FIVE ESTUARIES OFFSHORE WIND FARM

VOLUME 9, REPORT 12: OUTLINE CABLE SPECIFICATION AND INSTALLATION PLAN

Application Reference	EN010115
Application Document Number	9.12
Revision	A
AFPF Regulation	5(2)(q)
Date	March 2024

Project	Five Estuaries Offshore Wind Farm
Sub-Project or Package	Other Documents
Document Title	Volume 9, Report 12: Outline Cable Specification and Installation Plan
Application Document Number	9.12
Revision	A
Document Reference	005023928-01
APFP Regulation	5(2)(q)

Revision	Date	Status/Reason for Issue	Originator	Checked	Approved
A	Mar-24	DCO Application	VEOWFL	VE OWFL	VE OWFL

CONTENTS

TABLES

FIGURES

No table of figures entries found.

DEFINITION OF ACRONYMS

Term	Definition
AEZ	Archaeological Exclusion Zone
CBRA	Cable Burial Risk Assessment
CPS	Cable Protection Systems
CSIP	Cable Specification and Installation Plan
DCO	Development Consent Order
dML	Deemed Marine Licence
DWR	Deep Water Route
ECC	Export Cable Corridor
ES	Environmental Statement
HDD	Horizontal Directional Drilling
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
kV	Kilovolt
MDS	Maximum Design Scenario
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MW	Megawatts
NIP	Navigation Installation Plan
NSIP	Nationally Significant Infrastructure Project
OCSIP	Outline Cable Specification and Installation Plan
PLGR	Pre-Lay Grapnel Run
PTS	Permanent Threshold Shift
SAC	Special Area of Conservation
SAR	Search and Rescue
SoS	Secretary of State
TSS	Traffic Separation Scheme
UXO	Unexploded Ordinance
VE	Five Estuaries Offshore Wind Farm

Term	Definition
VEOWFL	Five Estuaries Offshore Wind Farm Limited
VTS	Vessel Traffic Service
WTG	Wind Turbine Generator

GLOSSARY OF TERMS

Term	Definition
Cable Burial Risk Assessment (CBRA)	Risk assessment to determine suitable burial depths for cables, based upon hazards such as anchor strike, fishing gear interaction and seabed mobility. The CBRA is provided in Volume 9, Report 9: Outline Cable Burial Risk Assessment.
Marine Guidance Note (MGN)	A system of guidance notes issued by the Maritime and Coastguard Agency (MCA) which provide significant advice relating to the improvement of the safety of shipping at sea, and to prevent or minimise pollution from shipping.
Vessel Traffic Service (VTS)	A service implemented by a Competent Authority designed to improve the safety and efficiency of vessel traffic and to protect the environment. The service should have the capability to interact with the traffic and to respond to traffic situations developing in the VTS area.

1 INTRODUCTION

1.1 THE PROJECT

1.1.1 Five Estuaries Offshore Wind Farm Ltd (VE OWFL or the Applicant) plans to submit an application to the Planning Inspectorate on behalf of the Secretary of State, for a Development Consent Order for the Five Estuaries Offshore Wind Farm (herein referred to as VE).

1.1.2 VE is the proposed extension to the operational Galloper Offshore Wind Farm located 37km off the coast of Suffolk and comprises both offshore and onshore infrastructure within the administrative area of Essex Country Council. VE will have an overall capacity of greater than 100 Megawatts (MW) and therefore constitutes a Nationally Significant Infrastructure Project (NSIP) under the Section 15 (3) of the Planning Act 2008. Such projects require a Development Consent Order (DCO) to be granted by the relevant UK Secretary of State (SoS).

1.1.3 This Outline Cable Specification and Installation Plan (OCSIP) has been produced to be submitted as part of the DCO application.

1.2 PURPOSE OF DOCUMENT

1.2.1 The export cable corridor for VE is located within a busy marine environment including shipping lanes, dredged channels, anchorage areas, mobile sediment features and various fishing activities including trawling, set nets and potting. This document sets out the considerations for cable route design and approach to installation, identifying where specific constraints or requirements regarding burial depth and cable protection will need to be factored into the final design and installation planning. It is a pre-cursor to the construction CSIP that is a condition of the dML

1.2.2 This OCSIP sets out the principles with which the final Cable Specification and Installation Plan (CSIP) must accord. The CSIP will be submitted for approval by the Marine Management Organisation (MMO) and is secured via a condition of the transmission assets deemed Marine License.

