken cable, the cable lay can then commence. The vessel shall then proceed to lay the cable as it moves away from the landfall. Touchdown monitoring will be conducted using an ROV deployed from the CLV or other support vessel.

Once the CLV reaches the other landfall, a similar process is conducted to pull the cable ashore and complete the cable laying operations, further detail is provided in Section 4.5.2.

4.5.2 Cable Stabilisation

SHEPD has compiled a list of cable stabilisation materials required, for which the final requirements will be informed based on survey data acquired from the nearshore and offshore surveys. This conservatively outlines the type (including alternatives) and a worst-case amount of material required for cable stabilisation and forms the basis of the assessment made in the MEA. While the worst-case for each type of material is presented in the following sections, the actual cable stabilisation may be a combination of methods and is subject to further survey and design. The cable stabilisation will be placed where required along the cable route. No burial is planned for any subtidal section of the cable due to a lack of sediment.

Engineering studies are ongoing which may alter the final quantity of cable stabilisation required but the information provided in the MLA and which forms the basis of the assessments in the MEA are based on anticipated worst-case scenario and includes 10% contingency.

Rock Bags

The cable installation strategy includes the installation of 2 t rock bags onto the cable to provide stability. If rock bags are used, they will mostly be installed below 8 m LAT and up to every 50 m either side of the installed cable. The LAT limits will be determined by the size of the rock bags. The 8 m LAT threshold is derived by ensuring that the navigable water depth has not been reduced by >5%; the 2 t rock bags are 600 mm tall when installed. There may however be the requirement to place rock bags <8 m LAT even though this will be avoided where possible. In such instances advice from the Marine and Coastguard Agency (MCA) and other navigational bodies will be sought and considered.

The 2 t rock bags which may be installed have a diameter between 2.4 m. Rock bags would potentially be positioned on top of the cable and/or on either side of it. The potential numbers required (including 10% contingency)is 276 no. 2 t rock bags (552 t collectively). The formation of rock bag installation would typically be in pairs, one either side of the cable at required intervals to maintain on-bottom stability.

Installation of rocks bags would either be from the CLV deck, a separate large installation vessel with ROV, or multicat vessel.

4.6 Sea Earths

Sea Earths will also be installed to provide protection from surges and lightning strikes to the electrical circuit. It is expected that two earthing cables will be required at each shore end (four in total) using copper wires with a cross sectional diameter of 95 mm^2. One cable will earth the armour of the HVAC cable system, while the other provides an earth for the FO armour (integral to the HVAC cable system (Figure 2-1). The earthing cables will be stranded copper wire.

The sea earths will be connected to the armour wire and fibre optic cable at the TJP. Between TJP and MLWS, the earth wire will be installed within the same trench as the subsea cable. From MLWS the earth wires will run between 30-50 m into the sea. Anchor chain weights may be used to anchor the sea earths at intervals/at their termination subsea. The working corridor will be 20 m (10 m either side of the cable). There will be up to four 200 m sections of sea earthing wire with a total length of 1,100 m (including contingency).

4.6.1 Clump Weights

Up to six concrete clump weights (at a maximum of 40 kilograms (kg) each) may be used to anchor the sea earths at intervals / at their termination subsea. If used intertidally, they would be completely buried along with the sea earth. In the subtidal section (max 50 m beyond LAT), the earth would be on the seabed surface and may be protected by clump weights. Clump weights may also be used to secure ends of OoS cables if they require cutting and removal. Up to 12 concrete clump weights (at a maximum of 100 kg each) may be used for six OoS cable crossings.

4.6.2 Rock Anchors

Up to 20 rock anchors (2 kg each) for the subsea earth may be used, in lieu of clump weights, where it is understood to be a harder seabed with less sediment cover. In instances where rock anchors are required, a diver would drill a hole in the rock (max 20 mm diameter, 200 mm depth) and insert a small volume of marine grade resin and a stainless-steel anchor.

4.7 Tubular Cable Protection System

A tubular cable protection system such as Uraduct or cast iron articulated (split) pipe will be fitted around the cable for additional protection in the event of exposure as detailed in Section 4.4.1.

