Culzean Floating Wind

A semi-submersible pilot project

Cable Plan (CaP)

GB-CZT-00-TOTA-000010

Rev.	Date	Issued by	Checked by	Approved by
003	09.09.2025	Claire MacDonald	Scott Dillon	Charles Howorth

TABLE OF REVISIONS

Revision	Modification
00A	Issued for Review
001	Revision addressing comments received from MD-LOT 20/02/2025.
002	Revision addressing comments from Consultation process, received from MD-LOT 29/04/2025
003	Revision addressing comments received from MD-LOT (including follow up Consultation comments) 28/07/2025

DETAILED CHANGE LOG

Date	Rev. Status	References	Description of changes
26/03/2025	Resubmission to MD-LOT for review		Throughout the document, MS-LOT has been changed to MD-LOT. Section 1.4 – Hyperlink to the Marine Directorate website has been updated. Section 3 – Table 3-1 has been included to include the WTG location co-ordinates (WGS84). Section 4.1 – information has been added in relation to attenuation of Electromagnetic Field (EMF), and methods to mitigate the effects of EMF. This section has also been updated with information of the materials used for the bend stiffener. Section 5.4.2 – Information has been added of the material used for the buoyancy module. Section 7.1 – has been updated to include that ROV and MBES Surveys will be conducted to ensure that the cable is buried as required. Section 8 – Table 9.1 has been relabelled 8.1. Section 9 - Annex 1 has been included with a summary of the surveys.
05/06/2025	Resubmission to MD-LOT for review addressing consultation comments	NatureScot comments on CaP consultation.	As per comment from NatureScot, Section 4.1 stated the burial depth of 0.5m to 1m – this has now been updated to 0.6m.
			As per Comment 4 from NatureScot Section 5.3 – Unexploded Ordnance has been updated regarding the outcome of surveys.
			As per Comment 5 from NatureScot, Section 5.4.1 has been updated to confirm that the marshalling yard for the cable will be Aberdeen.
			As per Comment 6 from NatureScot, Section 1.2 has been updated and inclusion of Table 1.1.

			As per Comment 7 & 8 from NatureScot, Table 1.2 has been included and, amendment to Section 1 and table numbering.
		Scottish Fishermen's Federation comments on CaP consultation	As per Comment 1 from the Scottish Fishermen's Federation, Section 6 has been updated to make it clearer in regard to rock / mattress placement only being at either end of the cable within the 500m safety zones for both the turbine and the Culzean offshore installation.
			As per Comment 5 from the SFF regarding the overtrawl survey, following internal review, it is not considered necessary to do an overtrawl survey, unless the as built report reveals something unexpected. Reference to the overtrawl survey has been removed from Table 8.1.
			As per Comment 7 & 8 from the SFF, Section 3.2 has been updated in relation to if there is movement of boulders, SFF will be informed of their location and the format for the geographical readings.
			As per Comment 10 from the SFF, Table 8.1 has been updated with the commitment to share the as built report with the SFF within 3 months of the cable installation.
09/09/2025	Resubmission to MD-LOT for review addressing comments		As per Comment 11 from the SFF, Section 6 has been updated to give consideration to the use of a guard vessel during any cable remediation works.
			As per Comment 12 from the SFF, Section 7.1 and Table 8.1 have been updated to confirm that the as built survey will be shared with the SFF to determine whether an overtrawl survey is required.
			As per Comment 13 from the SFF, Section 5.4 has been updated to reflect the NtM will be submitted 2 weeks prior to any activities regarding the cable lay and a follow up notification given closer to the start date.
			As per Comment 14 from the SFF, update to Section 6 – Remedial Protection to include reference to SFF's preference regarding rock size and profile for cable

			burial. Also, Sections 3.2 and 6 have been updated to acknowledge future fishing patterns being taken into consideration.
			As per Comment 15 from the SFF, Table 8.1 has been updated to include the proposed cable route being included on the Horizon Watch Bulletin.
			Other updates – update to Table 3-2 and 4-1 to amend timeframes.

DISTRIBUTION

Stakeholder No.	Document Recipient	Date Issued

Contents

ACRONYMS, ABBREVIATIONS and DEFINITIONS

AHV	Anchor Handling Vessel
AIS	Automatic Identification System
AtoN	Aid to Navigation
COLREGs	International Convention of the Prevention of Collisions at Sea
CAA	Civil Aviation Authority
CaP	Cable Plan
CLV	Cable Laying Vessels
CMS	Company Management System
CMS	Construction Method Statement
CNS	Central North Sea
CPF	Central Processing Facility
CSV	Construction Support Vessel
DGC	Defence Geographic Centre
DoL	Depth of Lowering
DP	Dynamic Positioning
DSLP	Development Specification and Layout Plan
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ERCoP	Emergency Response Cooperation Plan
ERRV	Emergency Response Rescue Vessel
FLO	Fisheries Liaison Officer
FOWT	Floating offshore wind turbine
FSO	Floating Storage and Offloading

HDPE	High Density PolyEthylene
HMCG	His Majesty's Coastguard
IAC	Inter Array Cable
IMO	International Maritime Organisation
KIS-ORCA	Kingfisher Information Service – Offshore Renewables & Cable Awareness
LAT	Lowest Astronomical Tide
LMP	Lighting and Marking Plan
LNtM	Local Notices to Mariners
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MD-LOT	Marine Directorate Licensing Operations Team
MGN	Marine Guidance Note
MRCC	Maritime Rescue Coordination Centre
NLB	Northern Lighthouse Board
NMCC	National Maritime Coastguard Centre
NOTAM	Notice to Airmen
NSP	Navigational Safety Plan
NSVMP	Navigational Safety and Vessel Management Plan
NtM	Notice to Mariners
O&M	Operations and Maintenance
OfCom	Office of Communications
OIM	Offshore Installation Manager
OREI	Offshore Renewable Energy Installation
PEMP	Project Environmental Monitoring Plan

PU	Polyurethane
ROV	Remotely Operated Underwater Vehicle
RYA	Royal Yachting Association
SFF	Scottish Fishermen's Federation
SOV	Service Operations Vessel
TEPNSUK	TotalEnergies E&P North Sea UK Limited
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordanance
VMP	Vessel Management Plan
ULQ	Living Quarters and Utility Platform
WHP	Wellhead Platform
WTG	Wind Turbine Generator

1. INTRODUCTION

1.1 Purpose of the Document

This Cable Plan (CaP) has been prepared by TotalEnergies E&P North Sea UK, hereafter referred to as TEPNSUK, to satisfy conditions of the Marine Licence.