1.2.3 In accordance with the condition in the deemed Marine License (dML), the CSIP will include the following details.

dML condition	Where addressed
(i) technical specification of offshore cables (including fibre optic cable) below MHWS within that stage, including a desk-based assessment of cable burial depth in accordance with good industry practice;	The outline technical specification of the offshore cables is set out in Section 3. The final routing of the export cables will be influenced by the potential environmental impacts (Section 2.2) and the results of the Cable Burial Risk Assessment (Section 5).

dML condition		Where addressed
(ii)	a detailed cable laying plan for the Order limits within that stage, incorporating a burial risk assessment encompassing the identification of any cable protection that exceeds 5% of navigable depth referenced to Chart Datum and, in the event that any area of cable protection exceeding 5% of navigable depth is identified, details of any steps (to be determined following consultation with the MCA and Trinity House) to be taken to ensure existing and future safe navigation is not compromised or similar such assessment to ascertain suitable burial depths and cable laying techniques, including cable protection;	Potential cable installation methods, including pre-construction surveys and cable route preparation, are set out in Section 4. Considerations that will inform the Cable Burial Risk Assessment are set out in Section 5. Those factors that will influence the final routing of the export cables are described in Section 2.2.
(iii)	proposals for the volume and areas of cable protection to be used for each cable crossing, and proposals for timing and methodology for reporting on actual volumes and areas post construction; and	The maximum design scenario for cable protection and outline approach to cable crossings is described in Section 4.
(iv)	proposals for monitoring offshore cables including cable protection during the operational lifetime of the authorised development which includes a risk based approach to the management of unburied or shallow buried cables;	The need for monitoring will be informed by the final Cable Burial Risk Assessment, as set out in Section 6.

1.2.4 This OCSIP and the final CSIP covers the installation and cable route preparation of the export cables with the Export Cable Corridor (ECC). It does not include the inter-array cables within the VE array areas which will be subject to other pre-construction management plans.

1.3 INTERFACES

1.3.1 The considerations, mitigations and measures that are described in this OCSIP are informed by relevant assessments and descriptions contained within the Environmental Statement (ES), with particular reference to the following:

- Volume 6, Part 2, Chapter 1, Offshore Project Description, (Document 6.2.1)
- Volume 6, Part 2, Chapter 5: Benthic and Intertidal Ecology, (Document 6.2.5);
- Volume 6, Part 2, Chapter 6: Fish and Shellfish Ecology, (Document 6.2.6);
- Volume 6, Part 2, Chapter 7: Marine Mammal Ecology, (Document 6.2.7);
- Volume 6, Part 2, Chapter 9: Shipping and Navigation, (Document 6.2.9); and,
- Volume 6, Part 2, Chapter 12: Infrastructure and Other Marine Users, (Document 6.2.12)

1.3.2 The final CSIP will interface with a number of other management plans, and will be drafted to be consistent with the timings, approaches and controls set out in the pre-construction plans and documents to be submitted for approval under the deemed Marine License (dML). Specifically, the CSIP will interface with the final versions of the following outline plans:

- Project Environmental Management Plan (available in outline - Volume 9, Report 18)
- Marine Written Schemes of Investigation (available in outline - Volume 9, Report 19)
- Navigation Installation Plan (NIP) (available in outline - Volume 9, Report 20)

1.3.3 In addition, the CSIP will be informed and influenced by the results of pre-construction surveys including:

- Geophysical and geotechnical surveys
- Marine archaeology surveys
- Unexploded Ordinance (UXO) surveys

1.4 CONSULTATION

1.4.1 The site selection of the export cable corridor and the mitigation measures contained within the Environmental Statement (described in Section 3.2 and Section 2 respectively) have been developed in consultation with relevant stakeholders and statutory authorities.

1.4.2 The final CSIP will be developed in consultation with the following stakeholders:

- Marine Management Organisation (MMO)
- Natural England
- Maritime and Coastguard Agency (MCA)
- Trinity House Corporation
- Port of London Authority
- Harwich Haven Authority
- London Gateway Port Authority

- Sunk Vessel Traffic Service (VTS)

1.4.3 The CSIP will be submitted for approval to the MMO.

2 ENVIRONMENTAL IMPACTS

2.1 ENVIRONMENTAL IMPACTS AND MITIGATION

2.1.1 The table below sets out those potential impacts identified in the Environmental Statement and committed-to mitigations which relate to cable routing and installation methodology. The final export cable route and installation method will be influenced by a number of considerations including seeking to avoid or minimise environmental impacts and managing cable burial risk.

2.1.2 Through the final cable routing it may not be possible to address all potential impacts without compromise. Where conflict arises between routing and installation considerations, VE will engage with the relevant stakeholders (as set out in Section 1.4) to seek the most appropriate solution.

