FIVE ESTUARIES OFFSHORE WIND FARM

VOLUME 9, REPORT 9: OUTLINE CABLE BURIAL RISK ASSESSMENT

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CONTENTS

TABLES

DEFINITION OF ACRONYMS

Term	Definition
AIS	Automatic Identification System
CBRA	Cable Burial Risk Assessment
DCO	Development Consent Order
DP	Dynamic Positioning
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
ES	Environmental Statement
MW	megawatts
OWF	Offshore Wind Farm
PLGR	Pre-Lay Grapnel Run
UXO	Unexploded Ordnance
VE	Five Estuaries Offshore Wind Farm
VE OWFL	Five Estuaries Offshore Wind Farm Limited
WTGs	Wind turbine generators

GLOSSARY OF TERMS

Term	Definition
VE	The Project.
The Applicant	Refer to as Five Estuaries Offshore Wind Farm Limited (The Applicant) and refer to them as 'the Applicant' thereafter.
EIA	Environmental Impact Assessment
ES	Environmental Statement (the documents that collate the processes and results of the EIA).
Array areas	The areas where the WTGs will be located. These should be referred to as the northern and southern arrays to differentiate them.
Export Cable Corridor (ECC)	The area(s) where the export cables will be located. Refer to either the offshore or onshore ECC.
Landfall	The area where the Export Cables come ashore and transition from the marine environment to the terrestrial environment.
Development Consent Order	An order made under the Planning Act 2008 granting development consent for a Nationally Significant Infrastructure Project (NSIP) from the Secretary of State (SoS) for the Department for Energy Security and Net Zero (DESNZ).
Outline plan	An early version of a management plan produced to secure principles, for which the final approved management plan will adhere to.
PINS	The Planning Inspectorate
Order Limits	The extent of development including all works, access routes, TCCs, visibility splays and discharge points. (Not Red Line Boundary (RLB))

1 INTRODUCTION

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).

2 PURPOSE OF THE DOCUMENT

2.1.1 This Outline Routing and Cable Burial Risk Assessment (CBRA) summarises the current project understanding of approach to cable routing and associated cable burial risk, including the key considerations that will be explored further during the pre-construction period and will inform the final routing and CBRA.

2.1.2 Cable routing is a multi stage process used to identify and refine the cable corridor and preferred route within a corridor. The aim is to avoid hazards within the seabed and reduce the risk of interaction with third parties.

2.1.3 The CBRA process is then used to identify the remaining risk from third parties such as fishing and vessel / anchor interaction and determine the burial depths to reduce the risk to an acceptable level.

2.1.4 This outline document sets out routing and burial risk considerations at this point in time and provides a starting point for the pre-construction CBRA that will be submitted in line with the dML conditions set out below.

2.1.5 The pre-construction CBRA document will include details of:

- Risks to the cable (e.g. from sediment mobility, anchoring, future dredging and fishing);
- Routing criteria;
- Target burial depths;and,
- Approach to defining the need for cable protection, and type/s of protection to the used if target burial is not met.

2.1.6 The CBRA is required to be submitted to the Marine Management Organisation (MMO) as set out in separate deemed Marine Licence (dML) conditions contained within the DCO (Volume 3, Document 3.1).

2.1.7 Schedule 11 of the DCO (Transmission Assets Deemed Marine Licence) covers the export cables and requires a CBRA to be submitted as part of the Cable Specification and Installation Plan (CSIP) as set out in the following condition:

13(h)(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;

2.1.8 The CSIP and CBRA document will inform and be informed by other management plans, specifically:

- Cable Specification and Installation Plan (CSIP), provided in outline in Volume 9, Report 12.
- Margate and Long Sands SAC Benthic Mitigation Plan (Volume 9, Report 13)
- Navigation and Installation Plan (NIP), provided in outline in Volume 9, Report 20.

3 OUTLINE CABLE BURIAL RISK ASSESSMENT

The following sections describe the initial review of cable burial risk and preliminary routing considerations that will influence the final design of the export cable route and burial within the ECC, including the micro routing of the individual cables, the target burial depths and the need for (and type of) cable protection.

