XLINKS' MOROCCO-UK POWER PROJECT

Environmental Statement

Volume 1, Appendix 3.4: Outline Cable Burial Risk Assessment

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Xlinks 1 Limited

Prepared for:

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Glossary

Term	Meaning
Bipole	A Bipole system is an electrical transmission system that comprises two Direct Current conductors of opposite polarity.
Environmental Impact Assessment	The process of identifying and assessing the significant effects likely to arise from a project. This requires consideration of the likely changes to the environment, where these arise as a consequence of a project, through comparison with the existing and projected future baseline conditions.
Landfall	The area where the marine HVDC cables come ashore and transition from the marine environment to the terrestrial environment - located at Cornborough Range on the north Devon coast, to the south west of Cornborough and approximately 4 km west of Bideford.
Offshore HVDC Cable Corridor	The proposed corridor within which the onshore High Voltage Direct Current (HVDC) Cables would be located.
Proposed Development	The element of Xlinks' Morocco-UK Power Project within the UK. The Proposed Development covers all works required to construct and operate the offshore cables (from the UK Exclusive Economic Zone to Landfall), Landfall, onshore Direct Current and Alternating Current cables, converter stations, and road upgrade works.

Acronyms

Acronym	Meaning
AEZ	Archaeological Exclusion Zone
CBRA	Cable Burial Risk Assessment
DML	Deemed Marine Licence
EEZ	Exclusive Economic Zone
FOC	Fibre Optic Cable
HDD	Horizontal Directional Drill
HVDC	High voltage direct current
MCA	Maritime and Coastguard Agency
MMO	Marine Management Organisation
NSVMP	Navigational Safety and Vessel Management Plan
OOWSI	Offshore Outline Written Scheme of Investigation
TSS	Traffic Separation Scheme
UK	United Kingdom
UXO	Unexploded Ordnance

1 OUTLINE CABLE BURIAL RISK ASSESSMENT

1.1 Introduction

1.1.1 Xlinks 1 Limited (the Applicant) is submitting an application to the Planning Inspectorate, for a Development Consent Order for Xlinks' Morocco-UK Power Project (the 'Project'). The elements of the Project within the UK Exclusive Economic Zone (EEZ) are referred to in this document as the 'Proposed Development'.

1.1.2 The Proposed Development forms part of the wider Project proposed by the Applicant to develop a sub-sea electricity connection between the UK and Morocco. The Project would be an electricity generation facility (solar and wind energy combined with a battery storage facility) in Morocco, connecting exclusively to the UK national grid high voltage transmission network via high voltage direct current (HVDC) marine cables routed through Morocco, Spain, Portugal and France to the UK.

1.1.3 The key offshore elements of the Proposed Development pertinent to this Outline Cable Burial Risk Assessment (Outline CBRA) are the marine HVDC cables which will be installed within the Offshore Cable Corridor (area where the marine HVDC cables will be located between mean high-water springs (MHWS) and the UK / France EEZ boundary). The Proposed Development would consist of four 525 kV HVDC marine power cables which would be installed for the majority of the cable route as two bundled pairs (Bipole 1 and Bipole 2). The bundled pairs would be separated into four individual cables a short distance before the Landfall horizontal directional drill (HDD) entry points, to allow each cable to be pulled onshore through individual HDD ducts. The Landfall is located at Cornborough Range on the north Devon coast, to the south west of Cornborough and approximately 4 km west of Bideford

1.1.4 A fibre optic cable (FOC) would be laid together with the marine HVDC cables within a shared trench (one FOC per cable bundle). FOC repeaters would be required every 70 km along the Offshore Cable Corridor (four to five repeaters per Bipole). At each repeater location, there would likely be a spur of FOC installed adjacent to the marine HVDC cables for the installation of the repeaters and ongoing maintenance purposes. The spur of FOC at each repeater location would be equal to the water depth at the repeater location.

1.1.5 A full description of the Proposed Development is provided in Volume 1, Chapter 3: Project Description of the Environmental Statement (ES).

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, the key considerations that have led to the proposed design and outlines further engineering design work that will be carried out post consent to inform the pre-construction 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 depths of burial 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 at this point in time 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)[1] methodology, which is best industry practice for cable burial risk assessment. It will include details of:

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

1.2.5 The pre-construction CBRA is a requirement of the draft deemed Marine Licence (DML) which forms Schedule 14 to the draft Development Consent Order, at application stage. Within Schedule 14, Part 2 'Pre-construction plans and documentation considerations', within the Development Consent Order application, a Cable Burial Risk Assessment is required to be submitted to the Marine Management Organisation (MMO), and approved, prior to the start of construction. The condition states:

14."—(1) No licensed activities in any stage of construction of the authorised development may commence until the following (insofar as relevant to those licensed activities or stage of those licensed activities) have been submitted to and approved in writing by the MMO—

…

(c) An offshore construction method statement for the relevant stage in accordance with the construction methods assessed in the environmental statement and the relevant offshore CEMP approved by the MMO under paragraph 8 of this licence, including—

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

…

(v) a pre-construction cable burial risk assessment in accordance with the outline cable burial risk assessment and construction methods assessed in the environmental statement, including—

(aa) a marine HVDC cable installation methodology;

(bb) a technical specification of marine HVDC cables below MHWS and cable burial depths in accordance with industry practice;

(cc) a detailed cable laying plan for the Order limits seaward of MHWS, incorporating a burial assessment which includes the identification of any part of the marine HVDC cables that exceeds 5 percent of navigable depth referenced to chart datum and, in the event of the identification of any area of cable protection that exceeds 5 percent of navigable depth, details of any steps (to be determined following consultation with Trinity House and the MCA on matters which fall within their statutory functions) to be taken to ensure existing and future safe navigation is not compromised or such similar assessment to ascertain suitable burial depths and cable laying techniques, including cable protection;

(dd) proposals for monitoring the marine HVDC cables including cable protection during the operation of the authorised development which includes a risk based approach to the management of unburied or shallow buried cables;

(ee) advisory safe passing distances for vessels around construction sites;

(ff) the name and function of any agent or contractor appointed to engage in the licensed activities vessels and vessel transit corridors and a completed Hydrographic Note H102 listing the vessels to be used in relation to the licensed activities;

(gg) codes of conduct for vessel operators;

(hh) details of any required micro-siting in relation to Annex I geogenic reef habitat or archaeological exclusion zones within the Order limits seaward of MHWS; and

(ii) associated ancillary works.

1.3 Embedded Mitigation Methods

1.3.1 **Table 1** below sets out the measures that the Applicant has committed to relevant to the cable installation methodology, micro-routeing and cable protection, which the Outline CBRA and pre-construction CBRA will take into consideration.