Table 1: Relevant environmental impacts and mitigation

Topic	Potential impact	Mitigation	Consideration in CSIP
Shipping and Navigation	Reduction in navigable depth	Cables will typically be buried at a target burial depth to be determined by the Cable Burial Risk Assessment (CBRA). A description of the Outline CBRA (Volume 9, Report 9) is provided with the application. Where cable burial is not possible or to sufficient depth, cable protection will be applied, ensuring use of the deep water routes by deep draught vessels is not compromised due to underwater allision risk.	An outline CBRA will be provided in the CSIP with details of proposed cable protection methods. The need for cable protection is outlined in Section 4.4. The initial considerations of cable burial risk are outlined in Section 5 and in Document 9.9 of the Application. Final locations of cable protection will be confirmed following installation (see Section 6 – Monitoring).
		VE will be compliant with MGN 654 and its annexes including in relation to reductions of no more than 5% in under keel clearance (unless risks can be satisfactorily be mitigated) and the Search and Rescue (SAR) Checklist.	
Shipping and Navigation	Interactions with vessels in sensitive	A NIP (provided in outline with the Application, Volume 9, Report 20) will	The commitments in the NIP will be reflected in the final construction method

Topic	Potential impact	Mitigation	Consideration in CSIP
	navigation locations	be developed to manage interactions between project vessels associated with export cable installation/ maintenance/ repair and third-party vessels in navigationally sensitive areas.	statement set out in the CSIP.
Shipping and Navigation	Interactions with other vessels during construction and operation.	Traffic management strategy (including cumulative considerations) should be discussed with local ports and the Sunk VTS.	The CSIP will be consistent with measures set out in the NIP (Volume 9, Report 20).
Shipping and Navigation, Benthic Ecology, Fish and Shellfish Ecology, Infrastructure and Other Marine Users	General impacts including impacts to ecology, navigable depth, safety of navigation.	Development of, and adherence to, a Cable Specification and Installation Plan (CSIP) post consent. The CSIP will set out appropriate cable burial depth in accordance with industry good practice, minimising the risk of cable exposure. The CSIP will also ensure that cable crossings are appropriately designed to mitigate environmental effects, these crossings will be agreed with relevant parties in advance of CSIP submission. The CSIP will include an outline Cable Burial Risk Assessment (CBRA) to enable informed judgements regarding burial depth whilst limiting the amount of sediment disturbance to that which is necessary. The CSIP will be conditioned in the deemed Marine Licence.	This OCSIP sets out the principles by which the CSIP will accord. The associated Cable Burial Risk Assessment (Volume 9, Report 9) provides the initial considerations of cable burial risk which will be expanded upon for the final CBRA.

Topic	Potential impact	Mitigation	Consideration in CSIP
Infrastructure and other marine users	Safety of Navigation	The Applicant will apply for safety zones around the foundations and WTGs post consent including up to 500 m around ongoing activities during construction and up to 50 m for installed structures pre commissioning. Where appropriate, guard vessels will also be used to ensure adherence with Safety Zones or advisory passing distances, as defined by risk assessment, to mitigate any impact which poses a risk to surface navigation. The avoidance areas around the Export Cable Corridor (ECC) will be agreed with the relevant Shipping and Navigation stakeholders via the Navigation and Installation Plan (Volume 9, Report 20).	The CSIP will consider the impacts on navigation from safety zones associated with cable installation and will be consistent with measures set out in the NIP.
Marine Mammals	Permanent Threshold Shift (PTS) / Disturbance from UXO clearance prior to export cable installation.	The primary mitigation for UXO impacts from export cable installation will be to avoid identified UXO through careful cable routing. Where this is not possible due to other constraints, the Applicant will apply for a separate Marine Licence for the clearance of any identified UXO.	Final cable routing will be set out in the CSIP.
Benthic ecology, Fish and Shellfish Ecology	Permanent habitat loss	Where burial depth cannot be achieved, cable protection will be implemented (e.g. mattressing, rock	Cable routing and use of cable protection will be set out in the CSIP. Final locations of cable protection will be confirmed

Topic	Potential impact	Mitigation	Consideration in CSIP
		placement etc). The suitability of installing rock or mattresses for cable protection will be investigated, based on (inter alia) the seabed current data at the location of interest, the assessed risk of impact damage and navigational water depth requirements.	following installation (see Section 6 – Monitoring).
Benthic Ecology	Impacts to the Margate and Long Sands (M&LS) SAC	As detailed within the Margate and Long Sands SAC Benthic Mitigation Plan (Volume 9, Report 13) additional mitigation is applied to cable protection within the M&LS SAC, this aims to reduce pressures on the sandbank features within this site.	Use of cable protection set out in the CSIP will take into account impacts on the Margate and Long Sands SAC.
Marine Archaeology	Damage to archaeological features	All intrusive activities undertaken during the life of the project will be routed and microsited to avoid any identified marine heritage receptors pre-construction, with Archaeological Exclusion Zones (AEZ) as detailed in the Outline Marine WSI unless other mitigation is agreed with Historic England and MMO.	Cable routing will be set out in the CSIP and will take into consideration any identified AEZs.

