Preliminary Environmental Information Report Volume 2

Appendix 2.5 Outline Cable Burial Risk Assessment

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Contents

1 Introduction

1.1 Background

1.1.1 This application is made by National Grid LionLink Limited (NGLLL) (a division of National Grid plc) (the Applicant).

1.1.2 The Applicant is submitting an application for development consent order (DCO) to the Planning Inspectorate for LionLink (the 'Project').

1.1.3 The Project comprises a new interconnector (offshore hybrid asset) with a capacity of up to two gigawatts (GW) between the National Transmission Systems (NTSs) of GB and the Netherlands, including a connection into a wind farm located in Dutch waters. An offshore hybrid asset combines interconnection with the transmission of offshore wind generation outside of GB territorial waters.

1.1.4 The Project will play an important role in reducing the UK's reliance on fossil fuels and supporting the UK government's objectives to create a secure, reliable, and affordable energy supply for UK households.

1.1.5 The Project is located partly in the territory of GB and partly in the territory of the Netherlands. The Proposed Scheme (defined as the part of the Project within the British jurisdiction; the subject of the DCO application) would involve the construction of a converter station and the installation of offshore and onshore underground high voltage direct current cables (HVDC) to the onshore converter station and underground high voltage alternating current cables (HVAC) between the converter station and the Friston substation.

1.1.6 This Outline Cable Burial Risk Assessment (Outline CBRA) has been prepared for the portion of the Proposed Scheme within the territory of GB only (referred to as the Proposed Offshore Scheme).

1.1.7 The Proposed Offshore Scheme would route from the proposed Landfall Site at Walberswick across the Southern North Sea to the boundary between the UK and Netherlands Exclusive Economic Zone (EEZ), a distance of approximately 182km.

1.1.8 The key elements of the Proposed Offshore Scheme relevant to this Outline CBRA are the marine HVDC cables which would be installed within the Order Limits (area where the marine HVDC cables will be located between mean high-water springs (MHWS) and the UK / Netherlands EEZ boundary). The Proposed Offshore Scheme would consist of two 525 kV HVDC marine power cables, and one separate Dedicated Metallic Return (DMR). It is expected that all three cables would be bundled together with no separation between the cables. A single fibre optic cable would also be laid as part of the cable bundle for control and communication purposes. All cables would be installed in one trench. Associated external cable protection (e.g., rock berm, concrete mattresses, rock bags etc) would be necessary where the required burial into the seabed cannot be achieved or where the Proposed Offshore Scheme crosses existing infrastructure such as cables or pipelines. The landfall would be constructed using horizontal directional drilling (HDD). Three cable ducts would be installed from the transition joint bay (TJB), positioned above the MHWS mark, drilled to an exit point between 5m and 9m water depth (lowest astronomical tide).

1.1.9 A full description of the Proposed Scheme is provided in **Chapter 2 Description of the Proposed Scheme** of this PEIR.

1.2 Purpose of this document

1.2.1 This Outline CBRA presents the Applicant's current understanding of the external threats that may affect the protection required for the marine HVDC cables. It summarises the approach to the identification of the cable route (which would be installed within the Order Limits), the key considerations that have led to the proposed design and outlines further engineering design work that will be carried out to update this document for the ES and post consent to inform the pre-construction CBRA. **Table 1.1** describes the different stages of development of the CBRA.

Table 1.1: CBRA Development Stages

Consent Stage	CBRA Development
PEIR	Outline CBRA (Phase 1): Initial review of hazards to the cable based on desktop and publicly (or commercially) available datasets.
ES	Detailed CBRA (Phase 2): Incorporates detailed geophysical and geotechnical information along with advanced route engineering to provide additional information on potential hazards to the cable.
Pre-Construction	Pre-Construction CBRA: Utilises final route alignments and additional geophysical and geotechnical survey data to refine the detailed CBRA.

1.2.2 The CBRA process is used to identify and review all external threats that may result in damage to the cables and determine the level of protection (by burial or additional protection measures) required to reduce the risk of damage to the cables occurring. The CBRA defines the minimum and target burial depths necessary to minimise the risk of damage from external threats such as anchor strike or fishing gear interaction. Where burial in the seabed to the burial recommendations may not be possible (e.g. due to unfavourable ground conditions) alternative protection measures are proposed.

1.2.3 This outline plan sets out route and burial risk considerations and provides a framework and minimum expectations for the pre-construction CBRA that will be prepared by the principal offshore contractor ahead of construction works commencing.

1.2.4 The pre-construction CBRA would be completed following the Carbon Trust (2015) (Ref 1) methodology, which is best industry practice for cable burial risk assessment. It will include details of:

a. Risks to the marine HVDC cables (e.g., from sediment mobility, anchoring and fishing);
b. Target burial depths for the bundled cables;
c. Approach to defining the need for cable protection, and type/s of protection to be used if target burial is not met; and
d. All relevant mitigation measures outlined in the Environmental Statement (ES).