The overall objective of the Culzean Floating Offshore Wind Turbine Pilot Project (Culzean Floating Wind) CaP is to ensure all environmental and navigational issues are considered for the location and construction of Inter-Array Cable (IAC) cable.

The Culzean Floating Wind CaP confirms the location of the IAC cable and methods of installation, burial and protection. It explains how cable routing has been, and will be, informed by survey work that has identified constraints within the Culzean Floating Wind Project.

The Culzean Floating Wind CaP also confirms the anticipated technical specification of the IAC cable. All TEPNSUK personnel and Contractors involved in the Project must comply with this Culzean Floating Wind CaP.

1.2 Scope and Objectives of the CaP

In line with the requirements of the Marine Licence condition (refer to Section 1.2.1), the CaP confirms the following:

- the location and layout of the cable route;
- the duration and timings of the licensed activities;
- the results of monitoring or data collection work (including geophysical, geotechnical and benthic surveys) which will help inform cable routing;
- technical specification of the cable, including a desk-based assessment of attenuation of electro-magnetic field strengths and shielding;
- Cable installation methods including vessel requirements, preparatory works, and cable installation techniques;
- Cable burial risk assessment, to ascertain burial depths and where necessary alternative protection measures, and a mechanism for risk-based approach to protection measures where target burial has not been achieved;
- Cable burial techniques, including measures to bury and protect cables where target burial has not been initially achieved;
- measures to ensure the remediation, where practicable, of any seabed obstacles created during construction;
- survey methodologies and planning (e.g., inspection, over trawl, post-lay) for cable through their operational life; and
- measures to address and report to the Licencing Authority any exposure of cable or risk to users of the sea from cables.

1.2.1 Consent Compliance

The CaP fulfils the consent conditions for the preparation of a Cable Plan and Cable Burial Risk Assessment.

Table 1.1 includes reference to how and where the condition clauses have been addressed within the CaP.

Table 1.1 Consent conditions to be discharged by this CaP

Condition reference	Condition	Relevant section
Cable Plan 3.2.11	The Licensee must, no later than six months prior to the Commencement of the Licensed Activity submit a Cable Plan ("CaP"), in writing, to the Licensing Authority for its written approval.	This document sets out the CaP for approval by the Scottish Ministers.
	Commencement of the Licensed Activity cannot take place until such approval is granted. Such approval may only be granted following consultation by the Licensing Authority with NatureScot, MCA, SFF and any such other advisors or organisations as may be required at the discretion of the Licensing Authority. The CaP must be in accordance with the Application.	Consultation to be undertaken by the Scottish Ministers.
	The CaP must include, but not be limited to, the following: a) The vessel types, location, duration and cable laying techniques for the cable;	Section 5.1 & 5.4
	b) The results of monitoring or data collection work (including geophysical, geotechnical and benthic surveys) which will help inform cable routing;	Section 3.1
	c) Technical specification of the cable, including a desk based assessment of attenuation of electromagnetic field strengths and shielding;	Section 4.1
	d) A Cable Burial Risk Assessment, to ascertain burial depths and where necessary alternative protection measures;	Section 6
	e) Methods to be used to mitigate the effects of Electromagnetic Fields ("EMF");	Section 4.1
	f) Methodologies and timetable for post-construction and operational surveys (including inspection, over trawl, postlay) for the cable through its operational life; and	Section 3.1 & 7.1

	g) Measures to address and report to the Licensing Authority any exposure of cables or risk to users of the sea from cables.	Section 7.2

1.3 Linkages with other Consent Plans

This CaP details the proposed construction programme, forming part of a set of approved documents (including other mitigation plans required under the Marine Licence). Table 1.2 lists the Consent Plans with linkages to this CMS.

Table 1.2 Consent Plans with linkages to this CaP

Other Consent Plans and Documents	Linkage with CaP
Development Specification and Layout Plan (DSLP)	The DSLP provides information about the Culzean Floating Wind site including WTG layout, seabed information, details on WTG dimensions, generating output of the WTG, as well as details on the cable.
Navigational Safety Vessel Management and Plan (VMNSP)	Provides the management and coordination of vessels to mitigate the impact of vessels.
Construction Method Statement (CMS)	The CMS provides details of the methods that will be implemented during the construction phase. The CaP has been informed by the descriptions of construction methodologies and construction vessels given in the CMS.
Operational Maintenance Plan (OMP)	The OMP gives details of the maintenance of the WTG and equipment as well as the cable.

1.4 Plan Audience

The CaP is intended to be referred to by personnel involved in the design and construction of the Culzean Offshore Floating Wind Project (Culzean Floating Wind), including TEPNSUK personnel and Contractors. All marine construction statements and documents produced in relation to the Project must comply with this CaP.

Compliance with this CaP will be monitored by the Culzean Floating Wind Project Team and the Marine Directorate - Licensing Operations Team (MD-LOT).

1.5 Plan Locations

The latest version of this CaP can be obtained from TEPNSUK's document management system (New Prodom), and from Marine Directorate website[1].

In addition, copies of the CaP are to be held in the following locations:

- TotalEnergies office In Westhill;
- With the CFW Marine Coordinator (MC); and

1.6 Updates and Amendments

This CaP will be revised as relevant to ensure the information is kept up to date, at intervals agreed with the Scottish Ministers. Linkages exist between a number of offshore Consent Plans (Section 1.2 within Table 1-2). As plans are updated, there will be a review of inter-linkages with other Consent Plans to ensure these are also updated as relevant.

The document is controlled via New Prodom, an electronic document management system.

2. INTRODUCTION

2.1 Project Description

The Culzean Floating Wind project is located in the central North Sea (CNS), approximately 222 kilometres (km) east of Aberdeen in the UK Continental Shelf (UKCS) Block 22/25a. The Culzean Floating Wind project will deploy one floating WTG with a capacity of 3 MW with test floater and mooring system technologies for offshore floating wind. This is a pilot project which aims to; i) test and qualify the floater technology designed by Ocergy, and ii) perform a hybridisation showcase for TotalEnergies to demonstrate the feasibility of platform electrification in an offshore environment.