2.2 APPROACH TO CABLE ROUTING AND DESIGN

2.2.1 The following sections describe the considerations for avoiding or minimising impacts on sensitive receptors through cable routing. How these receptors have been considered in the final cable route, design and approach to installation will be set out in the CSIP.

SHIPPING AND NAVIGATION

2.2.2 The ECC passes through an area of dense shipping traffic and charted Deep Water Routes (DWRs) for large container vessels. The potential impacts on shipping cannot be wholly avoided through cable routing and will therefore be managed through engagement with the relevant stakeholders and the measures contained in management plans including the CSIP and the NIP.

UNEXPLODED ORDNANCE

2.2.3 The potential impacts from Unexploded Ordnance (UXO) relate to their disposal and the associated noise emissions that can effect marine mammals and fish.

2.2.4 Using data acquired from the baseline geophysical survey, potential UXO will be identified and where necessary will be further investigated pre-construction using ROVs or divers.

2.2.5 Where potential UXO are identified, the priority will be to avoid disturbance with the final cable routing. This reduces the risk to personnel and installation equipment as well as limiting impacts due to disposal.

2.2.6 Should an UXO require disposal this will be the subject of a separate Marine Licence application.

ARCHAEOLOGY AND WRECKS

2.2.7 Marine archaeological features and wrecks are not a threat to the cable however they will be avoided through route engineering where possible.

2.2.8 Analysis was completed of the Fugro 2021 geophysical survey data by Maritime Archaeology to identify archaeological exclusion zones (AEZ) within the export cable corridor (Document 5.11.1). This analysis compared the survey data with Maritime Archaeology's internal database to cross compare known archaeological targets with the surveyed contacts.

2.2.9 Within the maritime archaeology study area covering the ECC there are 98 records for wrecks, aircraft, obstructions, foul ground, and sites. Of these, 23 were seen in the geophysical data, including one aircraft and 16 wrecks.

2.2.10 AEZs are recommended around all recorded wrecks and obstructions, as well as those assessed as high and medium archaeological potential identified in the geophysical assessment. The avoidance of marine heritage assets remaining *in situ* follows best archaeological practice, and impact by the proposed development will be avoided through the implementation of buffers around the known extents of sites.

2.2.11 The export cable route will take into account the locations of all AEZs. Where it is deemed that impacts cannot be avoided, measures to reduce, remedy or offset disturbance will be agreed with Historic England.

BENTHIC ECOLOGY

2.2.12 Potential impacts on benthic ecology from export cable installation includes temporary loss of habitat, smothering due to sediment dispersal and deposition, and permanent loss of habitat where cable protection is required.

2.2.13 Benthic habitats have been identified through baseline surveys as set out in the Benthic Ecology ES chapter (Document 6.2.5), and will be further informed through pre-construction surveys.

2.2.14 The ECC partially covers an area of the Margate and Long Sands Special Area of Conservation (SAC), designated for Annex I Sandbanks. For this particularly sensitive area the Margate and Long Sands SAC Benthic Mitigation Plan (Volume 9, Report 13) has been submitted with the Application and the final measures agreed will be reflected in the CSIP.

2.2.15 The all phases of the cable routing and design will seek to minimise impacts on features of conservation interest, including consideration of the use, type and location of cable protection.

FISH AND SHELLFISH ECOLOGY

2.2.16 Fish and shellfish may be impacted by the export cable installation through direct and indirect seabed disturbances, and associated increases in suspended sediment and deposition, as set out in Volume 6, Part 2, Chapter 6: Fish and Shellfish Ecology ES chapter.

2.2.17 The ECC overlaps with areas of higher intensity spawning areas for sole, herring and plaice, and high intensity nursery grounds for herring at the nearshore section.

2.2.18 The approach to installation and use of cable protection, will consider the potential impacts on fish and shellfish species.

INFRASTRUCTURE AND OTHER MARINE USERS

2.2.19 The ECC crosses the interconnector cables linking the north and south separate Galloper array areas and Greater Gabbard array areas. The VE export cables may also cross the export cables from North Falls Offshore Wind Farm, depending on timing of construction.