1.2.5 The pre-construction CBRA would be a requirement of the Deemed Marine Licence (DML). At this stage, the draft Development Consent Order has not been prepared, but it is expected that it would contain the following conditions or similar – the wording below has been taken from similar Marine Licences issued by the Marine Management Organisation (MMO).

1.2.6 Relevant conditions would be expected to state:

a. The works must not encroach on any recognised anchorage, either charted or noted in nautical publications within the consented area.
b. A detailed construction phase plan must be submitted to the MMO for approval…. The plan must include… a burial risk assessment to ascertain suitable burial depths, cable laying techniques and anticipated changes to water depths where applicable where cable protection/crossings are required…
c. The works must not exceed a maximum 5% reduction in surrounding depth referenced to chart datum.
d. There must be no more than a three degree electromagnetic variation for 95% of the cable route and for the remaining 5% of the cable route there must be no more than a five degree electromagnetic variation in water depths of 5m or deeper…

1.3 Embedded Design Mitigation and Control Measures

1.3.1 **Table 1.2** below sets out the measures that the Applicant has committed to which are relevant to the cable installation methodology, micro-routeing and cable protection. These would be taken into consideration by the Outline CBRA and pre-construction CBRA. If any relevant project specific mitigation is identified for the ES this would also be included. The full list of commitment measures is provided in **Appendix 29.1 Outline Schedule of Environmental Commitments and Measures** of this PEIR.

Table 1.2: Design and control measures

Commitment Reference Code	Measure	Compliance Mechanism
Design and Embedded Mitigation		
OD01	All cables will be installed in one trench.	Construction Environmental Management Plan (CEMP) secured by DML
OD02	HVDC cables will be bundled together to minimise the electromagnetic field (EMF) profile.	CEMP secured by DML
OD04	The intention is to bury the cables in the seabed, except in areas where trenching is not possible e.g. where ground conditions do not allow burial or at infrastructure crossings.	CEMP secured by DML
OD05	External cable protection shall only be used where it can be demonstrated that adequate burial depth cannot be achieved (e.g., where ground conditions do not allow burial or at infrastructure crossings); the footprint of any external protection shall be the minimum required to ensure adequate cable protection and stability.	CEMP secured by DML
OD06	In sites designated for benthic features, cable protection materials will be selected to match the environment (e.g. rock of similar grade as the receiving environment) where feasible.	CEMP secured by DML
OD07	Design and construction will be carried out in accordance with International Cable Protection Committee (ICPC) Recommendations.	CEMP secured by DML
OD09	The profile of rock berms used for cable protection will be designed to minimise the potential for scour to occur as much as possible (including alignment with flow and profiling).	CEMP secured by DML
OD11	Cable protection would be designed to prevent the risk of fishing gear snagging.	CEMP secured by DML
OD12	Routine surveys and inspections of the cables and associated protection measures would be conducted through the lifetime of the project, to ensure they remain in good condition, and adequately protected.	CEMP secured by DML
OD14	CBRA to be undertaken to identify appropriate target depth of burial based on geology, water depths and Automatic Identification System (AIS) data. This will reduce the chance of interaction with other marine users, and as per the CBRA recommendations deeper burial or cover will be implemented in areas of high shipping activity to further reduce risk.	CEMP secured by DML

Commitment Reference Code	Measure	Compliance Mechanism
Control Measures		
OC06	As-built locations of cables and external protection will be supplied to The Crown Estate, United Kingdom Hydrographic Office (UKHO) (Admiralty) and Kingfisher Information Services for inclusion in Admiralty and KIS-ORCA charts	DML secured through DCO
OC07	External cable protection (excluding crossing locations) shall not reduce chart datum by more than 5%, unless agreed in advance with the MCA and appropriate navigation authorities. If external cable protection at any location including crossings does impact on navigable depth, such locations shall be marked in accordance with Trinity House requirements and suitably marked on navigation charts.	DML secured through DCO
OC08	Any material introduced into the marine environment, such as rock protection material, will be from a suitable source or cleaned to ensure no Marine Invasive Non Native Species (MINNS) can be introduced.	CEMP secured by DML
OC20	In the event that cable exposures are identified during routine surveys, the location of these will be shared with fisheries stakeholders and where necessary, additional temporary measures put in place (e.g., marker buoys, use of guard vessels, etc), until a repair or remediation can be implemented.	Fisheries Liaison Co-existence Plan (FLCP) secured by DML
OC21	Guard vessel(s), using Radio Detection and Ranging (RADAR) with Automatic RADAR Plotting Aid (ARPA) to monitor vessel activity and predict possible interactions, will be employed to work alongside the installation vessel(s) during cable installation works and to protect any temporary cable exposures during installation.	CEMP secured by DML
OC24	Cable jointing operations to be planned away from areas of high shipping activity where possible.	CEMP secured by DML
OC25	Crossing and/or proximity agreements will be agreed with aggregate extraction, cable and pipeline owners. The crossing agreement describes the rights and responsibilities of the parties and also the design of the crossing. Crossing designs will be in line with industry standards, using procedures and techniques agreed with the cable and pipeline owners.	Crossing agreements / proximity agreements
OC28	Client Representation onboard Project vessels ensuring compliance with crossing design and communications with Asset Owners.	CEMP secured by DML