3.1 BASELINE DATA

OVERVIEW

3.1.1 Surveys undertaken to date to inform the ECC selection and identification of potential constraints and considerations for cable installation are described below. Further surveys and assessment will be undertaken post-consent to inform the CBRA.

SEABED SURVEYS

3.1.2 There are a number of data sources available for the assessment of the VE cable routes. These are detailed in Table 1 and include a proejct specific geophysical survey for the VE ECC was undertaken in Q3 & Q4 2021 using multibeam echo sounder (MBES), side scan sonar (SSS), parametric (Innomar) sub-bottom profiler (SBP) and a single magnetometer (MAG).

3.1.3 In addition to the project specific survey there are also additional bathymetry data available that has informed initial assessment of cable burial risks and provided historical information on the seabed and informed an assessment of sediment mobility. As the additional surveys were not project specific they may only partially cover the VE cable areas.

Table 1: Summary of available bathymetric data

Summary of available bathymetry data for the ECC				
Survey Type	**Contractor**	**Data Source**	**Survey Area**	**Survey Year**
Full multi-beam bathymetry coverage – 0.25m resolution	Fugro	RWE Renewables	ECC	2021
90 to 100m resolution	Undefined	EMODnet Bathymetry Portal	ECC	2021
2m resolution surface zone DTM (comprising MBES and LIDAR data)	DEFRA	DEFRA	ECC / Nearshore	2019
1m to 4m resolution bathymetry data	Various	UKHO / Admiralty Marine Data Portal	ECC	2011 – 2020
Full multi-beam bathymetry coverage. Resampled to 2m resolution	Osiris Projects	RWE Renewables	Galloper Wind Farm	2010

3.1.4 No site-specific geotechnical information is currently available for the VE ECC. However, as the geotechnical soil units are consistent across the region geotechnical data has been considered from other nearby wind farms including Galloper OWF, Greater Gabbard OWF and Gunfleet Sands OWF.

OTHER DATA SOURCES

3.1.5 Data and assessments that have and will inform the considerations on cable installation and specification are set out in Table 2 below.

Table 2: Data and assessments inform cable burial risk

Topic	Data
Metocean	Wave data (CEFAS 'WaveNet' sensors are located close to VE OWF at the West Gabbard 2 Wavenet site, the South Knock Wavenet site and the Felixstowe Wavenet site). Wind and sea state (Assessment made by C2Wind).
UXO	Magnetometry survey data (Fugro 2021) UXO Hazard Assessment (Ordtek 2021)
Archaeology	Wreck locations (UKHO) Assessment of marine archaeology from Geophysical Survey data (Maritime Archaeology)
Fishing	Fishing activity from public sources including DEFRA and EMODNet
Shipping	AIS and boat-based survey Anchor drag study (Anatec, 2023)
Dredging and dumping	Dredging and dumping sites from publicly available sources including UKHO, The Crown Estate and DEFRA. Additional data from London Gateway Port
Existing infrastructure	Existing sources including KIS-ORCA

3.2 OUTLINE ROUTING AND CABLE BURIAL RISK ASSESSMENT

3.2.1 The following sections describe the preliminary assessment of routing and cable burial risk, based on the available data as set out above.

3.2.2 Routing is initially used to avoid hazards and areas of increased risk. These include; for example, avoidance of potential UXO, boulders, seabed debris, excessive seabed gradients, areas, areas of dredging or deposition, areas of increased risk from fishing and vessels. There may be areas where these cannot be avoided and so alternate measures such as boulder relocation, pre-sweeping of sand waves, or deep burial are used to remove or reduce the risk.

3.2.3 Key risks and hazards identified as present in the VE cable corridors are described below. These will be further detailed in the pre-construction CBRA document.

3.2.4 SEABED GRADIENTS

3.2.5 The project specific survey data has been used to evaluate the seabed gradients. In general, seabed gradients are less than 5º within the ECC, with less than 2% of the total measured gradients being greater than 5º of these only a small proportion are greater than 10º (0.31% of the total).