2.2.20 The ECC crosses the under-construction Neuconnect subsea interconnector cable, and the proposed corridor for the Sealink interconnector.

2.2.21 VE are in discussions with all asset owners regarding the approach to cable crossings, and the agreed methodology will be reflected in the CSIP.

2.2.22 There is no direct overlap between the ECC and active marine aggregates areas, although it does run immediately adjacent to area 509/1 (see details in Volume 6, Part 2, Chapter 12: Infrastructure and Other Marine Users ES chapter), however VE have agreed in-principle with Tarmac Marine Ltd that there are no issues despite the close proximity of their licensed aggregate areas.

2.2.23 Whilst it is considered that the routing and installation of the export cables will have no significant impact on infrastructure or other users of the marine environment, where considerations have been given in the final design this will be reflected in the CSIP.

3 CABLE SPECIFICATION

3.1 OVERVIEW

3.1.1 Final details of the cable specification, including routing, burial depth, technical specifications and installation method statements will be provided in CSIP. The following sections outline the parameters and approaches to cable specification and installation, with which the final design will accord. Further details are provided in Volume 6, Part 2, Chapter 1: Offshore Project Description.

3.2 OFFSHORE EXPORT CABLE CORRIDOR

3.2.1 The ECC has been defined through a site selection process set out in the Site Selection and Alternatives ES Chapter (Document 6.1.4). The process was undertaken in line with a range of design principles (and receptors/constraints), as well as with reference to relevant guidance, notably including the 2017 Crown Estate 'Cable Route Protocol'.

3.2.2 The selected ECC Route selected was informed by:

- Avoidance and/or minimising the number of crossings of existing offshore cables and pipelines Interaction with proposed aggregate extraction sites
- Interaction with historic munitions disposal areas
- Interaction with dredged shipping channel into Harwich
- Interaction with traffic Separation scheme and Sunk Precautionary Area
- Interaction with pilot boarding activities
- Extent of interaction with Margate and Longsands SAC
- Shallow water less than 10m deep (with the exception of inshore waters to make landfall)
- Stakeholder consultation responses

3.2.3 The ECC route includes an interconnector corridor between the north and south turbine array areas across the Sunk Traffic Separation Scheme (TSS) which then runs to the south of the TSS lanes within the traffic separation zone. Heading landwards past the southern turbine array areas of the Galloper and Greater Gabbard Offshore Wind Farms, the route crosses the Sunk precautionary area and Sunk Deep Water Route (DWR), avoiding the Sunk Inner anchorage area before making landfall.

3.2.4 Within the ECC the offshore export cables will be installed, with the precise routes being defined post-consent, in-line with the considerations set out in this OCSIP.

3.3 OFFSHORE EXPORT CABLES

3.3.1 Offshore export cables will transmit the electricity produced by the wind turbine generators (WTGs) from offshore substations to the landfall point on the shore, before the cables continue to an onshore substation and connection to the National Grid.

3.3.2 A detailed description of the offshore export cables and the Maximum Design Scenarios (MDS) assessed in the Environmental Statement is set out in the Offshore Project Description ES Chapter (Document 6.1.4), with the key parameters set out in Table 2.

3.3.3 A number of different design scenarios have been considered in defining the MDS for the offshore export cables and array cables. These include:

- Two offshore substations platforms, with one located in the northern array and one in the southern array. Export cables would run to shore from each platform and an interconnector cable might be connected between the two offshore substation platforms.
- A single offshore substation platform located most likely in the southern array.
- A potential scenario where no offshore substation platform is installed and the export cables run directly from specific WTGs towards shore

3.3.4 The offshore export cables will consist of a number of cores, usually made from copper or aluminium, surrounded by layers of insulation material and armour to protect the cable from external damage.

3.3.5 The offshore electrical cables for the Project will generally comprise up to two cable circuits with a voltage of up to 275kV. Together, they will have a maximum total cable length of 196km.

3.3.6 The numbers of export cables that would be required to be installed in the interconnector corridor, and the length of export cables varies for each of the above scenarios. In some scenarios a longer individual export or array cable lengths (and corresponding impacted area / volume) is possible, but the additional length will always be within the interconnector corridor or array area.

3.3.7 The offshore export cables will typically be spaced 50 to 200m apart but locally both smaller spacing and larger spacing may be adopted to avoid archaeology exclusion zones or seabed obstructions.

3.3.8 The transmission technology proposed for VE is High Voltage Alternating Current (HVAC). This is considered the most appropriate technology for VE given its geographical location and promotes the production of affordable energy (relative to alternatives).