Commitment Reference Code	Measure	Compliance Mechanism
OC29	UXO survey and removal and /or charting of confirmed UXO targets to highlight known risks to other marine users.	CEMP secured by DML

1.4 Data Sources

Overview

1.4.1 To establish baseline conditions across the Proposed Offshore Scheme for the Outline CBRA various data sources were utilised, including, publicly available bathymetry and purchased data. For the PEIR submission stage the Outline CBRA is desk-based and will be subject to update following review of seabed survey information for the ES. Further surveys and assessments would also be undertaken post-consent to inform the pre-construction CBRA.

1.4.2 Publicly available high resolution bathymetry data from the UKHO has been used to inform the initial cable route and assessment of cable burial risks, providing information on the wider seabed, and inform the assessment of sediment mobility.

1.4.3 Intertek Energy and Water (Intertek) has been appointed by the Applicant to conduct a PEIR and ES CBRA study for the Proposed Offshore Scheme.

a. The CBRA for PEIR Report is a desk-based report which does not include a full assessment of the LionLink survey data. The report does included minimal amount of survey data for re-routing such as bathymetry, analysis of AIS shipping data and initial soils interpretation based on British Geological Society (BGS) data to identify where activities such as shipping and fishing, may pose a risk to the integrity of the installed HVDC cables, and to undertake a probabilistic assessment to quantify that risk.
b. The CBRA for ES Report will be completed after a full interpretation of the geophysical and geotechnical survey data has been undertaken, and this CBRA will be updated accordingly to support the ES.

Publicly available data sources

1.4.4 Publicly available data types used to inform cable routeing and the Outline CBRA are outlined in **Table 1.3**.

Table 1.3: Other data types used to inform the outline assessment

Data type	Data overview
Shipping	• AIS shipping data (12-month period September 2022 to September 2023).

Data type	Data overview
	• UKHO Nautical Charts [chart numbers: 0106-0, 1408-0, 1503-0, 1504-0, 1534-0, 1534-1, 1534-2, 1535-0, 1535-1, 1543-0, 1631-0, 2695-4] – used to identify navigational features.
Fishing	• 12-months AIS data for period September 2022 to August 2023. • MMO UK Fisheries Annual Statistics Reports 2019 to 2023 • International Bottom Trawl Survey (IBTS) Data 2023 – 2024 • MMO Surveillance Sightings Data 2018 – 2023 Fishing activity from public sources including EMODnet
Archaeology	• Records of known wrecks and obstructions (UKHO)
Existing / planned / proposed infrastructure	• Known cables, pipelines, dumping grounds, windfarms within the Order Limits. • Crown Estate GIS data for existing and planned OWFs. • Other existing sources including KIS-ORCA
Dredging and disposal	• Crown Estate GIS data for licensed, active and proposed marine aggregate dredging areas.

Seabed Surveys

1.4.5 A geophysical and geotechnical survey was conducted of the Offshore HVDC Cable Corridor by NEXTGEO [May 2024 to December 2024]. High quality geophysical data (multi-beam echosounder (MBES), sidescan sonar (SSS), sub-bottom profiler (SBP) and magnetometer (MAG)) was acquired over a standard 500m wide corridor. The survey area was widened to incorporate sections where potential seabed sensitivities were identified, and additional data was collected to enable future micro-routing within the proposed Offshore HVDC Submarine Cable Corridor. The extent of the geophysical and geotechnical survey has informed the extent of the Draft Order Limits (DOL) for the Proposed Offshore Scheme. The DOLs are the same spatial extent as the proposed Offshore HVDC Submarine Cable Corridor. The data provided information on solid geology, unconsolidated sediment thicknesses, sediment nature and seabed features (e.g., sandwaves, boulders, outcropping), and initial indication of potential Unexploded Ordnance (pUXO). In proximity to selected infrastructure crossings, the corridor was sufficiently wide to engineer crossing of existing infrastructure at or as close to 90 degrees as possible in line with ICPC Recommendation 3.