Table 1: Embedded (and foreseeable) mitigation measures relevant to cable routeing, cable protection and cable installation

Ref	Commitment	Securing Mechanism
Embedded Mitigation		
OFF01	Cables will be buried (where possible) up to a maximum of approximately 1.6 m below the seabed, as informed by detailed Cable Burial Risk Assessment (CBRA). The average target depth is 1.5 m. Only when full burial is not possible will additional protection be installed.	Design parameters set out in the Outline Offshore Construction Environmental Management Plan (document ref. 7.9), secured in the Deemed Marine Licence.
OFF02	Cable protection measures - Where possible introduced cable protection i.e. rock placement (and potentially concrete mattresses), would be kept level with the seabed, and if above the seabed would be kept to a maximum of c.1 m above seabed level (excluding crossings) as far as reasonably practicable.	Design parameters set out in the Outline Offshore Construction Environmental Management Plan (document ref. 7.9), secured in the Deemed Marine Licence.
OFF03	Micro-routing of the offshore cables, within the defined Order Limits, will be undertaken to minimise any potential damage to geogenic and biogenic Annex I habitats, to avoid sand waves or large ripples (that would otherwise require pre-lay seabed flattening), and to avoid direct impacts as far as reasonably practicable on archaeology and cultural heritage assets and submerged land surfaces.	Set out as 'Further Commitments' in the Outline Offshore Construction Environmental Management Plan (document ref. 7.9), secured in the Deemed Marine Licence.
OFF09	HDD methods will be employed to avoid as far as reasonably practicable any direct disturbance of the intertidal zone, the beach and the coastal cliffs.	Works Activity as set out in the Deemed Marine Licence.
OFF10	The HDD drill system will be designed to allow for the monitoring of pressure loss and therefore provision for the rapid identification of potential break out.	Outline Bentonite Breakout Plan requirement of the Outline Offshore Construction Environmental Management Plan (document ref. 7.9), secured in the Deemed Marine Licence.
OFF12	Route optimisation studies, including multiple desktop studies and marine investigation surveys, have informed the routing of the Offshore Cable Corridor to avoid sensitive locations where possible and as far as reasonably practicable (including known sites of archaeological interest).	The Offshore Cable Corridor is defined in the deemed Marine Licence authorised scheme grid coordinates.
OFF18	Data will be shared with the UK Hydrographic Office (UKHO) and the Marine Management Organisation (MMO) in accordance with the Deemed Marine Licence, for inclusion on Admiralty Charts (with associated note/warning about anchoring, trawling or seabed interaction).	Data sharing with UKHO provisioned on Deemed Marine Licence.
OFF21	Compass deviation effects will be minimised as far as reasonably practicable through cable design (bundled bipole installation) and burial. If there are any changes in the design and it cannot be demonstrated that MCA requirements for compass deviation can be met, a post-construction compass deviation survey will be undertaken.	Via Navigational Safety and Vessel Management Plan (NSVMP) which is a requirement of the Outline Offshore Construction Environmental Management Plan (document ref. 7.9), secured in the Deemed Marine Licence.
OFF22	Relevant policy guidance on water depth reduction has been followed during the design of the project.	Via NSVMP which is a requirement of the Outline Offshore

Ref	Commitment	Securing Mechanism
	During final engineering design and construction, should any areas be identified where cable protection is required and the Maritime and Coastguard Agency (MCA) condition of no more than 5% reduction in water depth is not achievable as far as reasonably practicable, a location specific review of impacts to shipping and consultations with the MCA will be carried out to agree additional mitigations as required.	Construction Environmental Management Plan (document ref. 7.9), secured in the Deemed Marine Licence.
OFF25	Cable crossing and proximity agreements will be entered into with asset owners as far as reasonably practicable. Crossing design will adhere to industry standard to minimise fishing gear snagging risk.	Outline Offshore Construction Environmental Management Plan (document ref. 7.9), secured in the Deemed Marine Licence.
OFF28	An Offshore Outline Archaeological Written Scheme of Investigation (OOWSI) accompanies the ES, with site-specific WSIs produced prior to commencing construction to inform specific investigation activities to record cultural heritage assets and subsequently the production of a post-excavation report and, if warranted, further dissemination of results, i.e. publication in relevant journals or the production of a monograph. An OOWSI is presented within the application for DCO as Volume 3, Appendix 7.5 Outline Offshore Archaeological Written Scheme of Investigation of the ES.	Specified requirement of the Deemed Marine Licence.
OFF29	100m Archaeological Exclusion Zones (zone in which no construction activities will take place) are committed around the extents of known (x1 site identified) wreck sites and anomalies of archaeological interest. This commitment will lead to archaeological preservation in-situ.	Outline Offshore Archaeological Written Scheme of Investigation (EN010164/APP/6.3), secured in the Deemed Marine Licence.
OFF30	100m Archaeological Exclusion Zones (zone in which no construction activities will take place) are committed around the recorded point locations of a) previously recorded sites that have not been seen in the geophysical data but at which archaeological material is likely to be present, possibly buried; and b) around magnetic anomalies interpreted (based on their magnetic anomalies) as substantial ferrous debris but buried with no surface expression. There are x3 such point locations identified (in total). This commitment will lead to archaeological preservation in-situ.	Outline Offshore Archaeological Written Scheme of Investigation (EN010164/APP/6.3), secured in the Deemed Marine Licence.
OFF31	30m Archaeological Exclusion Zones (zone in which no construction activities will take place) are committed around the extent of likely anthropogenic debris. There are x1 such points identified. This commitment will lead to archaeological preservation in-situ.	Outline Offshore Archaeological Written Scheme of Investigation (EN010164/APP/6.3), secured in the Deemed Marine Licence.
OFF32	Geophysical anomalies identified within the offshore archaeological assessment will be avoided where possible by micro-routing as far as reasonably practicable. Where this is not possible the Offshore Written Scheme of Investigation will provide the framework for potential further actions (an Outline Offshore Archaeological Written Scheme of	Outline Offshore Archaeological Written Scheme of Investigation (EN010164/APP/6.3), secured in the Deemed Marine Licence.

Ref	Commitment	Securing Mechanism
	Investigation is presented with the application for DCO as document ref. 6.3.7.5). This commitment will lead to archaeological preservation in-situ.	
OFF33	Further investigation of identified anomalies and previously recorded sites that cannot be avoided by micro-routing of design will be undertaken within the framework of the Offshore Written Scheme of Investigation (an Outline Offshore Archaeological Written Scheme of Investigation is presented with the application for DCO as document ref. 6.3.7.5).	Outline Offshore Archaeological Written Scheme of Investigation (EN010164/APP/6.3), secured in the Deemed Marine Licence.
OFF34	All potential sediment disturbance activities in Bideford Bay are to avoid peak spring tides and significant wave activity, to limit any potential for sediment mobilisation as far as reasonably practicable. These activities would include the excavation / sediment clearance at the HDD exit pits and trenching works.	Requirement of the Outline Offshore Construction Environmental Management Plan (document ref. 7.9), secured in the Deemed Marine Licence.
OFF36	All construction activities undertaken on the seabed including boulder clearance activities (inclusive of the depositing of moved boulders) will remain entirely within the Offshore Cable Corridor, and a minimum distance of 20 m from any Marine Conservation Zone boundary.	Requirement of the Outline Offshore Construction Environmental Management Plan (document ref. 7.9), secured in the Deemed Marine Licence.
OFF37	Ministry of Defence (Defence Infrastructure Organisation) will be provided with details of as laid rock protection and post-installation survey data.	Specified requirement of the Deemed Marine Licence.
Secondary (Foreseeable) Mitigation		
OFF26	Archaeological assessment of available data - Offshore geophysical surveys (including future UXO surveys as necessitated) and any additional offshore geotechnical campaigns undertaken pre-construction (if required) will be subject to archaeological review, where relevant in consultation with Historic England. Relevant results from geotechnical surveys will be released / shared with Archaeology Data Service (ADS), with the aim to enhance the paleogeographic knowledge and understanding of the area as far as reasonably practicable.	Outline Offshore Archaeological Written Scheme of Investigation (EN010164/APP/6.3), secured in the Deemed Marine Licence.
OFF35	Geophysical survey and associated marine archaeological review of these data will be undertaken of the area to the east of blocks U28 and U29 where there are data gaps. (These data gaps were introduced following expansion of the Offshore Cable Corridor to allow flexibility and increased separation distance from potential future infrastructure in The Crown Estate's Project Development Area 3) Final micro-routing in this area would rely on post-consent geophysical surveys undertaken at the time of/in combination with the Unexploded Ordnance surveys.	Requirement of the Outline Offshore Construction Environmental Management Plan (document ref. 7.9), secured in the Deemed Marine Licence.