3.3.9 The maximum cable burial depth will be dependent on numerous factors and will vary along the offshore ECC. The maximum burial depth presented in Table 2 is below the level of the non-mobile seabed (i.e. base of sandwaves) or potential future dredging operations. The cables will be buried below the seabed wherever possible, with a target burial depth defined post-consent in a CBRA (see Section 5) taking account of the ground conditions and other factors.

Table 2: Maximum Design Scenario for offshore export cables

Parameter	Design Envelope
Cable parameters	
Maximum system voltage (kV)	275

Parameter	Design Envelope
Indicative external cable diameter (mm)	310
Number of export cable circuits	2
Total length of export cables (km)	196
Cable installation	
Indicative maximum burial depth (m)	3.5
Minimum burial depth (m)	0
Maximum installation tool seabed disturbance width (jetting) (m)	18
Total area of seabed disturbed by cable installation (m^2)	3,520,000
Total area of seabed disturbed by cable installation (km^2)	3.52
Total volume of sediment disturbed by cable installation (m^3)	3,079,125
Total volume of sediment disturbed by cable installation (km^3)	0.00308

4 EXPORT CABLE INSTALLATION

4.1 PRE-CONSTRUCTION SURVEYS

4.1.1 Geophysical and geotechnical surveys would be carried out before works commence and the information from those surveys would allow the following to be determined:

- Route debris;
- Boulders;
- Archaeological features;
- Unexploded Ordnance (UXO) presence;
- Seabed features;
- Sediment depth; and
- The specific nature of the seabed.

4.1.2 The data from these surveys will be used to define the final cable routing, specification, installation and potential need for cable protection.

4.2 CABLE ROUTE PREPARATION

4.2.1 Ahead of cable installation, the cable route will be prepared to identify and, if necessary, remove obstructions and obstacles. During this period the final cable route may be refined subject to the results of assessment and preparation works.

4.2.2 Depending on timing, these works may be subject to a separate CSIP covering the preparation activities described below (where required), ahead of cable installation. The details below are provided for context, setting out the considerations that may impact the scope and timing of these activities. Further details including the MDS for each activity are provided in the Offshore Project Description ES chapter (Document 6.2.1).

BOULDER CLEARANCE

4.2.3 Where large volumes of boulders are present, micrositing of cables around these may not be possible. If left in situ, boulders would present the following risks to VE:

- Exposure of cables and/ or not achieving target burial depth for cables;
- Obstruction risk to the cable installation equipment leading to damage and/or delays; and
- Risk of damage to the cable assets themselves.

4.2.4 Boulders may be cleared using a number of methods, depending on the density of boulders encountered. Where boulders are present in high density, a boulder clearance tool, for example, SCAR plough or similar may be employed. In areas of low density, it may be more efficient to use a grab to target and re-locate individual boulders. Re located boulders are placed as close to the original position as possible, but outside the area to be affected by the cable installation tools.

4.2.5 This activity is expected to be completed within weeks to months, however, there are several variables that may affect this and it is possible the activity may not be carried out in one single campaign.

PRE-LAY GRAPNEL RUN

4.2.6 Following the pre-construction route survey and boulder clearance works, a Pre-Lay Grapnel Run (PLGR) may be undertaken prior to cable installation. A vessel will be mobilised with a series of grapnels, chains, recovery winch and suitable survey spread.

4.2.7 PLGR operations are typically only 1-2m wide. For the majority of the route a single pass with the PLGR grapnels would be expected to be performed but for certain sections multiple passes may be required.

4.2.8 The CSIP will set out the PLGR corridor and programme of works.

UNEXPLODED ORDINANCE

4.2.9 If found, a risk assessment will be undertaken and items of UXO are either avoided, removed or detonated *in situ*. The methods of UXO clearance considered for VE may include:

- High-order detonation;
- Low-order detonation (deflagration); and
- Removal/ relocation.

4.2.10 As described in Section 2.2, the Applicant will seek to avoid UXO through micrositing of the cable, where that is not possible UXO clearance will be subject to a separate Marine Licence, the conditions of which would be reflected (where relevant) in the CSIP.

TRIAL TRENCHING

4.2.11 If required, trial trenching may be undertaken up to two years prior to the commencement of the offshore construction phase. The trial trenching would utilise the proposed methodology for the installation of export cable.

SEABED PREPARATION

4.2.12 In some areas within the offshore ECC, existing sandwaves and similar bedforms may be required to be cleared or levelled before array and offshore export cables are installed. This is done for several reasons:

- Many of the cable installation tools require a relatively flat surface in order to achieve cable burial to the target depth. It may not be possible to successfully bury a cable on a slope above a critical gradient; and
- The cable must be buried to a depth where it is expected to stay buried throughout the lifetime of the project. Sandwaves are generally mobile features that migrate naturally. Over time, sandwave migration can cause cables to become exposed if they are not sufficiently cleared before cable installation.