1.4.6 Following the geophysical survey, a geotechnical survey campaign was completed acquiring vibrocores and cone penetrometer (CPT) samples along the Offshore HVDC Submarine Cable Corridor. The geotechnical data supports the interpretation of the geophysical data, e.g., in terms of determining sediment thickness, sediment types and provides information on aspects such as soil strength, which are important in determining which burial tool could be used.

2 Outline Cable Burial Risk Assessment

2.1 Overview

2.1.1 The following sections describe the initial review of preliminary route considerations and cable burial risk that will influence the final position of the cable route centrelines and the burial and protection of the marine cables in the Order Limits.

2.1.2 The process of route engineering determines the best option to minimise the installation and post-installation risk to the marine HVDC cables based on the data available. The shortest route is not always the most feasible when considering the hazards and risks present. Features such as steep slopes, outcropping rock, seabed obstacles (wrecks, ecologically sensitive features, existing infrastructure) may require the cable route to change direction at specific locations to avoid challenges for installation or environmental impacts.

2.1.3 The Offshore HVDC Cable Corridor has been developed in several stages including: initial route development; dynamic route development during survey and selection of a preferred route as described in **Chapter 3 Alternatives and Design Evolution** of this PEIR. The Offshore HVDC Cable Corridor is the same area as the Draft Order Limits.

2.1.4 Desktop analysis of factors such as water depth, seabed features and natural geohazards, metocean influences, conservation areas, external stakeholders (e.g. seabed leaseholders, general fishing activity, shipping), technical feasibility and ease of installation, protection and operation was used to define and optimise the Offshore HVDC Cable Corridor. Hazards, activities or factors that would increase the risk to the marine HVDC cables or designated features have been considered where possible. For example, route development initially considered UKHO data to evaluate the potential to avoid sandwave features; and crossing locations were located outside of Outer Thames Estuary Special Protection Area (SPA) in order to reduce requirements for external cable protection within the designated site and minimise the route length within the SPA . Navigation and Traffic Separation Schemes (TSSs) and areas of significant shipping activity, which present a continuous risk of planned and unplanned anchoring, have been considered as part of routeing with the Offshore HVDC Cable Corridor running parallel to these areas when possible or crossing at 90 degrees. There may be areas where hazards and areas of increased risk cannot be avoided and so alternate measures such as boulder relocation or deeper burial can be considered to remove or reduce the risk.

2.1.5 Although geophysical and geotechnical surveys have already been undertaken, further geophysical pre-lay survey will be undertaken prior to construction. Analysis of pre-lay survey data would allow micro-routeing around seabed features, including boulders, debris, sensitive habitats or pUXO.

2.1.6 Key risks and hazards identified as present in the Offshore HVDC Cable Corridor are described in Section 2.2. These will updated following completion of the Intertek CBRA Phase 2 Report which will be completed after interpretation of the geophysical and geotechnical survey data. Key risks and hazards will also be detailed further in the pre-construction CBRA document.

2.2 Seabed conditions and constraints

2.2.1 Potential seabed conditions and constraints for cable installation along the Offshore HVDC Cable Corridor have been investigated, including:

a. Seabed gradient and features
b. Mobile seabed features
c. Seabed contacts
d. Sediment conditions
e. Existing and planned infrastructure
f. Shipping and navigation
g. Fishing and dredging activities

Seabed gradient and features

2.2.2 Steep slopes (e.g., associated with large sandwaves, or bathymetric deeps) may prohibit the use of certain burial tools which track along the seabed, such as post lay tracked trenchers and simultaneous lay and burial jetting ploughs. A steep slope can make the burial equipment unstable and liable to tip over. Avoidance of steep slopes is therefore an important consideration when determining the cable burial and protection strategy.

2.2.3 UKHO high resolution bathymetry data has been used to evaluate seabed gradients for the desk-based CBRA study and initial route development. For the section of route where route development has taken place project specific survey data has been used to evaluate seabed gradients.

2.2.4 The route is generally characterised by flat or gradually changing seabed with gentle slopes. The water depth slowly increases from the landfall. The maximum depth along the route is 60m approximately 50km off the Suffolk coastline. Slopes of up to 5 degrees are measured across the Draft Order Limits and represents the highest slope angles found along the route based on EMODnet data.

2.2.5 The slopes present are not considered to pose a risk to burial.

Mobile seabed features

2.2.6 Seabed mobility is considered an important factor in determining burial depth. Sediment mobility and migration can lead to cable exposure during the life of the Proposed Scheme. The primary mitigation is to ensure that the marine HVDC cables are buried below the non-mobile reference level i.e. the point below which there is no seabed mobility. By using this level in the calculation of burial depth it allows mobile sandwaves to migrate over the cable, reducing the risk of future exposure which can increase the risk of damage to the cable from trawling and anchoring and potentially mechanical damage from free spans.