3.2.6 Steep slopes may prohibit the use of certain trenching tools and will be assessed in detail during trenching tool selection. However, seabed slopes can often be avoided through final cable routing, consideration of which will be set out in the pre-construction CSIP.

SEADBED CONTACTS

3.2.7 Boulders, debris and wrecks do not present a risk to the cables once installed, however, they may affect cable installation (and therefore the successful cable burial), requiring avoidance via routing or removal / relocation.

3.2.8 The preference for any seabed obstruction will be to avoid it in the first instance. Where this is not possible the object will be further investigated and if needed, removed. Following final cable routing boulders that cannot be routed around may be relocated (as close as possible to the existing location) before a pre-lay grapnel run (PLGR) will be undertaken along the route to clear any remaining debris.

MOBILE SEABED FEATURES

3.2.9 Evidence of sediment mobility, indicated by the presence of large-scale sandwaves, and megaripples, has been identified along the ECC. The physical processes baseline undertaken by ABPmer (Volume 6, Part 5, Document 5.2.1) describes sandwaves are typically found to be between 0.7 and 7.5 m in height along the ECC, with average wavelengths between 25 and 50 m, up to a maximum of approximately 260 m for the largest sand waves with a migration rate up to 7m per year. The report references larger sandbank features and suggests that the average lateral migration rates of the nearshore banks were around 7m to 10m/year.

3.2.10 These parameters illustrate the importance of a more detailed investigation into sediment mobility to inform the routing, target burial depth and any seabed preparation such as pre-sweeping.

3.2.11 In some circumstances there may also be a and need for cable protection on the final cable route either after installation or at some point during the lifetime of the cable to reduce the risk of exposures and free spans.

3.2.12 The assessment of mobile seabed features will also consider the non-mobile reference level). This surface represents "the absolute level (mLAT) below which the seabed level is not expected to fall below locally during the economic lifetime of the Project. To mitigate against the risk of unburial due to seabed mobility cable burial will be calculated from this surface. This allows the sandwaves to migrate over the cable and reduces risk of exposure.

3.2.13 Based on initial geophysical analysis it is predicted that the depth of sandwave clearance and seabed preparation will vary along the route between 1 – 12 m. In addition, the width of clearance will vary between 25 m to 140 m based on the features present. The maximum design scenario (MDS) as described in the Offshore Project Description (Volume 6, Part 2, Chapter 1) sets out the parameters for the maximum area and volume of sandwave clearance which have been determined on the basis that the export cables are installed below the NMRL, wherever possible.

3.2.14 Other risks which could occur due to sediment mobility include thermal stresses within the cable due to increased burial depths from the overlying sandwaves.

3.2.15 The pre-construction CBRA will describe the interactions with mobile sediment features and ŧset out the target burial depth or need for cable protection in these areas. In addition, the Margate and Long Sands SAC Benthic Mitigation Plan (Volume 9, Report 13) sets out specific considerations and commitments to mitigate impacts to sandbank features from cable installation and operation.

DREDGING

3.2.16 The ECC crosses a number of important shipping areas including two deep water routes (DWRs), the Trinity DWR (charted depth 18m) and the Sunk DWR (charted depth 16m). London Gateway Port have approval to dredge a maximum of 16.5m within the Sunk DWR, however there is potential for this depth to be increased in future to account for larger draught vessels (subject to approval).

3.2.17 The outline CBRA will take into account both active and potential future dredging over the ECC when identifying the target burial depth.

3.2.18 An additional 1.0m may be applied to any allowance for dredging in the Sunk DWR to account for the risk of over-dredging. It should be noted that this is unlikely to be required in areas with London Clay as this is not likely to be dredged.

SHIPPING

3.2.19 Vessel anchors may present a significant hazard to subsea cables, whether in a designated anchorage zones (as further discussed below), or because of deployment of anchors in emergency situations such as mechanical failure or the need to prevent a collision. Defining the risk to a cable from shipping is a function of the intensity and frequency of vessel traffic, type of vessel, size and type of the deployed anchor, bathymetric profile and the seabed material in which it penetrates. This risk is normally assessed through a probabilistic risk assessment, which assesses the likelihood of a anchor striking the cable for different depths of burial. For VE the final version of this assessment will be carried out post consent once geotechnical data is available. The method used will align with the methodology outlined in “Cable Burial Risk Assessment Methodology: Guidance for the Preparation of Cable Burial Depth of Lowering Specification”, Carbon Trust, 2015. An summary of assessment will be contained within the pre-construction CBRA.