1.4 Data Sources

Overview

1.4.1 To establish baseline conditions across the Offshore Cable Corridor for the Outline CBRA numerous data sources were consulted, including project specific survey data, publicly available bathymetry and geotechnical data, and data and assessments that advise on the known or planned position of hazards and features in the UK EEZ. Further surveys and assessments would be undertaken post-consent to inform the pre-construction CBRA.

Seabed Surveys

1.4.2 A geophysical and geotechnical survey was conducted on the Offshore Cable Corridor by GEOxyz in 2022/23. High quality geophysical data (multi-beam echosounder (MBES), sidescan sonar (SSS), sub-bottom profiler (SBP) and magnetometer (MAG)) was acquired over a 500 m wide corridor. The data provide 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 locally widened from 500 m to 1,500 m to allow sufficient coverage to engineer crossing of existing infrastructure at or as close to 90 degrees as possible in line with International Cable Protection Committee (ICPC) Recommendation 3.

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

1.4.4 Publicly available high resolution bathymetry data from the UK Hydrographic Office has also been used to inform the initial cable route and assessment of cable burial risks, providing information on the wider seabed, and informed the assessment of sediment mobility.

Other Data

1.4.5 Other data types used to inform cable routeing and the Outline CBRA are outlined in **Table 2**. The Outline CBRA has also been informed by the data sources and assessments contained in the Environmental Statement Part 6, Volumes 1 to 4, in particular the offshore assessments at Volume 3, Chapters 1-9.

Table 2: Other data types used to inform the outline assessment

Data type	Data overview
Shipping	• Automated Identification System (AIS) shipping data (12-month period September 2022 to August 2023). • UKHO Nautical Charts [chart numbers: 1179, 777, 1178, 2656, 2655, 2649, 1123, 2675] - used to identify navigational features. • Admiralty sailing directions NP37 West Coast of England Pilot used to inform on navigational features.
Fishing	• 12-months AIS data for period September 2022 to August 2023. • MMO satellite fishing data for 2018 to 2023. • Fishing activity reports (as collated by the Proposed Development's Fisheries Liaison Officers). • Fishing activity from public sources including DEFRA and EMODNet
Archaeology	• Records of known wrecks and obstructions (UKHO). • Assessment of marine archaeology from Geophysical Survey data (Wessex Archaeology)
Existing / planned / proposed infrastructure	• Crown Estate GIS data concerning offshore wind farm sites (existing and planned). • Other existing sources including KIS-ORCA
Dredging and disposal	• Crown Estate GIS data concerning licensed, active and proposed marine aggregate dredging areas.
Metocean	• Metocean operational statistics and design criteria.

1.5 Outline Cable Burial Risk Assessment

Overview

1.5.1 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 HVDC cables within the Offshore Cable Corridor.

1.5.2 The process of route engineering determines the best option to minimise 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.

1.5.3 The Offshore Cable Corridor has been developed in three stages, as described in Volume 1, Chapter 4: Need and Alternatives of the ES. 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 Cable Corridor. Hazards, activities or factors that would increase the risk to the marine HVDC cables have been avoided wherever possible. For example, sensitive environmental sites, where there may be consent restrictions on cable protection, were excluded from the Offshore Cable Corridor wherever possible. Navigation and Traffic Separation Schemes (TSSs) and areas of significant shipping activity, which present a continuous risk of planned and unplanned anchoring, have been avoided. 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 are considered to remove or reduce the risk.

1.5.4 Although geophysical and geotechnical surveys have already been carried out, further geophysical pre-lay survey will be undertaken before construction commences. Analysis of the data from the pre-lay survey will allow further micro-routeing to take place around features such as boulders, debris, or potential UXO. If UXO clearance is required, a separate Marine Licence would be sought from the MMO.

1.5.5 Key risks and hazards identified as present in the Offshore Cable Corridor are described below. These will be further detailed in the Pre-construction CBRA document.

Seabed conditions and constraints

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

- Seabed gradient and features
- Mobile seabed features
- Seabed contacts
- Sediment conditions
- Existing and planned infrastructure
- Shipping and navigation
- Fishing and dredging activities

Seabed Gradient and Features

1.5.7 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.

1.5.8 The project specific survey data have been used to evaluate seabed gradients. The bathymetry ranges from approximately 1 m below lowest astronomical tide at the Landfall to 131 m. Generally, the slope is less than 1˚, increasing in the presence of seabed bedforms, with a maximum peak of 8.3˚. The slopes present are not considered to pose a risk to burial.

Mobile Seabed Features

1.5.9 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 Development. 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

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

1.5.11 Sandwaves, megaripples, ribbons, patches, streaks, furrows and trawl scars have all been identified along the Offshore Cable Corridor. The mobile sediments are generally less than <0.5 m in depth, which will not limit cable burial tools (standard burial tools would be suitable) and will not require any seabed clearance activities (such as pre-sweeping or large scale flattening) to ensure the marine HVDC cables are installed below the non-mobile reference level. The non-mobile reference level depth would be considered in the pre-construction CBRA in addition to the risks from external factors such as anchor and fishing risk.

1.5.12 A large topographic mound, 8 m in height, associated with the northern termination of one of the Celtic Banks (sandbank) is present approximately 46 km from the UK / France border. The sandbank stretches approximately 2 km within the Offshore Cable Corridor and is non mobile. Therefore, standard cable burial is anticipated to be suitable in this feature.

Seabed Contacts

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

1.5.14 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 Development's Outline Offshore Archaeological Written Scheme of Investigation (Volume 3, Appendix 7.5 of the ES).

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

1.5.16 Areas of boulder fields have been identified within the Offshore Cable Corridor, which may prevent burial. In the first instance boulders will be avoided through micro-routeing. Where this is not possible, boulders may be relocated (using a grab), or a swathe cleared using a pre-lay plough. Approximately 200 km of the route may need boulder clearance works to support cable burial.

Sediment Conditions

1.5.17 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 Cable Corridor is an important factor in determining what burial tool is selected, and whether full burial 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.