2.2.7 Other risks which could occur due to sediment mobility include thermal stresses within the cable due to increased burial depths from the overlaying sediments.

2.2.8 The seabed topography along the route is characterised by several areas of large natural features such as sandbanks, ridges and other likely bedforms.

2.2.9 UKHO high resolution MBES data was used to inform initial route development. Geophysical data was also subsequently reviewed during the geophysical survey and the survey area extended to inform further route development to avoid mobile seabed features.

2.2.10 The selected cable route avoids the largest sandwaves and megaripples.

Seabed contacts

2.2.11 Wrecks, boulders and marine debris do not generally present a risk to marine cables once installed, however, they may affect cable installation and cable burial success.

2.2.12 Known wrecks were avoided during initial route development. The geophysical survey data has been reviewed by experienced marine archaeologists to identify any potential heritage assets, which will be avoided through the development of site and feature specific mitigation developed within the framework of the Proposed Scheme's Outline Offshore Archaeological Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) (see Draft WSI and PAD provided in **Appendix 26.4** of this PEIR). A final WSI and PAD will be provided for the ES.

2.2.13 Debris will be cleared using a pre-lay grapnel run, prior to installation, to ensure a clear path for the burial tools.

Sediment conditions

2.2.14 Burial in the seabed is recognised as the best protection method for marine HVDC cables. However, ground conditions may not always allow full cable burial to the depth necessary to protect from external risks. The type, depth and strength of sediments present within the Offshore HVDC Cable Corridor is a critical factor in determining the selection of the burial tool, and whether full burial depth can be achieved. If only partial burial is achieved i.e., either the trench does not reach the required burial depth, or there is not sufficient backfill cover, then additional cable protection may be required.

2.2.15 Publicly available data from the BGS indicates that the surface sediments mainly consist of sand with isolated patches of coarse substrate and muddy sand. The route begins in Suffolk with the predominant surface sediment being sand and other coarse substrate, with small patches of sandy mud and muddy sand before returning to sand for the majority of the route. Seabed sediments remain consistent offshore with some areas increasing slightly in the amount of coarse sediment.

2.2.16 Following a full review of the geophysical and geotechnical survey data as part of the Intertek CBRA Phase 2 Report further information will be provided for the ES on sediment conditions along the Offshore HVDC Cable Corridor. This will include detailed descriptions of sediment types e.g. sand, gravelly sand, gravel and locations of rock outcrops and bedrock which will inform and limit the burial tools that can be used. Information will be provided on the most appropriate burial tool (via likelihood of achieving target burial depth) for defined sections of the Offshore HVDC Cable Corridor.

Existing and Planned Infrastructure

2.2.17 The Proposed Offshore Scheme crosses several types of third-party infrastructure as follows:

a. 13 are in service (IS) cables and pipelines (two cables are crossed twice)
b. Two are proposed offshore wind farm export cables
c. Four are abandoned pipelines
d. 15 are out of service (OOS) telecommunication cables.

2.2.18 The requirement to cross operational infrastructure will necessitate the use of cable protection, as the Proposed Offshore Scheme will cross over the top of the existing and planned (if installed first) subsea cables and pipelines.

2.2.19 A total of 19 in-service crossing structures will require cable protection. The Applicant will be engaging with all asset owners and discussions will be held with respect to crossing agreements. Where cables are out of service negotiations with asset owners will be undertaken in regard to cutting the cables..

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

Shipping and navigation

2.2.21 A shipping and navigation assessment has been conducted to identify potential threats to the cable that could influence the target burial depth. The principal risk to the Proposed Offshore Scheme is from vessel anchors; either through anchor dragging or emergency anchoring.

2.2.22 Anchor dragging, which is caused by factors such as bad weather, anchor failure, or poor ground conditions for anchor holding, could cause a vessel to drift towards the cables potentially snagging the marine HVDC cables if they are not sufficiently buried or protected.

2.2.23 Emergency anchoring describes the situation where a vessel suffers engine failure while travelling over a cable and subsequently drops anchor onto the cable, potentially damaging it. Emergency anchoring could occur anywhere along the Offshore HVDC Cable Corridor however is more likely in areas closer to danger, e.g., close to shore, or where there is a high density of shipping.

2.2.24 Probabilistic assessment is used to define the risk to a cable from vessel anchors. The assessment considers the frequency of vessel traffic, type of vessel, size and type of deployed anchors, bathymetry and ground conditions (i.e., sediment type and cohesiveness). The dead weight tonnage (DWT) of a vessel is often an important factor in the assessment as it determines the size and type of anchor that is used for commercial vessels. For recreational and fishing vessels vessel length is often more important. Specific models looking at anchor drag also consider the probability that the vessel fails to recover in time and distance from the cable. The probabilistic assessment is conducted for different depths of burial to determine the likelihood of an anchor striking the marine HVDC cables.