The Culzean Floating Wind project will be installed approximately 2.5 km west of the Culzean oil and gas platform, linked via an export cable to the Culzean Central Processing Facility (CPF) (Figure 2-1). The wind turbine will be connected to the plant power management system to allow the export of the produced electricity to the site. The Culzean facility is a stand-alone development involving three bridge linked platforms including a Wellhead Platform (WHP), Central Processing Facility (CPF) with flare tower, and separate Living Quarters and Utility Platform (ULQ).

The Project does not require a grid connection to shore and will be entirely within the offshore region between 12 nautical miles (nm) and the Exclusive Economic Zone (EEZ) boundary.

The floating WTG will be connected to the Culzean facilities via an existing J-tube on the platform. The key components include:

- One WTG;
- One floating substructure;
- Up to six mooring lines
- Up to six drag anchors;
- One 2.5 km long IAC cable; and
- Associated scour and cable protection (if required).

The design life for the WTG is 10 years.

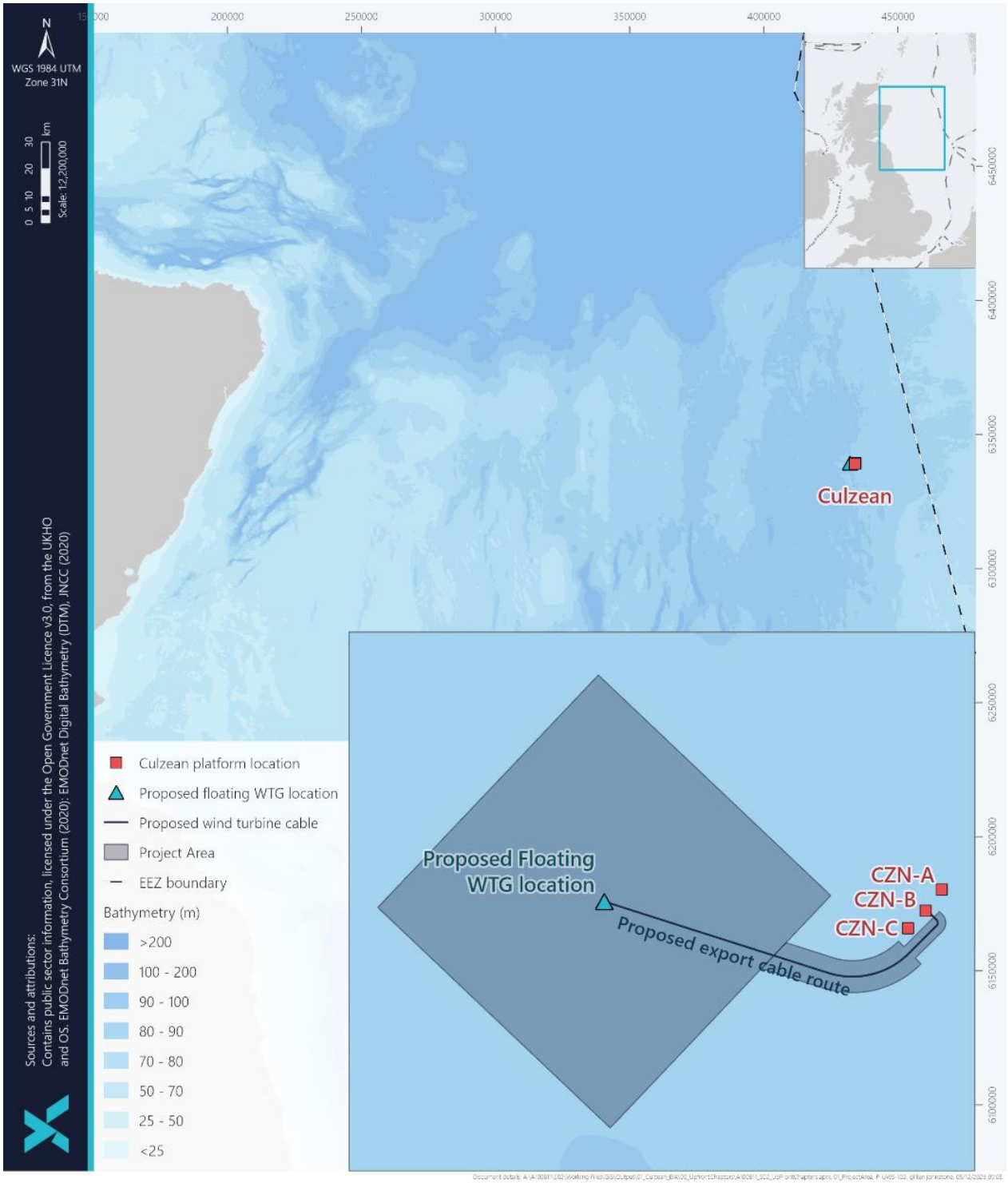


Figure 2-1 Culzean Floating Wind Project Area

3. LOCATION AND LAYOUT OF EXPORT CABLE

Figure 3.1 shows the layout of the Culzean Floating Wind Project, including the layout of the wind turbine generator (WTG) in relation to the Culzean CPF. The IAC cable connects the WTG to the Culzean CPF via an existing J-tube located on the platform.

The floating WTG coordinates are presented in Table 3-1.

Table 3-1 WTG location co-ordinates (WGS84)

	Latitude	Longitude	Status
Centre point	57° 11’ 29.3’’ N	1° 52’ 35.3’’ E	Proposed location

The full cable arrangement, along with the specifications of the WTG and the location coordinates of each structure, is provided in the Development Specification and Layout Plan (DSLP).

This section describes the layout, the location of the IAC cable and the information that has been used to inform cable routing.