4.2.13 Across areas of high shipping traffic it may be necessary to undertake removal of upper (typically mobile) seabed sediments to ensure industry standard trenching tools can reach a depth of burial sufficient to adequately protect the cable from anchor strike (as informed by the CBRA).

4.2.14 Sandwave clearance / bed preparation may be undertaken using the following methodologies:

- Mass flow excavator (MFE)
- Boulder clearance plough; and/ or
- Dredging:
  - Water injection dredging;
  - Trailer hopper suction dredger; and/ or
  - Backhoe dredging.
  - Cutter suction dredger

4.2.15 The CSIP will describe the approach, timing and scale of any seabed preparation.

SEDIMENT DISPOSAL

4.2.16 Material may be collected from seabed preparation, depending on the selected technique. If material is collected by commercial-scale suction dredger for example, then it will be released at the water surface within the disposal sites proposed in the Offshore Project Description (Document 6.2.1).

4.2.17 The CSIP will confirm specific disposal areas and locations (within the wider areas detailed in the DCO application and dMLs) to ensure that shipping activity is not unnecessarily disrupted and that water depth/under keel clearance is not adversely affected.

4.3 CABLE INSTALLATION

4.3.1 The cable burial depth will be dependent on numerous factors which are described in this document, and which will vary along the offshore ECC. The cables will be buried below the seabed wherever possible, with a target burial depth defined post-consent in the Cable Burial Risk Assessment (CBRA) appended to the CSIP.

4.3.2 Possible installation methods for export cables include:

- Jet trenching;
- Pre-cut and/or post-lay ploughing;
- Mechanical trenching;
  - Dredging (Trailer suction hopper dredger, water injection dredger, cutter suction dredger or backhoe dredger);
- Mass/ Controlled flow excavation;
- Vertical injector; and
- Rock cutting.

4.3.3 The CSIP will set out the method of cable installation including information on the equipment, timing and programme of these works.

4.4 CABLE JOINTING

4.4.1 Cable installation vessels are limited in the length of cable they can transport and install in a single loadout. Where lengths of offshore cable must be jointed to one another, it is not possible to bury the joint using conventional cable burial tools such as ploughs. It is therefore necessary to excavate a pit to accommodate the joint, which is then backfilled to ensure the joint's protection. Each export cable circuit will require up to two joints, giving a maximum requirement of up to four cable joints for the offshore export cables.

4.4.2 Details of the locations and methodology of cable jointing will be provided in the CSIP.

4.5 CABLE PROTECTION

4.5.1 In some cases, where burial cannot be undertaken, or where the minimum necessary cable burial depth cannot be achieved, it is necessary to use alternative methods such as rock placement, concrete mattresses or other solutions such as Cable Protection Systems (CPS) or protective aprons to protect the cable from external damage. It should be stressed that cable burial is the preferred method of installation, and additional cable protection will only be used as a contingency where cable burial is not appropriate or achievable. The cables will be buried below the seabed wherever possible, with a target burial depth defined post-consent taking account of the ground conditions and other factors.

4.5.2 Cable protection may consist of one or more of the following methods:

- Rock placement;
- Concrete mattresses;
- Flow dissipation devices;
- Protective aprons, coverings, cladding or pipes; and/ or
- Rock bags.

4.5.3 Further details on the MDS and methods of cable protection are set out in the Offshore Project Description ES Chapter (Document 6.2.1) and consideration of the use of cable protection in the Margate and Long Sands SAC specifically are set out in the Margate and Long Sands SAC Benthic Mitigation Plan (Document 9.13). The MDS for cable protection includes a maximum height of 1.1m for export cables.

4.5.4 In the nearshore (out to 1,600 m seaward of MHWS), any cable remedial protection will not include loose rock or gravel. Additionally, in the intertidal, any cable remedial protection methods will be buried. Rock bags (or similar) or concrete mattresses may be placed at the ends of the Horizontal Directional Drilling (HDD) ducts.

4.5.5 The final CSIP, taking into account the results of the CBRA and consideration of the potential environmental impacts set out in Section 2.2, will set out the need for and method of any cable protection required.

4.6 CABLE CROSSINGS

4.6.1 It is necessary to cross existing cables in the area to achieve connection from the array to the National Grid connection point, as set out in Section 2.2.

4.6.2 Cable crossings usually consist of a layer of protection over the existing asset (the separation layer) over which the VE cables would be installed. A secondary layer would then be installed over the VE cable for protection. Cable crossings may utilise rock protection or concrete mattresses or bridging typically of steel or concrete construction. These methods are necessary to provide protection to both assets, and to ensure a minimum separation so that cables do not overheat.