2.2.25 Preliminary assessments have been undertaken to ensure that risk from anchoring is understood. A summary of the key findings is presented below:

2.2.26 There are two main shipping lanes or areas along the Proposed Offshore Scheme, the major shipping traffic is located near the EEZ border between the UK and Netherlands. The Offshore HVDC Cable Corridor crosses perpendicular to these lanes minimising the risks of encountering traffic during survey, installation and any operations and maintenance campaigns, as well as reducing risk of anchor strikes that have the potential to damage the cable. At times the cable will run parallel to these lanes in order not to cross at an angle, so that the cable spends the least amount of distance within the shipping lane. The Off Botney Ground TSS is located approximately 1.2NM to the west of the northern extent of the Proposed Offshore Scheme. A mandatory deep-water route connects to the entry/exit of the TSS which overlaps with the Proposed Offshore Scheme (see below).

2.2.27 Areas of relatively high-density shipping traffic include:

a. A north/south route to the east of the Proposed Offshore Scheme, following the deep-water route that connects to the Off Botney Ground TSS and consisting of commercial vessel traffic.
b. A northwest/southeast route through the central part of the Proposed Offshore Scheme, consisting of commercial vessel traffic including passenger ferries transiting between the UK and Netherlands.
c. A northwest/southeast route through the southern part of the Proposed Offshore Scheme, consisting of wind farm support vessels transiting between Lowestoft and the East Anglia One OWF.
d. Nearshore north/south routeing through the Proposed Offshore Scheme, mainly consisting of cargo vessels and dredgers, and nearshore southest/northwest routeing from wind farm support vessels transiting between Lowestoft and the Greater Gabbard and Galloper OWF’s.

2.2.28 Analysis of AIS data (for the period November 2023 to October 2024) noted that the most frequent vessel type during the 12-month period was cargo vessels, followed by tankers and wind farm support vessels. Recreational craft and fishing vessels, passenger vessels and dredgers, tugs and military vessels accounted for the remainder.

2.2.29 Vessels with the lowest DWT (less than 250 tonnes) were mainly seen close to the coast (comprising recreational vessels and wind farm support vessels) while vessels with the largest DWT (at least 15,000 tonnes) were seen using the deep-water route that connects to the Off Botney Ground TSS or undertaking north/west/south east routeing (mainly comprising cargo vessels and tankers). corridor.

2.2.30 A reported anchorage is charted 60m south of the Draft Order Limits, at the approaches to Southwold Harbour. A designated anchorage area is also located between Southwold Harbour and the Port of Lowestoft, approximately 1.8NM north west of the Proposed Offshore Scheme.

2.2.31 Anchoring activity takes place mainly in the vicinity of the southern portion of the Proposed Offshore Scheme. Tankers were seen anchored further offshore compared to other vessel types, which were mainly seen anchored within 5NM of the coast. Common locations for anchoring included the designated anchorage area and in the vicinity of the reported anchorage location as well as a location approximately 16NM from the coast and south of the Proposed Offshore Scheme. A total of 20 instances of anchoring were noted over the 12-month period (with some occurring over multiple days). Tankers accounted for the majority of anchored vessels.

2.2.32 Anchoring risk is concentrated further offshore towards the boundary of the EEZ, both in terms of vessel traffic density and also the size of associated vessels. Traffic in the nearshore area is composed generally of lighter vessels and therefore pose less risk to the HVDC cables once buried. Anchor risk is not the key determinant for setting cable burial depth along most of the route due to both the relatively light vessel densities and also the prevalent presence of soils which prevent anchors from penetrating very deeply.

2.2.33 For the Proposed Offshore Scheme, ashipping and navigation assessment will be produced for the ES with a final version of the shipping and navigation assessment to be conducted post-consent. The Applicant with comply with best practice guidance applicable at the time of application. A summary of this assessment will be contained within the pre-construction CBRA. The pre-construction CBRA will consider the work done to date regarding the risk posed by anchors, and will include further assessment of the risks associated with anchor strikes and shipping density based upon up-to-date data. This will inform final target burial depth, burial equipment and the potential need for any cable protection. These considerations will be set out in the pre-construction CBRA.

Fishing activity

2.2.34 Mobile and static fishing areas are present along the entire Offshore HVDC Cable Corridor.

2.2.35 Demersal gears have the greatest potential of interacting with subsea cables as they tow their gear along the seabed. Static gear types such as pots, traps, long lines, gill nets are not considered a risk to the cable since these vessels do not penetrate the seabed (unless anchors are used, in which case the penetration depth is not more than a few centimetres). Beam trawlers have the potential to penetrate up to 0.2m in sand and/or gravel and up to 0.4m in mud / very soft clay. Demersal (otter) trawlers (single and twin) have the potential to penetrate up to 0.25m in sand and/or gravel, and up to 0.35m in mud / very soft clay, while the depth of demersal seiners is expected to be minimal (less than 2cm).