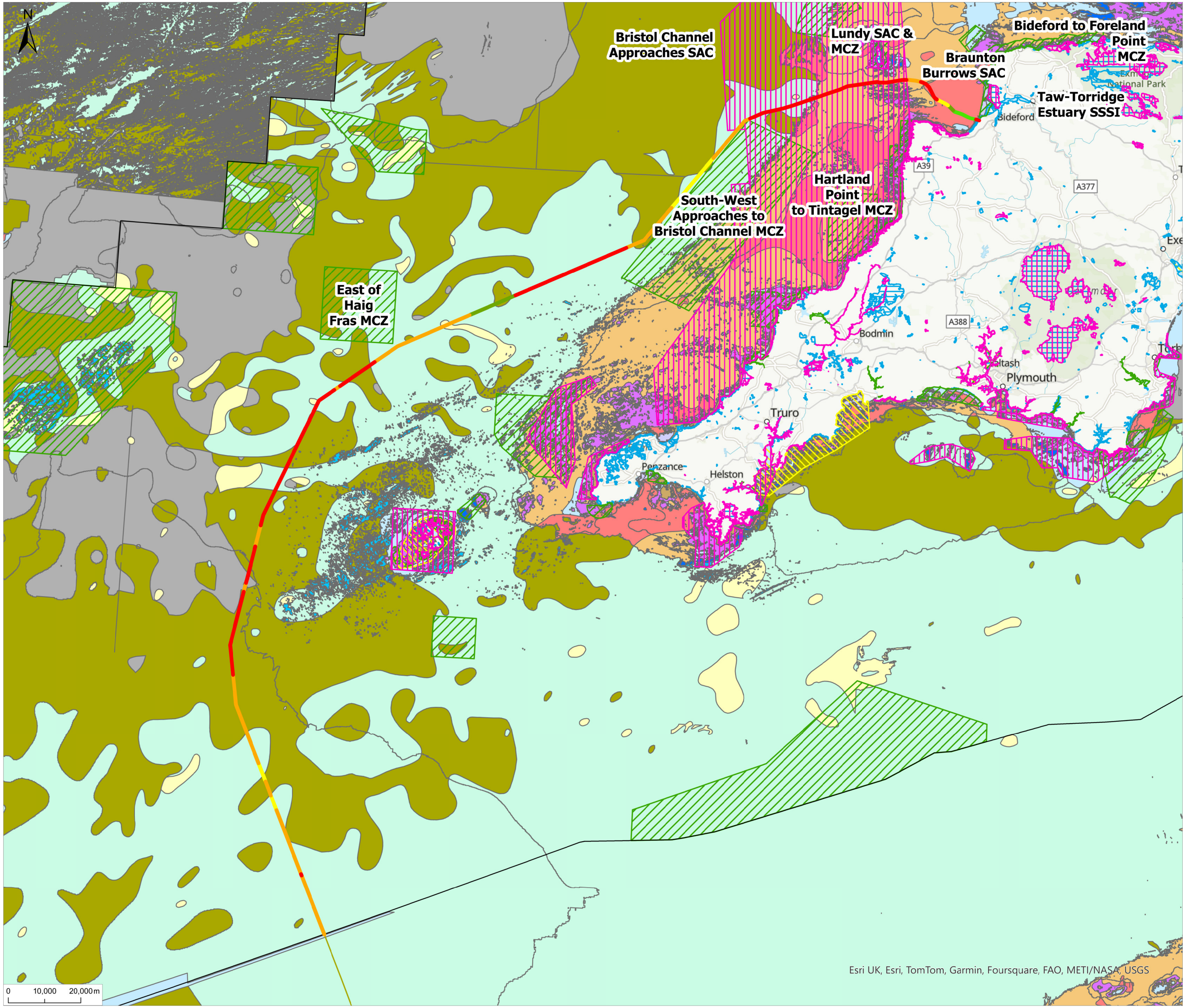
1.5.18 For the first 50 km of the Offshore Cable Corridor from the UK / France border, surface sediments consist of slightly gravelly to gravelly Sand, locally Gravel, with the gravel proportion higher towards the border. Rock outcrops are also more frequent approaching the border. The bedrock is generally very dense gravelly Sand to Siltstone at about 0.5 m below the seabed surface. Where the Celtic Bank (sandbank) is present the bedrock is deeper than 5 m below the seabed surface.

1.5.19 The middle part of the Offshore Cable Corridor (approximately 125 km) is characterised by variable sands, with some fines present (low fines proportion). The fine content is commonly present where Chalk is approaching the surface or close to it. Review of Cone Penetration Testing (CPT) logs for central locations where greatest proportion of fines were recorded, confirms low penetration, supporting an assumption that fines are largely associated with local chalk erosion. Locally the chalk outcrops, but generally the top of the chalk is encountered down to 1 m below the seabed surface. Surface sediments are thin (approximately 0.5 m thick) and comprised of medium dense to very dense gravelly to gravelly Sand and fine Sand.

1.5.20 For the next 40 km of the Offshore Cable Corridor, as the fine content decreases, surface sediments change to slightly gravelly to gravelly Sand, locally with sandy Gravel. This is underlain by Clay / Claystone which is generally below 1.5 m deep but locally can be shallower at 0.5 m deep. After 40 km Claystone and Shale subcrop and outcrop on the surface for approximately the next 30 km; associated with extended areas of cobbles and pebbles. After this the bedrock is generally deeper (at 1.5 m below the seabed surface) but with local subcropping (potentially weathered bedrock / Shale). Surface sediments remain dense to very dense slightly gravelly to gravelly Sand to sandy Gravel.

1.5.21 As the Offshore Cable Corridor approaches the Landfall (last approximately 20 km) the top of the bedrock (Claystone and Shale) is found deeper, generally greater than 4 m below the seabed surface. Surface sediments are fine to medium dense Sand. The bedrock approaches the surface, becoming rock out crop again at the Landfall, with a veneer of fine Sand.

1.5.1 The high prevalence of shallow (subcropping) and outcropping bedrock along the Offshore Cable Corridor will limit the burial tools that can be used. **Figure 1** confirms that jet trenching is unsuitable for the majority of the Offshore Cable Corridor, with the exception of shallow coastal areas in Bideford Bay where surface sediments are predominantly sand and the bedrock is <4 m depth.



Notes

1. This plan is scaled at paper size A3. If received electronically it is the recipients responsibility to print to the correct scale. Only written dimensions should be used.

P01	FINAL	RM	RW	Nov 2024
Rev	Description	By	CB	Date

Xlinks

Client: Xlinks 1 Limited

Project: Xlinks' Morocco-UK Power Project

Title: EU Sea Map (2023), designated sites and Offshore Cable Corridor burial risk - jetting

Status	Scale @ A3	Date Created
FINAL	1:1,000,000	Nov 2024

Figure Number: 1

Rev: P01

www.xlinks.co

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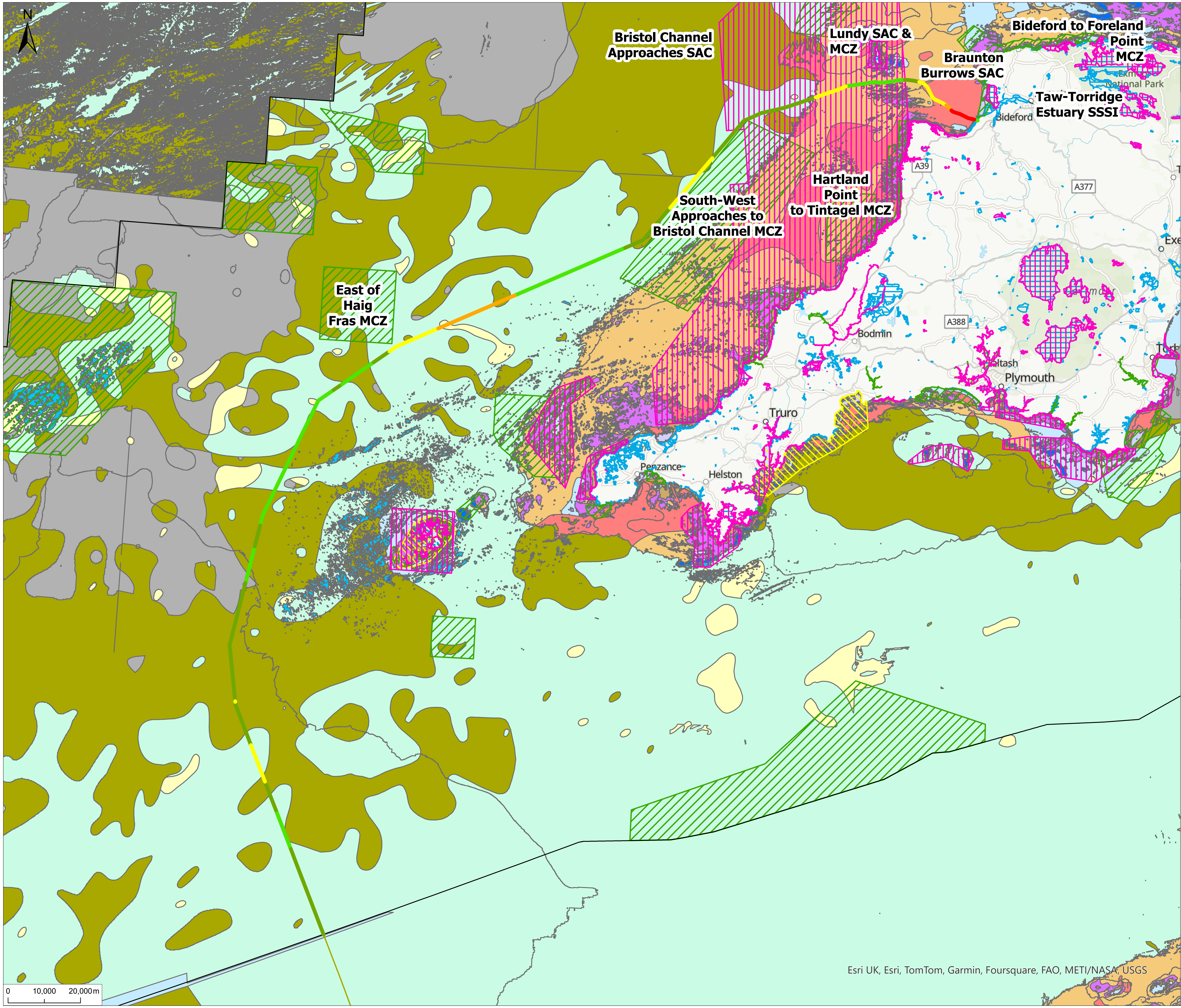