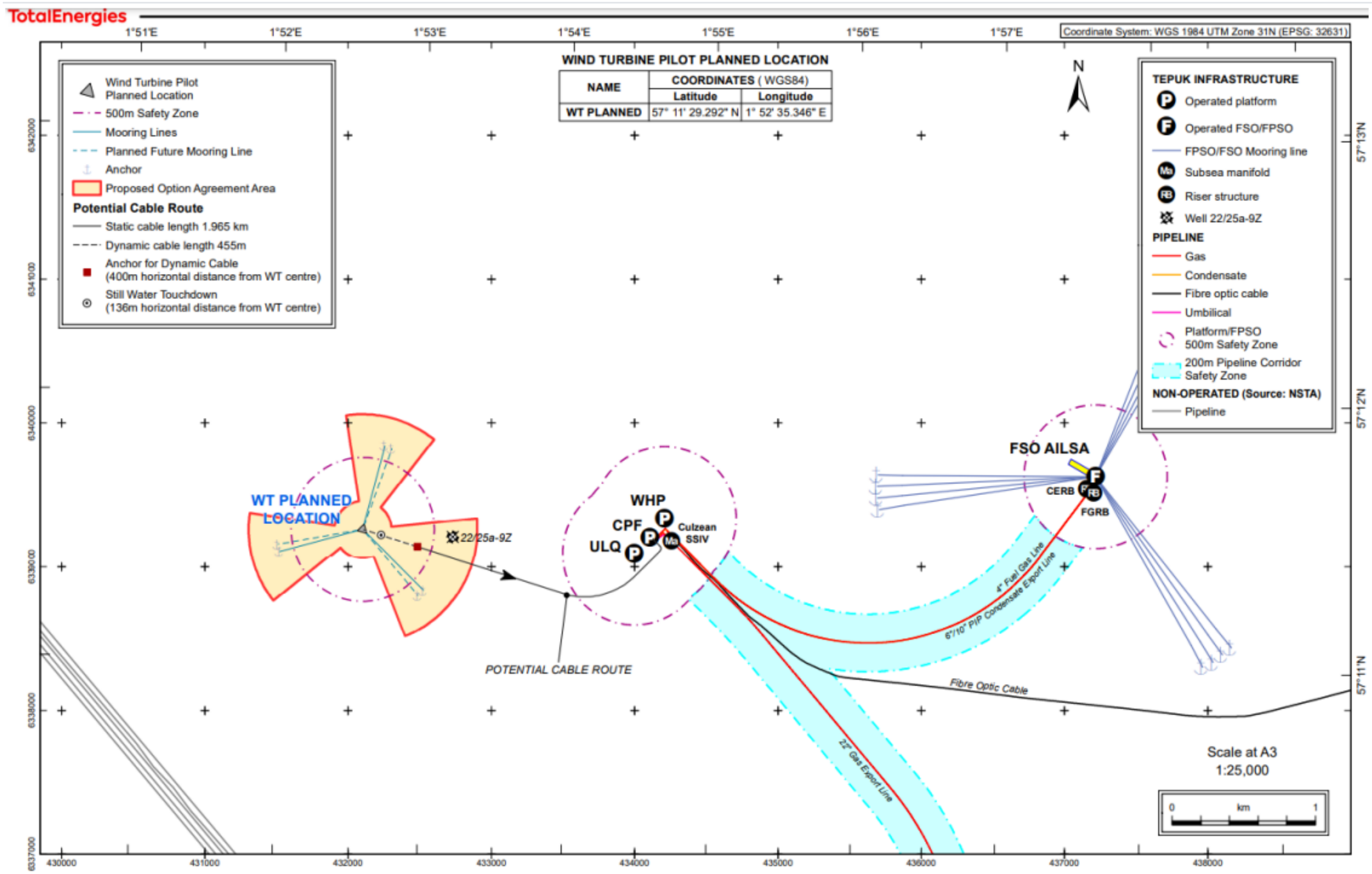


Figure 3-1 Culzean Floating Wind planned layout

3.1 Site Investigation and Survey Results

3.1.1 Site Investigation

A series of site investigation surveys (geophysical, geotechnical, and benthic) have been commissioned by TEPNSUK to understand the seabed and subsurface conditions within the Culzean Floating Wind site in order to initially define, and then refine the cable route and determine the most appropriate installation methodologies. A summary of the surveys that have already been carried out, as well as known future surveys are summarised in Table 3-2.

Table 3-2 Site investigation surveys (completed surveys and anticipated surveys)

Survey Type	Description	Date
Geophysical	Culzean Floating Wind Project site specific survey used to inform site development and EIA; Multibeam Echo Sounder (MBES), Side Scan Sonar (SSS), Sub-Bottom Profiler, Sparker and a single Magnetometer	March/April 2023
Geotechnical	Culzean Floating Wind Project site specific survey used to inform site development and EIA; Vibrocore (VC) and cone penetration tests (CPT) investigations at the planned mooring locations and at along the proposed cable route.	March/April 2023
Benthic	Culzean Floating Wind Project site specific survey used to inform site development and EIA; Baseline information on the benthic communities within the study area collected using grab samples, seabed imagery and dropdown video (DDV), and eDNA analysis. Grab samples were used for particle size analysis (PSA).	March/April 2023
Pre-Lay Inspection Surveys	Pre-Lay ROV survey	April 2026*
Cable Pull-ins	ROV video monitoring of the entire cable pull-in operations	April 2026*
Cable Burial - Post Trench Survey	Cable tracking and MBES to confirm as trenched status	June / July 2026*
As built survey	Post installation ROV survey	June / July 2026*

*Dates are subject to change

Additionally, geophysical and benthic site surveys (2013) and export pipeline route surveys (2014) carried out as part of the Culzean platform construction were used to inform the baseline as part of the EIA.

3.2 Cable Routing and Constraints

The general key principles for cable route design considered by CFW and the cable installation contractor can be identified as follows:

- The shortest or most efficient path between the assets (CFW and the Culzean installations);

- Avoidance of all identified exclusion zones;
- Avoidance of infrastructure (where possible). Where avoidance is not possible, minimise number of third-party asset crossings;
- Consideration of all the constraints that bound the cable route such as the UXO (Unexploded Ordanance) clearance corridor, anomalies identified by geophysical and geotechnical surveys, large debris, etc;
- Avoidance of shipping anchorages (if identified);
- Reduction in the number of alter courses (curves in route) to reduce installation time, and cable damage risk;
- Operational consideration of a minimum cable straight distance from the structure exit positions before any route alters course;
- Consideration of constraints regarding operational limitations of trenching equipment (e.g. seabed slope, offset distances, turning radius)
- Achieving target depth of lowering and depth of cover (with consideration of natural seabed mobility characteristics of a given site) to minimise the amount of mechanical protection required; and
- Consideration of fishing activities and methods around the turbine site (it is acknowledged that the potential fishing in this area is historically low however, fishing patterns could change in the future and this will be taken into account).