Articulated pipe (also referred to as split pipe) is commonly used on cable shore ends and beach landings, as well as subtidal sections of cables. It consists of a series of approximately 639 mm long half pipe sections of iron which clamp around the cable and interlock, providing mechanical protection, a flexible connection and bend restriction. Various types of split pipe are available, but most typically have an external diameter of approximately 260 mm. Uraduct or similar system provides the same protection but is made of polyurethane.

A tubular cable protection system can be applied during the shore end installation, being fitted on the CLV whilst the cable is being paid out or retrofitted at low tide. The protection can also be installed by divers in the subtidal area using a DSV, in which case it is likely that the cable protection system will be retrofitted. If divers are used to install the tubular cable protection system, the DSV will either hold station using spud legs or a mooring spread, as detailed in Section 4.2.2. Additional protection afforded by the tubular cable protection system has been incorporated into the route engineering with respect to both shore end landfalls and out to include the nearshore subtidal rocky outcrops and boulder fields. The nearshore cable protection system will be installed during the cable laying campaign in Autumn 2026, and subtidal protection in Spring/Summer 2027.

An example of a split pipe diagram is shown in Figure 4-13 and installation method in Figure 4-14.

Figure 4-13 Split Pipe

Figure 4-14 Split Pipe Installation

A summary of the tubular cable protection system requirements by area are summarised in Table 4-9.

Table 4-9 Split Pipe Requirements

SITE LOCATION	LOCATION	WORST-CASE PROTECTION REQUIREMENTS (M)
Sanday	Intertidal area	1,200
North Ronaldsay	Intertidal area	500
Rocky Outcrops	Subtidal area	2,300
	TOTAL	4,000

4.8 As-built Survey

Installation data will be compiled to confirm the as-built positions, and to ensure that the design and licence requirements have been met. Details of the as-built locations of the cable and associated protection measures will be provided to the United Kingdom (UK) Hydrographic Office and the Kingfisher Information Service for inclusion on Admiralty Charts, and Offshore Renewable and Cable Awareness Charts respectively.

4.9 Schedule of Deposits

The materials used in installation or removed from below MHWS are detailed in Table 4-10 and Table 4-11.

Table 4-10 Materials Used in Installation or Removed from the Seabed During the Project

	INSTALLATION MATERIALS		REMOVALS	
Type of Deposit / Removal	**Description**	**Quantity and Dimensions (metric)**	**Description**	**Quantity & Dimensions (metric)**
Submarine Cable	HVAC power cable. Three core design with copper round compacted stranded conductors, XLPE insulation, copper laminated tape and polyethylene outer sheath, PPY, galvanized steel-wire armour.	Quantity No. 1 Dimensions: • Diameter: 102.5 mm; and • Length: 10,400 m. Weight: 27.1 kg/m	HVAC power cable. Three core design with copper conductors, EPR insulation, and polyethylene outer sheath. Existing cables in the nearshore at both ends (two cables), as well as potential removal of subtidal sections to allow the new cable to cross the route.	N/A Dimensions • Diameter: 64 mm; and • Length: 1,450 m. Weight: 9.3 kg/m
Earthing wire	Copper wire for earthing.	Quantity No. 4 Dimensions: • Diameter: 95 mm^2; and • Total Length: 1,100 m. Weight: 0.6 kg/m	N/A	N/A
Tubular Cable Protection System	Tubular cable protection system that interlocks around the cable and is fixed with bolted end clamps will be used. This will be placed on either shore end of the cable where burial is not possible.	Quantity No. 4,000 m Dimensions: • Diameter: 260 mm; • Length of each shell: 639 mm; and	N/A	N/A

INSTALLATION MATERIALS				REMOVALS
		• Length: 500 m.		
		Weight: 37 kg/m		
2 t Rock Bags	Rock bags may be required to stabilise the cable.	Quantity No. 276	N/A	N/A
		Dimensions: • Diameter: 2.4 m; and • Height: 0.6 m.		
		Weight: 2 t each		
Earthing Clump Weight	Concrete or chain clump weight or for earthing wires.	Quantity No. 6	N/A	N/A
		Dimensions: • Diameter: 1 m; and • Height: 0.5 m.		
		Weight: Up to 40 kg each.		
Clump Weight	Steel, or iron clump weights for securing free cable ends - may be required where existing cable(s) are cut to secure the cable ends.	Quantity No. 12	N/A	N/A
		Dimensions: • Diameter: 1 m; and • Height: 0.5 m.		
		Weight: Up to 100 kg each.		