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Notes

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Legend

- Indicative Cable Centreline
- UK Exclusive Economic Zone (EEZ)
- Special Protection Areas (SPA)
- Sites of Special Scientific Interest (SSSI)
- Marine Conservation Zones (MCZ)
- Special Areas of Conservation (SAC)

Burial risk - mechanical cutters

- 1 = Low risk when using mechanical cutter (full depth burial should be easily achieved)
- 2 = Slight risk when using mechanical cutter (full depth burial may not be achieved locally / risk of heavy machinery wear)
- 3 = Moderate risk when using mechanical cutter (full depth burial may not be achieved over extensive areas)
- 4 = High risk when using mechanical cutter (full depth burial unlikely to be achieved)
- 5 = Very high risk when using mechanical cutter (highly unsuitable for burial using mechanical cutter)

EU Sea Map (2023)

- A3.1: Atlantic and Mediterranean high energy infralittoral rock
- A4.1: Atlantic and Mediterranean high energy circalittoral rock
- A4.27: Faunal communities on deep moderate energy circalittoral rock
- A4.2: Atlantic and Mediterranean moderate energy circalittoral rock
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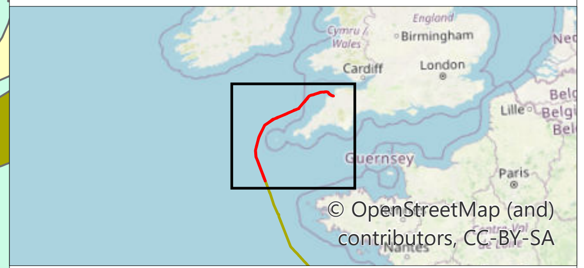

Rev	Description	By	CB	Date
P01	FINAL	RM	RW	Nov 2024

Client: Xlinks 1 Limited

Project: Xlinks' Morocco-UK Power Project

Title: EU Sea Map (2023), designated sites and Offshore Cable Corridor burial risk - mechanical cutter

Status	Scale @ A3	Date Created
FINAL	1:1,000,000	Nov 2024

Figure Number	Rev
2	P01

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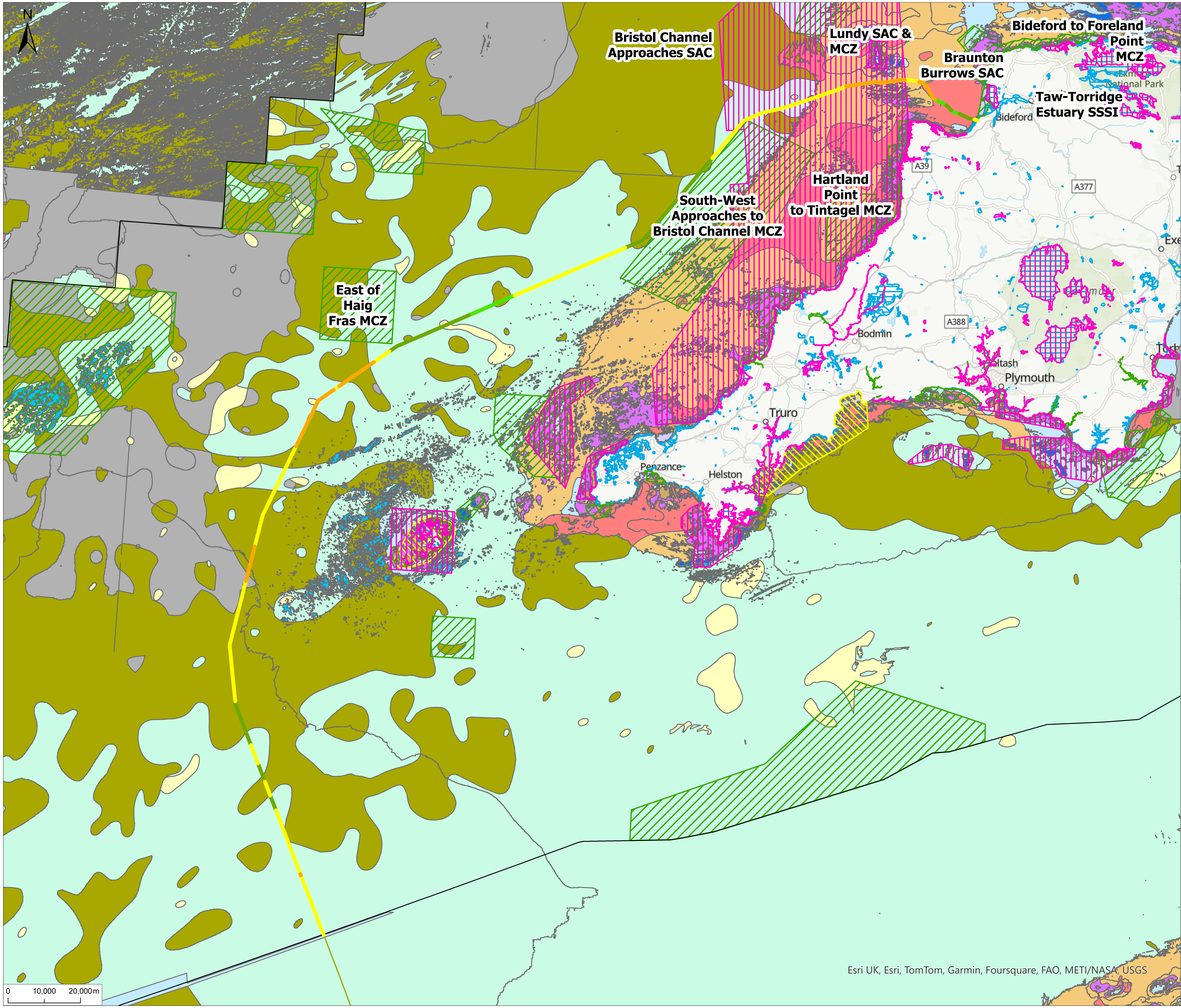

Notes
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Legend

- Indicative Cable Centreline
- UK Exclusive Economic Zone (EEZ)
- Special Protection Areas (SPA)
- Sites of Special Scientific Interest (SSSI)
- Marine Conservation Zones (MCZ)
- Special Areas of Conservation (SAC)