4.6.3 Where an out of service telecoms cable is cut and removed, the typical procedure would be remove a section of the cable at the crossing point. The position of the cable would be identified via survey techniques, the cable uncovered (mass flow excavation or another technique), then cut, and the length to be removed pulled out of the seabed. Remaining ends will be sealed if required and secured via weights or re-burying.

4.6.4 Details of all cable crossings and the proposed installation method of the VE export cables will be set out in the CSIP. Crossing designs will also be discussed with the Commercial Fisheries Working Group (CFWG)

4.7 LANDFALL HORIZONTAL DIRECTIONAL DRILLING

4.7.1 Horizontal Directional Drilling (HDD) is the expected methodology to be used to carry out the landfall works, but other trenchless techniques may be considered.

4.7.2 The basic HDD process involves the use of a drilling head controlled from the rig to drill a pilot hole along a predetermined profile to the exit point, which is then widened (reamed) using larger drilling holes until the hole is wide enough to accommodate the cable ducts.

4.7.3 Entry and exit pits must be excavated at either end of the bore: one in the landfall compound and one on the offshore side.

4.7.4 Exit pits will be excavated or dredged to the required depth. An indicative size of 10m x 75m has been allowed for at this stage, with a depth of 2.5m. This will be typically done via backhoe dredger type vessel or an excavator mounted on a support barge. Prior to forming the exit pit any obstructions or boulders in the intended exit locations will be removed if required.

4.7.5 An Outline Horizontal Directional Drilling Methodology that sets out the locations, methodology and constraints associated with this approach to cable landfall has been submitted with the Application (Document 9.28), and the marine elements will be described in the CSIP.

5 CABLE BURIAL RISK ASSESSMENT

5.1.1 An outline routing and CBRA will be submitted as an Appendix to the CSIP, and the CSIP will reflect the outcomes of this assessment.

5.1.2 The assessment in the CBRA considers potential risks and impacts to the cables themselves. These, alongside impacts on other receptors such as shipping, marine archaeology and benthic ecology (as set out Section 2) will all contribute to the final cable design set out in the CSIP.

5.1.3 The CSIP and associated Outline Routing and CBRA will consider the following risks to cable burial:

- Shipping, including anchoring and exposure due to disturbance of the seabed
- Seabed gradients
- Seabed contacts
- Mobile seabed features
- Dredging
- Fishing activity
- Existing infrastructure

5.1.4 An initial CBRA is provided with the Application (Document 9.9).

6 MONITORING

6.1.1 The approach to cable burial monitoring will be discussed with the relevant stakeholders and set out in the final CSIP. This will include consideration of both post-construction (as built) monitoring, and ongoing monitoring during operation.

6.1.2 The monitoring approach will consider:

- Areas of higher risk of cable exposure, e.g. mobile sediments
- Areas where cable burial depth is of greater significance, e.g. deep water routes
- As built post-construction survey of location of cable routing and cable protection
- Frequency, spatial extent and technical details of proposed monitoring.
- Reporting of monitoring

6.1.3 The need for and scope of ongoing monitoring activities will be reviewed following installation (once as-built details are known) and during the operational lifetime of the project.

7 STRUCTURE OF THE CSIP

7.1.1 The CSIP will set out the considerations that have defined the export cable routing and target cable burial depths along the route. It will further set out the justification for any cable protection and the choice of protection to be used.

7.1.2 The proposed structure for CSIP is set out below.

Section	Content
Introduction	Sets out the purpose of the document, consultation undertaken, relevant interface documents.
Cable routing design plan	Describes the final cable routing and key considerations.
Programme	Overall construction programme
Cable specification	Detailed cable specification
Cable burial risk assessment	Overview of results of the cable burial risk assessment. The full CBRA will be appended to the CSIP.
Cable installation methodology	Detailed installation methodology including timings, vessels and installation technique.
Cable protection	Location, type, volume and area of proposed cable protection.
Monitoring	Proposed monitoring of cable burial and protection
Compliance statement	Confirmation of compliance with relevant DCO requirements and dML conditions.

FIVE ESTUARIES
OFFSHORE WIND FARM

PHONE	0333 880 5306
EMAIL	fiveestuaries@rwe.com
WEBSITE	www.fiveestuaries.co.uk
ADDRESS	Five Estuaries Offshore Wind Farm Ltd Windmill Hill Business Park Whitehill Way, Swindon, SN5 6PB
COMPANY NO	Registered in England and Wales company number 12292474