The route that has been chosen does avoid boulders however, should any boulder relocation have to occur following installation, the Scottish Fishermen's Federation will be informed of the location of the relocated boulders (geographical readings will be given in decimal of a minute format, 3 decimal place, using WGS84 datum).

3.3 Exclusion Zones

There is one identified disused (plugged and abandoned) oil and gas wellhead located in the vicinity of the IAC route. Similarly, the mooring lines with their designed excursion have been considered as exclusion zone for the IAC routing.

3.4 Route Deviations

During construction, unforeseen circumstances or previously unidentified hazards could result in minor route deviations, these would typically be within the cable survey and UXO clearance corridors. As such, large deviations (greater than +/- >25 m) from the planned routes are not foreseen.

4. TIMING OF CONSTRUCTION WORKS

The program for the offshore construction works of the Culzean Floating Wind is described within the Construction Method Statement (CMS). Construction works for the cable will be undertaken as detailed in Table 4-1 (based on the program at time writing this document). Full details of the construction programme are provided in the CMS.

Table 4-1 Summary of key milestone dates of the cable construction works

Dates below are subject to confirmation nearer the time

Operation	Time period	Description
Pre-Installation Survey	April 2026	ROV run of the cable route
Cable Lay	April 2026	Lay of cable
Cable Testing and Terminations	April 2026	Testing and Terminations of cable
Cable Trenching	April / May 2026	Trenching of cable
Mattresses Placement	May / June 2026	Post installation rock placement (if required)

4.1 Technical Specification of the Cable

Inter array cable (IAC) will be a 11kV cable with optical fibres as part of the cable cross section.

Description	Value
Outer diameter	ø97.1mm (-5.0 / + 6.0mm)
Outer sheath material	Semiconductive PE
Weight in air and interstices dry	200.5 N/m (20.4 kg/m)
Weight in water and interstices flooded	135.5 N/m (13.8 kg/m)
Nominal mass (weight in air, flooded)	212.7 N/m (21.7kg/m)
Bending stiffness @ 20°C (kN.m^2)	2.48
Minimum Bending Radius, storage	0.90 m
Minimum Bending Radius, installation	1.13m
Minimum Bending Radius, normal operation	1.42m
Maximum Crushing Load, for 4 tensioners	25 tf/m/pad
Maximum tensile load, normal operation	571 kN
Maximum tensile load, installation	705 kN

Table 4.2 IAC Main Characteristics

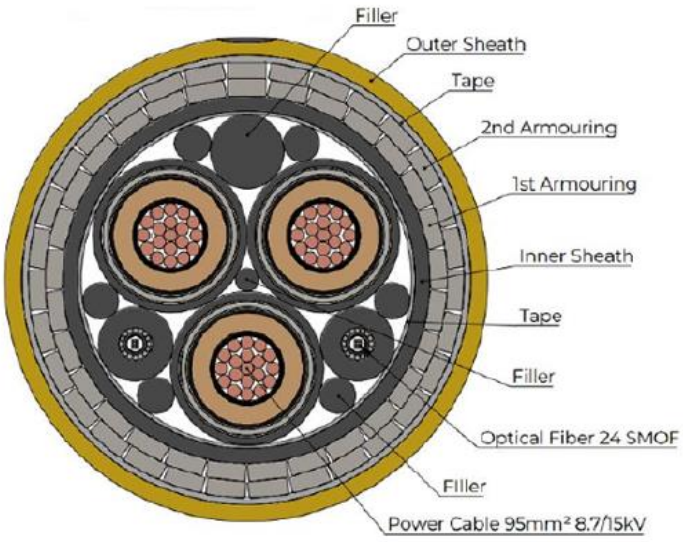


Figure 4.1 IAC Cross-Section

The cable configuration will be a dynamic lazy-wave configuration on the FOWT (Floating offshore wind turbine) side and a static configuration on the Culzean CPF side. Connection to the platform will be via a spare J-tube on the south-east side.

On the FOWT side a bend stiffener (made of Polyurethane - PU) and bend stiffener connector will be mounted to the I-tube. On the platform J-tube side, bend restrictors will be mounted. Split flange hang-off will be used topside on both sides.

Following expertise advise from Prysmian (who are the suppliers of the cable) and internal expertise, it was concluded that as the cable is being buried to a depth of between 0.6 m deep, the Electromagnetic Field impact is minimal and therefore would not affect marine life. This is also further back up on the fact that the cable will be buried by concrete mattresses at either end of the cable. The total amount of concrete mattresses are 20 (10 at each end of the cable), size – 6m x 3m x 0.15m giving a total of 54m3.

5. CABLE INSTALLATION METHOD

5.1 Vessel-Related Requirements

Table 5.1 presents the main construction vessel types and their role in the IAC cable installation campaign. The vessel used during the cable installation activities will adhere to the NSVMP (Navigational Safety and Vessel Management Plan) and, at least five days prior to vessel engagement, the details of the vessel are provided within the Vessel Report. Further details on this procedure can be found within the NSVMP.

Table 5.1 Main IAC and OSP inter-connector cable installation vessels

Vessel Type	Role
Cable Lay Vessel (CLV)	Cable delivery from marshalling yard to site. Pre-lay surveys of cable route Cable laying and touch-down point monitoring Trenching Remedial cable protection As-Built survey.

Typical vessel to be used for such Works is the Skandi Hera (vessel details available at the following link: Skandi Hera | DOF)

5.2 Cable Route Pre-Lay Inspection

Pre-lay inspection survey of the IAC will be carried out to ensure that the cable lay areas are free from any debris or hazards that can damage the cables. The survey will be carried out prior to the cable installation.

5.3 Unexploded Ordnance

No Unexploded Ordnance (UXO) were detected during site-specific surveys with a magnetometer or during any other surveys undertaken within the Culzean Field over the last 15 years. The 2023 surveys also confirmed that that boulder movement will not be required prior to anchor installation. Pre-installation surveys took place in 2024 and will continue in 2026. These will consist of visual inspections (using Remotely Operated Vehicle (ROVs)) of the mooring locations and cable routes to confirm the exact routing and determine the need for any seabed preparation. These surveys are likely to take up to a day. All survey equipment will utilise ultrashort baseline positioning equipment to ensure precise subsea locations.