Burial risk - ploughing
- 1 = Low risk when ploughing (full depth burial should be easily achieved)
- 2 = Slight risk when ploughing (full depth burial may not be achieved locally / risk of heavy machinery wear)
- 3 = Moderate risk when ploughing (full depth burial may not be achieved over extensive areas)
- 4 = High risk when ploughing (full depth burial unlikely to be achieved)

EU Sea Map (2023)
- A3.1: Atlantic and Mediterranean high energy infralittoral rock
- A4.1: Atlantic and Mediterranean high energy circalittoral rock
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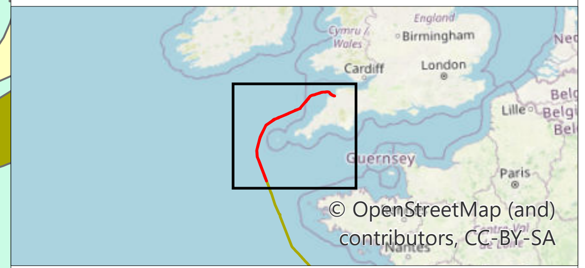

Rev	Description	By	CB	Date
P01	FINAL	RM	RW	Nov 2024

Client: Xlinks 1 Limited

Project: Xlinks' Morocco-UK Power Project

Title: EU Sea Map (2023), designated sites and Offshore Cable Corridor burial risk - ploughing

Status	Scale @ A3	Date Created
FINAL	1:1,000,000	Nov 2024

Figure Number: 3

Rev: P01

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1.5.2 The use of cable ploughs may also be limited, and initial assessments indicate that mechanical trenching (mechanical cutter mounted on a remotely operated vehicle) is expected to be the main burial method in UK waters. **Figure 2** and **Figure 3** provide an indication of the most appropriate burial tool (via likelihood of achieving target burial depth) for each section of the Offshore Cable Corridor.

1.5.3 This CRBA is outline at this stage and has been completed to help define the maximum amount of cable protection that is expected to be needed. This outline plan provides a starting point for the pre-construction CBRA that will be submitted in line with the deemed Marine Licence (DML) condition.

Existing and Planned Infrastructure

1.5.4 Forty-seven cables cross the Offshore Cable Corridor. Of these:

- 19 are operational (or in installation) fibre-optic telecommunication cables;
- 1 is a planned power cable;
- 5 are out of service fibre-optic telecommunication cables;
- 1 is a historic out of service, co-axial telecommunications cable; and
- 21 are historic out of service telegraph cables.

1.5.5 The need to cross operational infrastructure will necessitate the use of cable protection, as the Proposed Development will cross over the top of the existing and planned subsea cables; noting for each existing or planned cable there will be a crossing structure for Bipole 1 and Bipole 2. 40 in-service crossing structures will require cable protection. The Applicant is engaging with all the asset owners and discussions are ongoing with regards to crossing agreements. Where cables are out of service negotiations to cut the cables are proceeding, the assessment considered that if agreement is not reached then up to 10 out of service cable crossing structures may also be required (5 out of service telecommunication cables x 2 Bipoles).

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

Shipping and Navigation

1.5.7 A shipping and navigation assessment has been carried out to identify all potential threats to the cable that could influence the target burial depth. The main risk to the Proposed Development is from vessel anchors; either through anchor dragging or emergency anchoring incidents.

1.5.8 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 were not sufficiently buried or protected.

1.5.9 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 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.

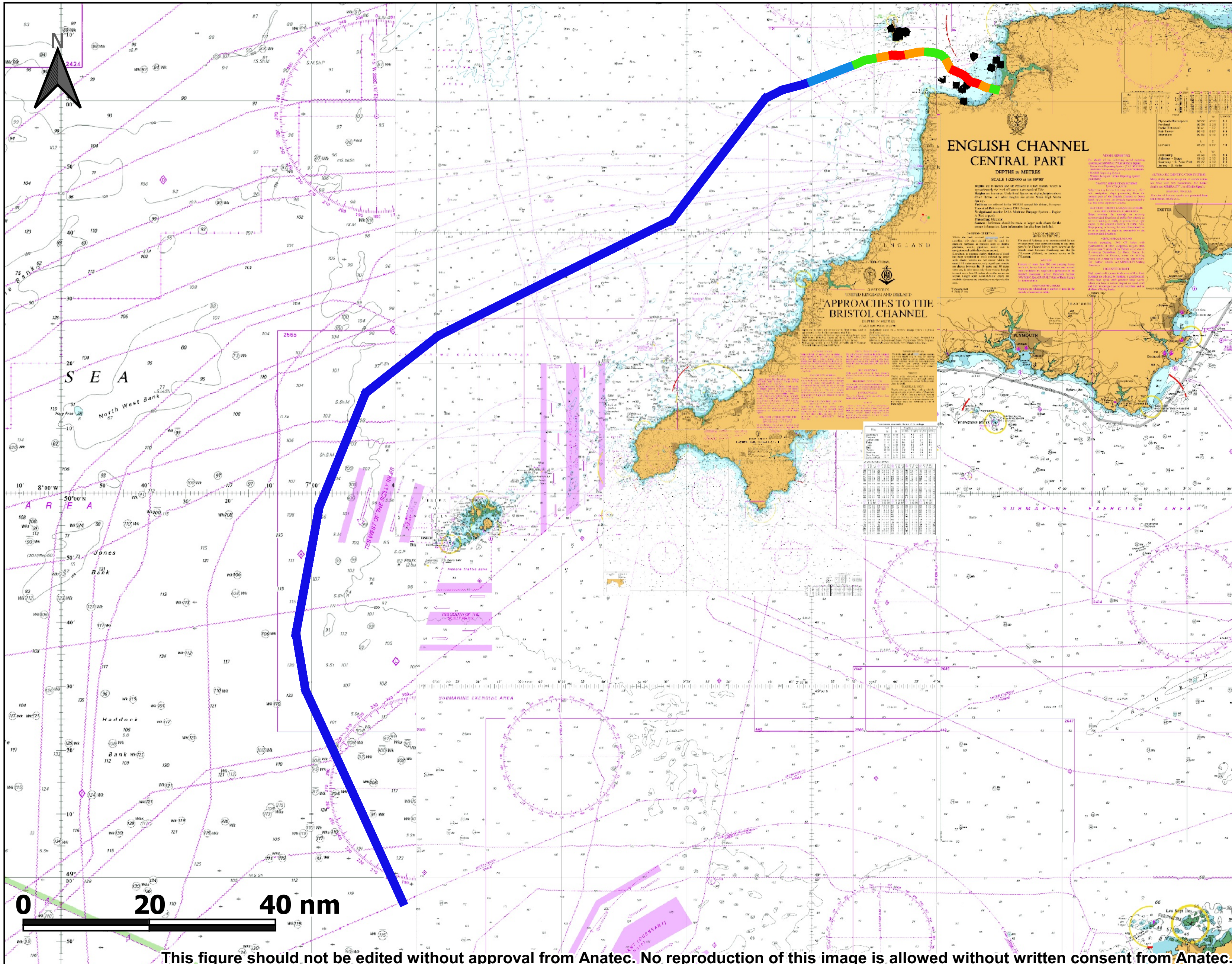
1.5.10 Probabilistic assessment is used to define the risk to a cable from vessel anchors. The assessment considers the frequency of vessel traffic, type of vessel, size and type of deployed anchors, bathymetry and ground conditions (i.e., sediment type and cohesiveness). The dead weight tonnage (DWT) 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 the distance from the cable. The probabilistic assessment is carried out for different depths of burial to determine the likelihood of an anchor striking the marine HVDC cables.

1.5.11 As the Proposed Development requires two bipoles there is a heightened risk to the marine HVDC cables from vessels dragging anchors. As such, preliminary assessments have been undertaken to ensure that risk from anchoring is understood. A summary of the key findings is presented below.