2.2.36 Review of AIS data (for the period November 2023 to October 2024) indicated an average four to five fishing vessels per day within the navigational risk assessment study area (5NM buffer of the Draft Order Limits) over the 12-month period. Fishing vessel levels within the Proposed Offshore Scheme were highest during the months of May to October, with an average of seven vessels per day within these months.

2.2.37 The most common gear type recorded was beam trawlers which accounted for 85% of the active fishing within the study area and were heavily distributed towards the northern half of the Proposed Offshore Scheme. This was followed by demersal trawlers and potter/whelker gear. Fishing vessels seen close to the proposed landfall site appeared to be transiting, as opposed to actively fishing.

2.2.38 The pre-construction CBRA would consider the potential impact of fishing on the marine HVDC cables and propose suitable target burial depths and cable protection using up-to-date data.

Dredging activities

2.2.39 There are four aggregate extraction sites within the study area. One of these, Aggregate Area 2109 Indefatigable East was announced in late 2024 and is currently crossed by the proposed Offshore HVDC Cable Corridor.

2.2.40 The proposed Offshore HVDC Cable Corridor includes an option for avoiding Aggregate Area 2109 (Indefatigable East) and while the Project is in discussions with the Aggregate Area owner regarding the current route, an alternative route is included within the assessments. The alternative cable corridor shall avoid the boundary of Aggregate Area 2109 by 500m while remaining as close to the original alignment as possible. The 500m exclusion zone is a generally accepted industry standard used for most constraints when undertaking marine spatial planning. A single route will be provided for the ES.

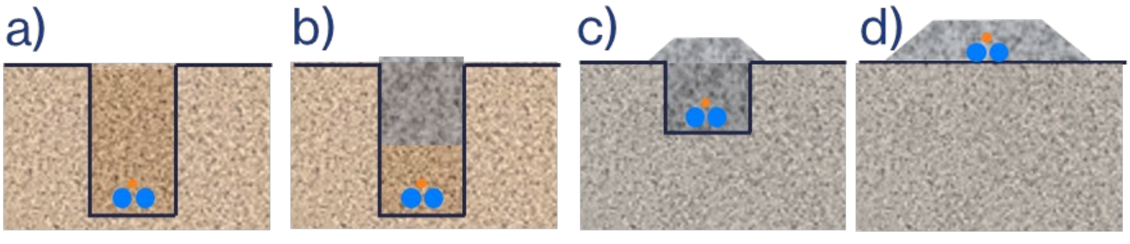
2.2.41 An average of three to four dredgers per day were seen within the navigational risk assessment study area during the 12-month period November 2023 to October 2024. Dredgers were mainly seen transiting north/south within the southern portion of the study area. No aggregate active dredging was identified in the study area.

2.2.42 It is considered that dredging activities will not be a constraint for cable burial.

2.3 Outline Burial and Protection Recommendations

2.3.1 Burial in the seabed is recognised as the best protection method for marine HVDC cables. However, ground conditions may not always allow full cable burial to the depth necessary to protect from external risks. **Inset 2.1** presents the various cable burial and protection scenarios that may be utilised along the Offshore HVDC Cable Corridor.

Inset 2.1: Cable burial and protection scenarios



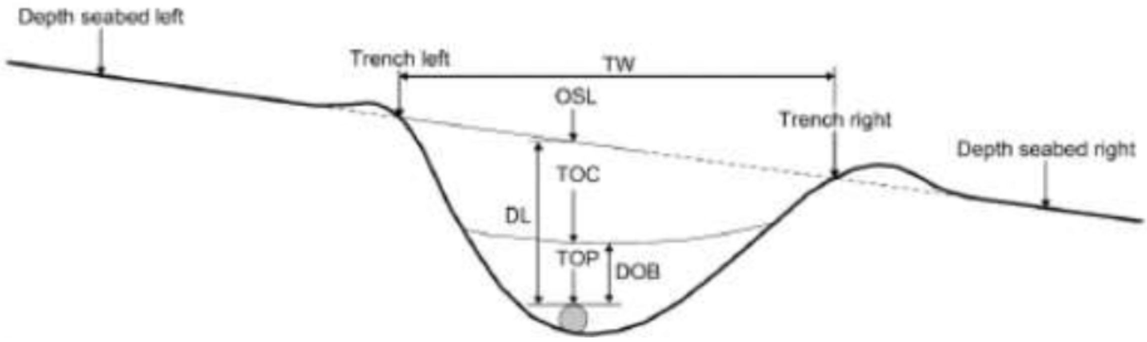
a) Target depth of burial achieved - full burial in sediment.
b) Target depth of burial achieved - insufficient natural backfill, cable protection required to seabed level.
c) Target depth of burial not achieved - additional cable protection required above seabed level to achieve adequate protection.
d) Cables surface laid - protection provided fully by external measures.