INSTALLATION MATERIALS			REMOVALS	
Rock Anchors	Stainless steel threaded rod, plus bolt fixing and marine grade resin.	Quantity No. 20	N/A	N/A
		Dimensions: • Diameter: 0.02 m; and • Length: 0.3 m.		
		Weight: 2 kg each		
Aids to Navigation (AtoN)	Two new permanent AtoN will be installed.	Quantity: 2	N/A	N/A
Concrete Plinth	A single concrete plinth and single fibre box for the TJP at North Ronaldsay.	Quantity: 1, Diameter: 10 m x 3 m, Weight: 29 t	N/A	N/A
Fibre Box		Quantity: 1, Size: 1 m x 1 m		

Table 4-11 Temporary Equipment Below MHWS

TYPE OF DEPOSIT	DESCRIPTION	QUANTITY & DIMENSIONS (METRIC)
Anchors	2 t Delta Flipper Anchors may be used for diving support vessel or pontoon support craft mooring spread.	Quantity: 4, Diameter: 2.4 m x 2.6 m, Weight: 2 t each.
Mooring Chains	Mooring chains will be attached to the anchors for the diving support vessel or pontoon support craft mooring spread.	Quantity: 4, Diameter 0.3 m, Length: 54 m each, Weight: N/A

5 PROPOSED DELIVERY PROGRAMME

Table 5-1 summarises the indicative schedule of works relating to the proposed cable installation activities, including the expected duration of each activity; however, it should be noted that some may take longer or less days depending on different variables such as weather and/or operational delays. Therefore, the below should be taken as the best estimate. The licence duration being sought by SHEPD is two years for contingency in case the installation programme is delayed. It is proposed to split the installation campaign in two parts; cable and nearshore tubular cable protection system installation in Autumn 2026 before the adverse winter weather, and cable protection installation in Spring/Summer 2027.

Table 5-1 Duration of Key Installation Activities

ACTIVITY	DURATION (DAYS)
Autumn 2026	
PLGR and (if required) survey works	2
Cable pull-in operations	4
Offshore cable lay	3
Intertidal works, including trenching, split pipe installation and backfill	28
TOTAL	37
Spring / Summer 2027	
Installation of offshore tubular cable protection system	40 (with 2x dive teams)
Rock bag installation (including 2 days as left survey)	20
TOTAL	60

6 UXO STRATGEGY

Unexploded Ordnance (UXO) are explosive weapons (bombs, shells, grenades, land mines, naval mines, cluster munition, and other munitions) that did not explode when they were deployed and still pose a risk of detonation, sometimes many decades after they were used or discarded. UXO exist worldwide and poses a potentially lethal threat in any area in which they are present. The inherent dangers associated with UXO can largely be attributed to the deterioration of the detonator and main charge, which makes these already volatile components more sensitive to disturbance such as heat, shock and/or friction. Therefore, as part of the route engineering process, a detailed UXO risk assessment within the proposed cable corridor was carried out. The risk assessment concluded that there is a low risk (Hydrofix Ltd., 2026).

Given that any UXO or potential UXO (pUXO) identified would be avoided through cable micro-routeing, there will be no UXO clearance associated with the proposed activities and therefore no UXO clearance is included in the MEA. In the unlikely event that UXO clearance is required, this will be consented separately and subject to a Separate Marine Licence Application and associated environmental appraisal.

7 REFERENCES

Hydrofix Ltd. (2026). Caithness and the Orkneys Regional UXO Risk Assessment. Project Number H25041. Document Number: H25041-REP-001.