The route for the cable has now been identified and agreed and survey of the seabed identified no UXO.

5.4 Cable Installation

Prior to any cable installation activities, a Notice to Mariners will be submitted 2 weeks in advance with a follow up notice being submitted nearer the time. During the IAC cable installation operations, notifications to other mariners will be provided by way of Notice to Mariners (NtM), information to Sea Users Bulletins (Kingfisher Bulletin), and communications with the local port authorities. A Guard vessel will also be present from the start of cable lay to the satisfactory completion of cable protection works to warn other mariners about the installation operations in progress and to protect the installed cable and other users for the sea. Further details on this can be found within the NSVMP.

5.4.1 IAC Cable Loadout and Transportation

Load-out of the cables onto the CLV will be performed at the marshalling yard (Aberdeen, UK). The cable load out will follow project specific procedure to carefully monitor the cable and to ensure that the mechanical limits of the cable is not exceeded.

5.4.2 Cable Installation

The installation sequence of IAC cable will be as follows:

- Pre-lay survey of cable route
- Install cable 1st end up to platform J-tube
- Topside pull-in with installation vessel paying out cable
- Cable installation along static route
- Install buoyancy modules for dynamic section (made of High Density PolyEthylene (HDPE)
- Deploy 2nd end and handshake to FOWT pull-in wire
- Trenching
- Testing
- As-built survey

6. CABLE BURIAL AND PROTECTION

Risk assessment

There are a wide range of obstacles and seabed users that present potential hazards to subsea cables; or which have direct interactions with cables that risk damage. Such hazards include ship anchors, which could impact or snag the cable if dragged along the seabed; and fishing, where bottom trawling gear can snag and damage cables.

The aim of this study is to evaluate potential risks to the cable and provide recommendations as to the most efficient risk mitigation, including recommendations of burial depth where appropriate. The basis of a risk assessment for a submarine cable relies on identifying the potential hazards, associated risks, and evaluating the level of protection that may be given to the cable by its armouring (internal and/or external), cable burial beneath the seabed or any other means, such as rock placement or concrete mattress protection.

The most reliable and cost-effective form of cable protection is generally recognised to be ensuring no interaction between the cable and the identified hazards. This is most easily achieved by routing the cable away from such hazards or, where this is not practical, by burial below the seabed. It is acknowledged that the potential fishing in this area is historically low however, fishing patterns could change in the future and this will be taken into account.

The simplified methodology followed in this report is adopted in accordance with the guidance documents:

- Carbon Trust, Cable Burial Risk Assessment (CBRA) Methodology
- Carbon trust, CBRA Application Guide
- DNV-GL Subsea Power Cables in Shallow Water

The methodology for the CBRA includes an assessment of the seabed conditions followed by the identification and quantitative assessment of the threats/hazards for the area. A probabilistic assessment has then been performed using Global Maritime's in-house GIS based software to assess the risk posed to the cable by external threats and a recommended burial depth has been established. This includes a full 3-dimensional approach to the probabilistic calculation of the threat of an anchor strike.

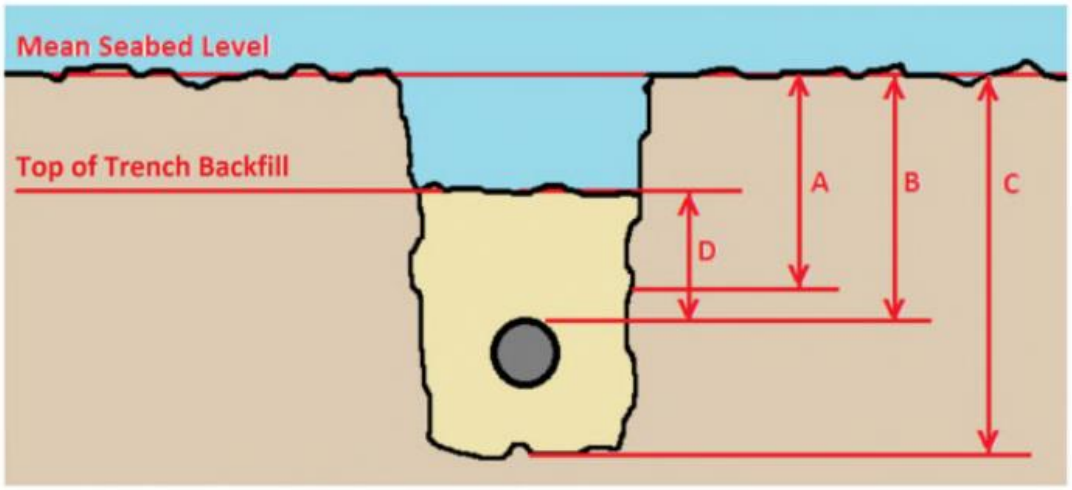
The CBRA method reviews an identified hazard based on its anticipated frequency and consequence. The combined outcome of frequency and consequence indicates whether risk is unacceptable, "As Low As Reasonably Practical" (ALARP) or Acceptable. This adheres to the criteria outlined in DNVGL-RP-F107 .

Hazard classification

Hazards are classified as primary or secondary. Primary hazards are those that have a direct impact upon the cable and can cause damage and secondary hazards are those that do not damage the cable directly but can result in increased risk or susceptibility to damage from primary hazards. An example of a primary hazard would be impact or snagging of the cable due to a ships anchor being deployed. An example of a secondary hazard would be seabed mobility resulting in reduced cable burial cover or exposure, leaving the cable vulnerable to primary hazard

As presented in the methodology above, threat lines have been suggested for the identified site hazards for cable burial. These follow the information and terminology described in the Carbon Trust Guidance Documents.

The Figure below provides an illustration and summary of the main abbreviations and terminology used for burial in this report. The Target DOL generally includes an installation tolerance (or safety allowance).



A **Recommended Minimum Depth of Lowering**
B **Target Depth of Lowering**
C **Target Trench Depth**
D **Depth of Cover**

Assessment summary

The results of the CBRA have allowed the determination of suitable target depth of lowering along the Culzean IAC route. The outcome of the analysis has shown that the entire route has a DNV risk category of 1 (equivalent to the probability of the cable being struck by an anchor being from 100,000+ years) for a depth of lowering of 0m to 0.5m. Whilst the cable could be left on the seabed if stability and dropped object protection is found to be acceptable, it can be evaluated to bury the cable with a 0.5m DOL target to protect from all potential threats (dropped objects, stability and fishing interaction.