3.2.20 The proposed export cable route for VE is located close to two designated anchorage areas, and there may therefore be a risk to the cable from vessels dragging anchor. This would typically be assessed within the CBRA process however as this is a particular risk for VE an Anchor Dragging Risk Assessment (Anatec, 2023) has been undertaken for the DCO submission and the key findings are set out below.

3.2.21 There are two charted anchorage areas in proximity to the ECC. The Sunk Inner is less that 100m to south of the ECC whilst the Sunk DW anchorage is approximately 2nm north of the ECC.

3.2.22 Following a review of AIS data between June 2022 and June 2023 it was found that an average of between two and three vessels per day were at anchor within 2nm of the ECC. From this data it has been estimated that the likelihood of a vessel dragging anchor over the entire export cable route (assuming the cable is unburied) is one every 180 years (Anatec, 2023). Areas that contribute most to this risk correspond to the sections of cable that lie close to the charted anchorages, in particular the area close to the Sunk Inner anchorage, i.e. between KP24.5 and KP32.5, which contributed 87% of the risk. This risk will be reduced by burying the entire cable, however special consideration will be given to depth of lowering specification in the areas where the cables a close to the anchorages.

3.2.23 The Sunk pilot boarding station is located approximately 1km north of the ECC corridor. Whilst vessels do not deploy their anchors when waiting for the pilot to board, the increased density of the vessels in this area as well as restricted ability to manoeuvre and the reduced vessel speed will be accounted for in the pre-construction CBRA.

3.2.24 Areas of higher risk correspond to the sections of cable that lie close to the charted anchorages, in particular the area close to the Sunk Inner anchorage and where the routes cross the deep water routes where the vessel intensity is higher. . Deeper burial may be required in high risk areas that cannot be avoided where larger vessels were observed to anchor, and areas where larger vessels transit (as anchor penetration from these vessels will be higher).

3.2.25 The pre-construction CBRA will consider the work done to date regarding the risk caused by anchorages.

3.2.26 It should also be noted that there is a risk of exposing buried cables due to the thruster plumes of large vessels interacting with the seabed and removing the sediment It is assumed however that this is only considered to be a risk in areas with <17m water depth and further study will be undertaken pre-construction on the degree of disturbance due to large draft vessels in order to determine the severity of this risk for specific routes selected prior to construction.

3.2.27 The pre-construction CBRA will further assess the risks associated with anchor strikes and shipping traffic, and this will inform the final target burial depth, burial equipment and the potential need for any cable protection (also considering the potential impact on shipping due to reduction of navigable depth). These considerations will all be set out in the final CSIP to be submitted for approval.

FISHING ACTIVITY

3.2.28 Fishing activity has been identified along the full length of the export cable route and presents a hazard to the cable due to the risk of fishing gear interacting with the seafloor and snagging the cables.

3.2.29 Trawling is considered to be the key risk to the cables as the gear can be dragged along the seabed. Typical depths of both beam trawls and otter boards into sand are 0.15m or less. In areas of scallop trawling or more aggressive and destructive forms of fishing it is greater, potentially up to 0.3m. Based on the assumptions on soil type, the minimum depth of lowering to provide protection from all fishing is considered to be approximately 0.5m.

3.2.30 The outline CBRA will consider the potential impact of fishing on the cables and propose suitable target burial depths and cable protection.

EXISTING INFRASTRUCTURE

3.2.31 The need to cross existing subsea cables will necessitate the use of cable protection, as VE's export cables will be installed over the existing subsea cable. VE is engaging with all cable operators and discussions are ongoing with the asset owners with regards to proximity and crossings.

3.2.32 The pre-construction CBRA will detail the cable crossings, their location and the need for and extent of cable protection.

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