1.5.12 There are several IMO adopted Traffic Separation Schemes (TSS) in place near the Offshore Cable Corridor, notably the West and South of the Isles of Scilly TSS and the Off Land's End TSS. The area surrounding these TSSs has a high density of shipping due to it being on the approach to the western English Channel, a major shipping route. Cargo vessels are prominent throughout the whole Offshore Cable Corridor, with notable activity to the northwest of St Ives as well as the Landfall, due to vessels transiting to and from the multiple TSS lanes surrounding the Isles of Scilly. Additionally, activity towards the south of the Offshore Cable Corridor was noted from vessels routing through the English Channel. Passenger vessels were most active in the mid-section of the Offshore Cable Corridor, northwest of St Ives through the Off Land's End TTS.

1.5.13 Vessels with the largest DWT (>50,000) were most prominent in the south of the Offshore Cable Corridor, on approach to the English Channel. Vessels of lower DWT (<10,000) were present throughout the Offshore Cable Corridor but were most prolific closer to the coast and towards the north. The most common DWT range for commercial vessels was between 10,000 and 15,000 DWT (15%).

1.5.14 Analysis of AIS data (for the period September 2022 to August 2023) noted that commercial vessels (tugs, military vessels, research vessels and cargo vessels) anchor within Bideford Bay, near the Landfall. The majority of vessels recorded at anchor, within the data set analysed, were recorded around the island of Lundy, which is situated approximately 17 nautical miles northwest of the Landfall. From this data, initial assessments conclude that the likelihood of a vessel dragging an anchor over the Offshore Cable Corridor (assuming the cable is unburied) is one incident every 18,300 years. Areas of higher risk correspond to the areas closer to where anchoring currently occurs e.g. within Bideford Bay and adjacent to the island of Lundy (see **Figure 4**). The risk of emergency anchoring is relatively higher at one incident every 5,000 years. The high risk areas are located along the parts of the Offshore Cable Corridor north of the Isles of Scilly and adjacent to the Cornwall and Devon coastline, due to transiting commercial vessels entering /leaving the TSSs and active fishing vessels (see **Figure 5**).



Legend

Anchored Vessel Track

Anchor Dragging Annual Frequency (per 500m)

- < 6.9e-021
- 6.9e-021 - 4.8e-014
- 4.8e-014 - 7.4e-010
- 7.4e-010 - 4.5e-008
- 4.5e-008 - 1.5e-005

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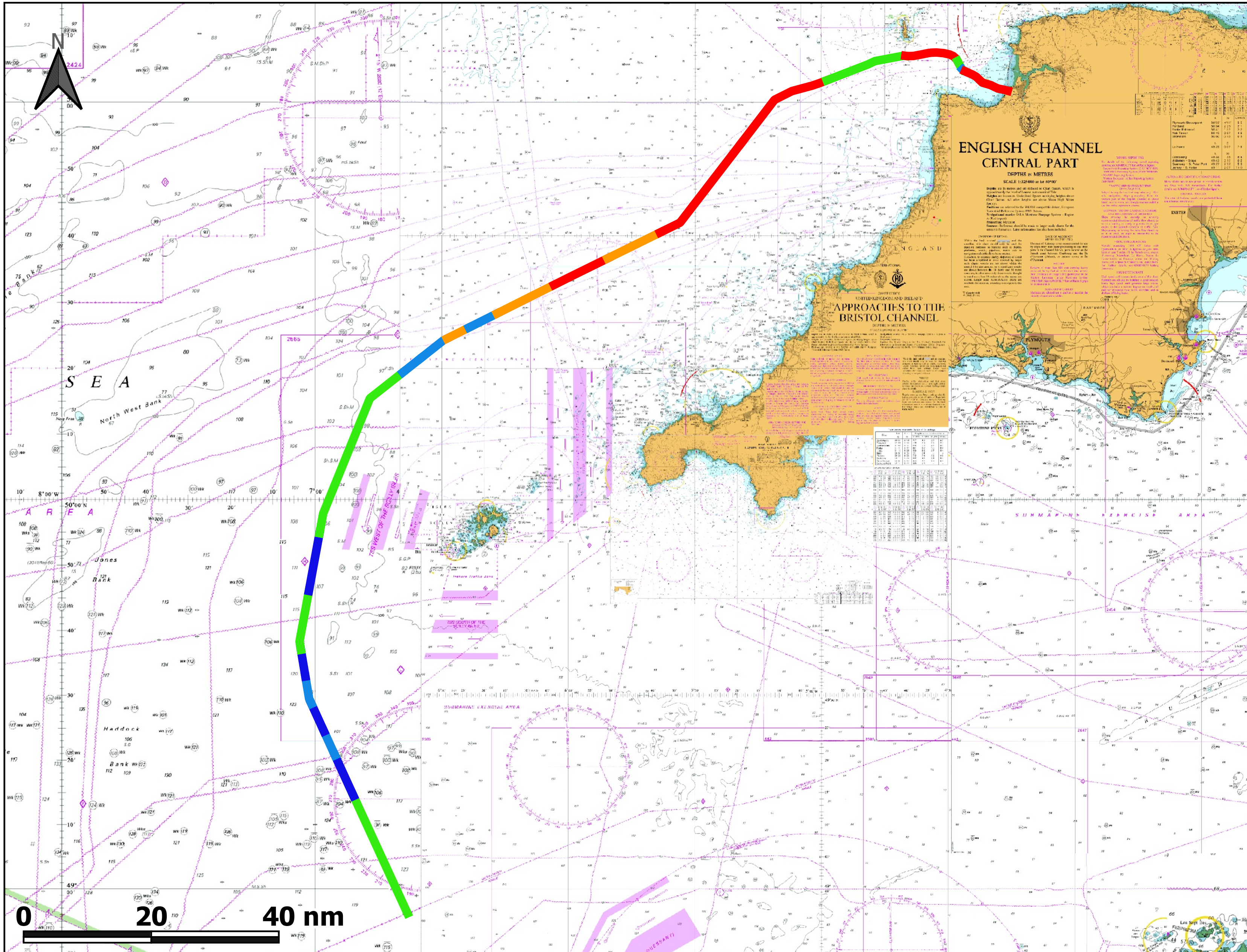
Project:
A4884 Xlinks Cable Burial Risk Assessment

Figure Title:
Figure 4 - Annual Anchor Dragging Frequency (Unburied)

Date: 12/11/2024	**Drawn:** MI	**Checked:** LC

Coordinate System: WGS 84 / World Mercator



Legend

Emergency Anchoring Annual Frequency (per zone)

- < 2.2e-006
- 2.2e-006 - 2.7e-006
- 2.7e-006 - 5.6e-006
- 5.6e-006 - 1.1e-005
- 1.1e-005 - 4.7e-005

anatec

Project:
A4884 Xlinks Cable Burial Risk Assessment

Figure Title:
Figure 5 - Annual Emergency Anchoring Frequency (Unburied)

Date: 12/11/2024	**Drawn:** MI	**Checked:** LC

Coordinate System: WGS 84 / World Mercator

1.5.15 The frequency of anchor strike due to an anchor dragging or emergency anchoring if the marine HVDC cables remain unburied was estimated to be reasonably probable. This risk would be reduced by burying the marine HVDC cables; although given the sediment conditions along the route are mainly dense sand / gravel, high shear strength silt/clay or bedrock, which limits the penetration depth of anchors, this burial could be relatively shallow.

1.5.16 Based on the known soil types, the minimum depth of lowering to provide protection from anchors is considered to be approximately 0 m to 1.1 m, noting that in the high shear strength silt / clay or bedrock, anchor penetration might be limited.