Cable Burial Techniques

Primary burial methods can be categorised as ploughing, jetting or mechanical cutting all of which have their own optimised performance in certain soil conditions. This section aims to summarise the type of burial tools and their suitability for the Culzean cable based on the results of the CBRA:

- Cable ploughs,
- Jet trenchers,
- Mechanical cutters.

Considering the anticipated soil conditions, cable route length and depth of lowering requirement, it is recommended that a jet trencher be utilised for the Culzean IAC. Tools such as Helix T1400, Deepocean's UT1, LDT's Rovjet 1200 or similar should be considered, with tool configuration required to achieve the recommended burial depth, by fluidising the sand as well as, where there is apparent clay, cutting the blocks

of clay and removing them from the trench, often requiring additional rearward flow. Give the soil types for cable burial, there is high confidence that the recommended DoL can be achieved using this tool type for the full length of the cable route.

Remedial Protection

Where DoL and DoC cannot be achieved during installation, additional means of protection such as the use of concrete mattresses will be employed.* The final achieved (i.e., as-built) burial profile for the IACs cable will be provided by the cable installation contractor once cable installation and post-lay survey have been completed.

The final route and trenching engineering for the IACs cable route is now confirmed. The primary method of cable protection will be trenching with supplementary rock / mattresses placement on the sections of cable route where trenching is not possible at the final approaches to the CFW and Culzean installation and trench transition areas (which are both within the 500m safety zone of the Turbine and the Culzean installation).

* Consideration will be made to the Scottish Fishermen's Federation preferred cable protection measure of rock protection considering industry standard rock size (1" – 5") with a 1:3 profile followed by an over trawl sweep alongside a long-term monitoring programme. Also consideration should be made as to whether a guard vessel is required during any remedial works or cable replacement.

Planned Protection (Non-Trenched Sections)

There are a number of planned locations requiring rock, concrete mattress and/or other alternative protection methods. These are as follows:

- It is expected that the IAC cable will require a cable protection system (CPS) where the cable approaches the WTG touch down point. CPSs, which may be used alone or in combination with other protection methods, are effectively protective polymer or equivalent which are installed around the cable to provide equivalent mechanical protection.

Where an alternative cable protection solution is used that is not covered by the licensed deposits on the OfTI Marine Licence, these will be subject to approval of an additional Marine Licence or variation to the existing Marine Licence.

7. OPERATION AND MAINTENANCE

Once the Development is fully operational, a programme of cable or seabed surveys will be undertaken to confirm that cables remain buried and fully protected.

7.1 Ongoing Cable Inspections

Prior to completion of installation, a full set of as built documentation will have been obtained as the baseline for the as-built condition of the IAC cable. Post-construction surveys will be undertaken shortly after installation, to determine the as-built conditions. These as-builts will consist of survey data for all aspects of the lay and burial and include updated charts and acceptance tests. The as built report will be shared with the Scottish Fishermen's Federation for review and in conjunction with the SFF, determination will be made as to whether an overtrawl survey is required. In addition, ROV footage of the seabed will be collected during the laying and specific other aspects of the installation of the cables.

The IAC cable will also be subject to periodic inspections. An initial MBES survey for specific sections identified through a risk-based assessment will be undertaken approximately 1-year post-installation to confirm the cables remain buried. The frequency and scope of further monitoring, (ROV visual inspection or MBES surveys) will be proportionate to the risk of future cable exposure and determined based on comparisons with the initial post-installation survey results and subsequent surveys.

7.2 Further Remedial Actions

Should the post-installation MBES surveys identify that the IACs and OSPs inter-connector cable have become locally exposed, experience a significant reduction in burial depth, or in the event of cable failure, TEPNSUK will notify MD-LOT and the cable sections will be inspected to determine the full extent of the exposure or failure.

An assessment will be undertaken to determine the risk posed by the exposed cables to other sea users and to the Development. Where the risk is unacceptable, remedial action will be undertaken to ensure the cable is adequately protected. The following measures may be considered:

- cable reburial, placement of rock bags, rock armour or suitable alternatives, at the relevant locations to mitigate cable movement / migration; and
- placement of rock along the length of exposed cable and merging into areas of adjacent burial or pre-existing rock placement.

If a fault occurs on the subsea portion of the route, the following actions will be taken:

1. First notification of cable damage – the cable repair contractor and relevant third parties and authorities will be notified by way of Notice to Mariners (NtM) and information to Sea Users Bulletins (Kingfisher Bulletin).
2. Initial fault location – if any damage is identified, it is essential to be able to locate the relevant area (rough position) early, to be able to determine what kind of repair spread will be required. Fault location equipment is assumed to be readily available.

All remedial work will be undertaken immediately after mobilisation and on a continuous 24/7 basis until operations are fully completed. Following the repair, the cable will be tested prior to demobilisation. Following reinstatement of the IAC, it may be required to install remedial protection as described above upon issue of a Marine Licence from Marine Directorate Licensing Operations Team (MD-LOT) for the deposits required.

7.2.1.1 Replacement of a Section of Cable

Typically, a quantity of cable equal to three to four times the water depth will be used for limited cable damage. This estimate is dependent on several factors and the specifics of the repair including potential water ingress of the cable.

An overview of the procedure to cut out a section of cable and insert a new piece using two cable joints is presented below:

1. The repair vessel will uncover the damaged section. The cable may be exposed using a jetting tool and/or mass flow excavation.
2. The cable will be cut either side of the damaged location.
3. The cable repair vessel will then recover the first end of the cable to be repaired.
4. A cable joint will be used to connect the replacement section of cable to the cut end of the recovered cable.
5. The second end of the cable to be repaired will then be recovered. This end of the cable will be connected to the other side of the cable repair section using a second cable joint.
6. The repaired cable will then be lowered to the seabed. The cable repair section will result in a bight (loop) at the repair location.
7. The cable will then be re-buried using the most appropriate burial tool or protected using rock protection.

8. REPORTING MEASURES

Table 8.1 below provides the opportunities for sharing and communicating information to MD-LOT on matters relating the IAC, including reporting any exposure of cables or risk to other users of the sea from the cables.