2.3.2 The Applicant has committed to burying the marine HVDC cables where possible (Commitment Reference OD04). Information on seabed conditions provided by the geophysical and geotechnical surveys has still to be incorporated into Phase 2 Cable Burial Risk Assessment (CBRA) study for the Proposed Offshore Scheme.

2.3.3 The initial threat assessment identified that a minimum of 0.6m depth of burial (DOB) should be targeted to avoid fishing interaction and seabed mobility and up to 1.8m DOB to avoid anchor strikes. **Inset 2.1** illustrates a typical profile of a cable trench.

2.3.4 Embedded Mitigation Measure OD04 commits to burying the cables in the seabed, except where ground conditions do not allow burial at infrastructure crossing.

Inset 2.2: Typical profile of cable trench



Definitions
Original Seabed Level (OSL): Average of seabed left and right
Depth to Top Cover (TOC): Vertical distance to top cover, backfill or rockberm from vertical reference level
Depth to Top of Product (TOP) Vertical distance to top of cable from vertical reference level
Depth of Lowering (DL) Vertical distance between TOP and OSL
Depth of Burial (DOB) Vertical distance between TOC and TOP
Trench Width (TW) Horizontal distance between trench/rockberm left and right

2.3.5 Embedded Mitigation Measure OD05 commits to only using external cable protection where it can be demonstrated that adequate burial depth cannot be achieved.

2.3.6 For the ES the Outline CBRA will be updated to provide a risk-based assessment of where cable protection may be required. Whilst it would be based on the analysis of ground conditions from the geophysical and geotechnical survey, it would consider generic burial tools and therefore will be indicative for the ES. This assessment would be further updated in the pre-construction CBRA. This would take into consideration, the Embedded Mitigation Measures, the final recommended target burial depths, the capabilities of the actual burial tools to be used following engagement of the Offshore EPC Contractor, any Contractual Requirements such as the number of passes each burial tool is required to make to reach burial depth, as well as any new information on ground conditions.

2.3.7 Cable protection will be required at the crossing protection structures.

Topic Glossary

Acronym/ Phrase/ Abbreviation	Definition
AEZ	Archaeological Exclusion Zone
AIS	Automatic Identification System
ARPA	Automatic RADAR Plotting Aid
BGS	British Geological Society
CBRA	Cable Burial Risk Assessment
CEMP	Construction Environmental Management Plan
CPT	Cone penetrometer
DCO	Development Consent Order
DL	Depth of Lowering
DML	Deemed Marine Licence
DMR	Dedicated Metallic Return
DOB	Depth of Burial
DWT	Dead weight tonnage
EEZ	Exclusive Economic Zone
EMF	Electromagnetic Field
EMODNet	European Marine Observation and Data Network
ES	Environmental Statement
GB	Great Britain
GW	Gigawatts
HDD	Horizontal directional drilling
HVAC	High voltage alternating current
HVDC	high voltage direct current
IBTS	International Bottom Trawl Survey
ICPC	International Cable Protection Committee
IS	In service
Km	Kilometre
kV	Kilo volt
LAT	Lowest Astronomical Tide
MAG	Magnetometer
MBES	Multi-beam echosounder
MCA	Maritime and Coastguard Agency

Acronym/ Phrase/ Abbreviation	Definition
MHWS	Mean high-water springs
MINNS	Marine Invasive Non Native Species
MMO	Marine Management Organisation
NGLLL	National Grid LionLink Ltd
NM	Nautical mile
NTS	National Transmission Systems
OOS	Out of service
OSL	Original Seabed Level
OWF	Offshore Wind Farm
PAD	Protocol for Archaeological Discoveries
PEIR	Preliminary Environmental Information Report
pUXO	Potential Unexploded Ordnance
RADAR	Radio Detection and Ranging
SBP	Sub-bottom profiler
SPA	Special Protection Area
SSS	Sidescan sonar
TJB	Transition joint bay
TOC	Depth to Top Cover
TOP	Depth to Top of Product
TSS	Traffic Separation Schemes
TW	Trench Width
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordnance
WSI	Written Scheme of Investigation

References

Ref 1 Carbon Trust, (2015). Cable Burial Risk Assessment Methodology – Guidance for the Preparation of Cable Burial Depth of Lowering Specification

National Grid LionLink Limited

Company number 14722364

1-3 Strand

London

WG2N-5EH

United Kingdom

nationalgrid.com