Table 8.1: Reporting opportunities

Reporting Pathway	Summary of Content
As-built report	CFW will provide by way of Notice to Mariners (NtM) and information to Sea Users Bulletins (Kingfisher Bulletin) the proposed, and as-built locations of the areas where remedial rock placement is required to the fisheries stakeholders, MD-LOT, and NatureScot in the form of maps and coordinates, as soon as these become available. The cable route will also be included on the Horizon Watch bulletin prior to it becoming available via KIS-ORCA. The as-built report will also be shared with the SFF within 3 months of the cable installation. If the cable is seen to be incorrectly buried / exposed following the as-built report, remedial works options will be considered including whether an overtrawl survey is required.

9. ANNEX 1: SUMMARY OF THE FINDINGS OF COMPLETED SITE INVESTIGATION SURVEYS.

Survey Type	Description	Date
Geophysical	Culzean Floating Wind Project site specific survey used to inform site development and EIA; Multibeam Echo Sounder (MBES), Side Scan Sonar (SSS), Sub-Bottom Profiler, Sparker and a single Magnetometer	March/April 2023
Geotechnical	Culzean Floating Wind Project site specific survey used to inform site development and EIA; Vibrocore (VC) and cone penetration tests (CPT) investigations at the planned mooring locations and at along the proposed cable route.	March/April 2023
Benthic	Culzean Floating Wind Project site specific survey used to inform site development and EIA; Baseline information on the benthic communities within the study area collected using grab samples, seabed imagery and dropdown video (DDV), and eDNA analysis. Grab samples were used for particle size analysis (PSA).	March/April 2023

The above surveys conclusions were submitted to MD-LOT as part of the Appendices for the Marine Licence submission. The information below are summary extracts taken from various documents as part of that submission and should be referenced if further information is required.

Environmental Impact Assessment Report – Appendix J – Geophysical Survey Report.
Below is a summary of the geohazards and man-made hazards within the survey and route, from this report:

HAZARD	PRESENT	DESCRIPTION
Seabed Gradients	No	No steep seabed gradients were detected in the survey area
Mobile sediments and bedforms	Yes	The only indication of mobile sediments in the area is an isolated furrow, orientated in an NNE-SSW direction. The furrow is shallow, only 10 cm deep and shows rippling, indicating bottom currents.
Cable and pipelines	No	The planned cable route doesn't cross any Culzean seabed infrastructure but is close to the SSIV umbilical where it approaches the platform.
Boulders	Yes	Possible boulders are detected in the survey area. Boulders are often associated with small seabed depressions.
Sub-surface boulders	No	No sub-surface boulders were detected in the survey area.
Glaciotectonics in Quaternary deposits	Yes	Disturbance in Unit 50, Fisher Formation
Erosive Channels	Yes	Base of channels and channel-like features were interpreted, Unit 20, 30 and 60. Several stages of sedimentation and erosion can be seen in Units 20 and 30.
Acoustic blanking and gas seepage features	Yes	No gas-charged sediments deposits were interpreted from SBP and UHRS data. However, numerous small depressions are present in the surficial sediments, possibly indicating fluid escape.

Environmental Impact Assessment Report – Appendix D – Environmental Baseline Survey Report.
Below is a summary of the conclusions from this report:

Overall, the survey area presented a homogeneous seabed comprised mainly of fine to very fine sand. Contaminants were low throughout, with all concentrations within background levels for this region of the North Sea. The variations in faunal abundance and species richness of the sediment samples, as well as in the fauna observed in the photographic data, are likely driven by the natural variability in seabed composition found in the area, as demonstrated by the correlations between biological and physical indices resulting from the BEST tests.

The data collected on the survey is considered to be consistent with a relatively uncontaminated seabed.

The Environmental Impact Assessment report – Non Technical Summary.
Below is a summary of conclusions from this report:

Geophysical and Geotechnical Survey
The completed geophysical surveys identified the presence of infrequent boulders across the Project Area, which were all present on the surface, and none detected below the seabed surface. The seabed is relatively featureless, although evidence of rippling on the seabed indicates bottom currents. The location of the Project offshore means that there is no interaction with the coast. Additionally, there are no protected sites

designated for geological or geomorphology features within the Study Area.

Potential impacts associated with all phases of the Project, were identified. These included:
• Loss or alteration of seabed morphology;
• Increase in suspended sediments; and
• Introduction of scour.

Due to the small-scale of the Project and with embedded mitigation measures in place to lessen the impact on the seabed such as the application of scour protection, these impacts will result in effects of negligible and not significant consequence. Any potential impacts to Marine Physical Process properties from the Project will be highly localised and temporary, as such, transboundary impacts were scoped out of the EIA. The Study Area does not overlap with any other projects and therefore no cumulative effects will occur. Additionally, no significant inter-related effects were established on other receptors. Given these conclusions, no additional mitigation is required, as no significant effects were identified.

Geotechnical Survey
The shallow geotechnical survey included vibrocore (VC) and CPT investigations at the 3 planned mooring locations and at 500m intervals along the proposed cable route to the Culzean CPF platform.

Benthic Survey

Benthic Ecology encompasses the species, habitats and communities located on the seabed within the Study Area, which is defined by a 5 km radius around the WTG. The main benthic habitat classification type present in the Study Area is 'Deep Circalittoral Sand.' The primary sensitive receptors identified in the Study Area include:

- •'Seapens and burrowing megafauna' habitat (Figure 10); and
- Ocean quahog species.

Both are designated under the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) and are Scottish Priority Marine Features (PMFs). There are no protected sites designated for benthic features within 18 km of the WTG.

Several potential impacts on Benthic Ecology associated with all phases of the Project, were identified. These included:
• Temporary habitat disturbance;
• Temporary increase in suspended sediment and sediment deposition;
• Long-term loss and/or damage to benthic habitats and species;
• Disturbance of contaminated sediments;
• Colonisation of hard structures; and
• Removal of artificial hard structures during decommissioning.

Due to the small-scale of the Project and with embedded mitigation measures in place, the assessment concluded that these impacts will not result in significant effects on benthic ecology receptors and as such, no additional mitigation is required. Any potential impacts from the Project will be localised and temporary, as such transboundary impacts were scoped out of the EIA. Additionally, no significant cumulative or inter-related effects were identified on Benthic Ecology receptors.