1.5.17 For the Proposed Development, the final version of the shipping and navigation assessment will be carried out post-consent. The methodology used will align with the Carbon Trust (2015) best practice guidance. 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 further assess the risks associated with anchor strikes and shipping density based on up-to-date data. This will inform the final bipole separation distance, 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

1.5.18 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 0.2 m in sand and/or gravel, and up to 0.4 m in mud / very soft clay. Demersal (otter) trawlers (single and twin) have the potential to penetrate up to 0.25 m in sand and/or gravel, and up to 0.35 m in mud / very soft clay, while the depth of demersal seiners is expected to be minimal (less than 2 cm).

1.5.19 Review of AIS data (for the period September 2022 to August 2023) identified on average eight fishing vessels per day intersect the Offshore Cable Corridor. Most vessels (64%) were engaged in fishing, rather than transiting. Fishing vessels were more prevalent in the northern half of the Offshore Cable Corridor, off the Devon and Cornwall coastline, with the most common gear types being demersal and beam trawls.

1.5.20 Based on the known soil types, the minimum depth of lowering to provide protection from all fishing is considered to be approximately 0 m to 0.5 m, noting that in the high shear strength silt / clay or bedrock, penetration by fishing gear will be limited.

1.5.21 The pre-construction CBRA will 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

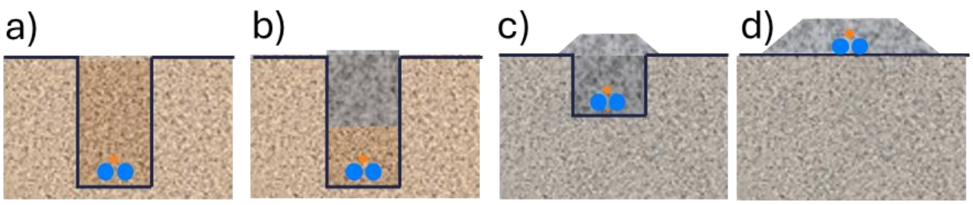
1.5.22 There are no charted dredged channels or aggregate extraction areas within the Offshore Cable Corridor. The closest aggregate extraction area is approximately 19 nautical miles north of the Offshore Cable Corridor, at Nobel Banks in the Bristol Channel.

1.5.23 On review of the 12-months of AIS data, one dredging / subsea military vessel was recorded every five days transiting nearshore and through the TSS lanes to the Isles of Scilly.

1.5.24 Subsequently, dredging activities will not be a constraint for cable burial.

Outline Burial and Protection Recommendations

1.5.25 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. **Figure 6** presents the various cable burial and protection scenarios that may be encountered along the Offshore Cable Corridor.



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.

Figure 6. Cable burial and protection scenarios

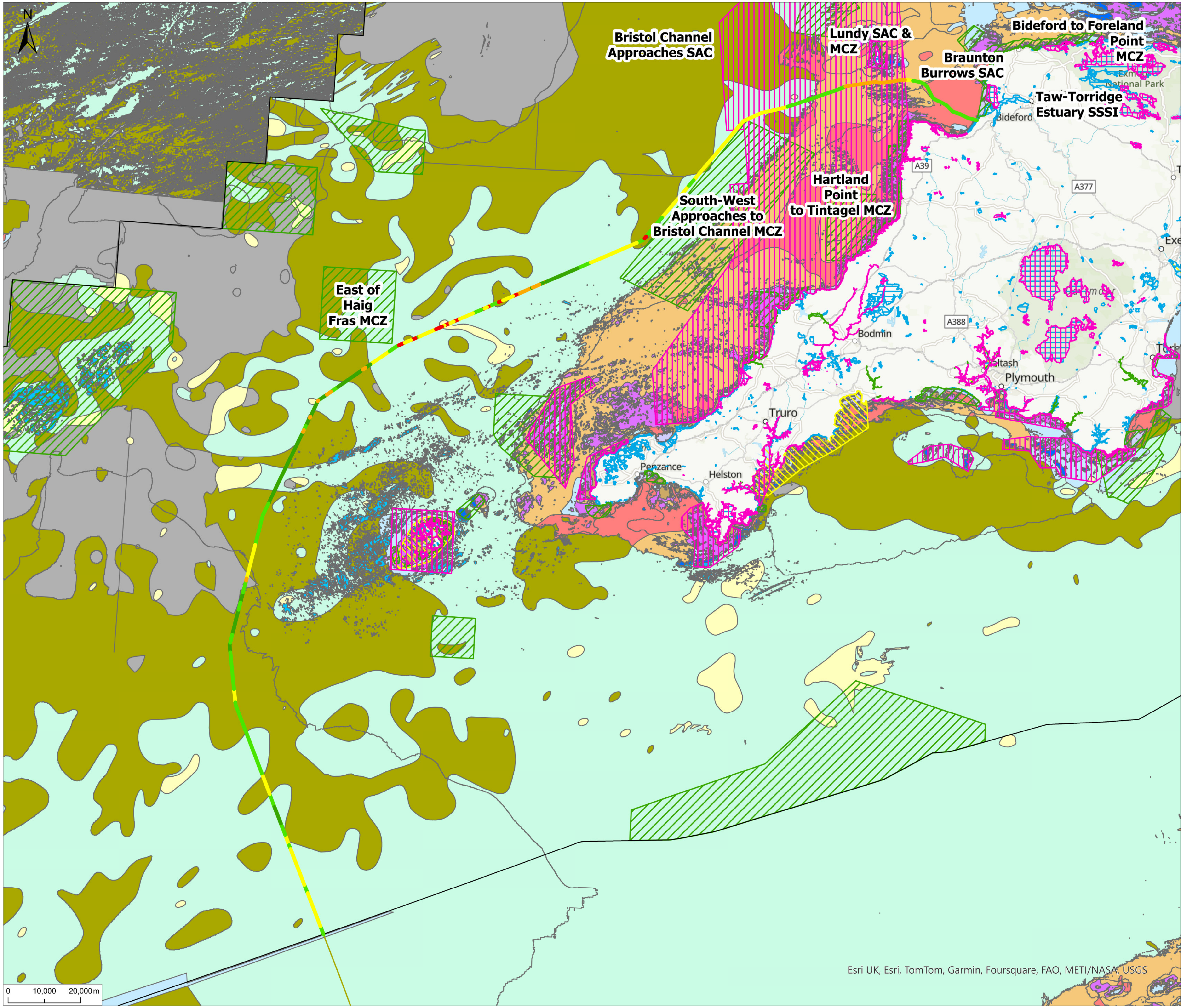
1.5.26 The Applicant has committed to burying the marine HVDC cables where possible (Embedded Mitigation, OFF01). Information on seabed conditions provided by the geophysical and geotechnical surveys has indicated a high prevalence of shallow (subcropping) and outcropping bedrock along the Offshore Cable Corridor which will limit the burial tools that can be used, and full burial may not be possible.

1.5.27 The initial threat assessment identified that a minimum of 0.5 m burial should be targeted to avoid fishing interaction and seabed mobility and up to 1.1 m to avoid anchor strikes. The target burial depth detailed in Embedded Mitigation, OFF01 is 1.5 m, noting that the target depth will only be achieved if ground conditions allow. Where full burial is not possible, additional protection would be required i.e., to provide the same level of protection as would result from burial in sediment.

1.5.28 Embedded Mitigation OFF02 commits to keeping cable protection level with the seabed, as far as possible, and up to a maximum of 1 m high above seabed level, excluding at crossings.

1.5.29 **Figure 7** presents a risk-based assessment of where cable protection may be required. Whilst it is based on the analysis of ground conditions from the geophysical and geotechnical survey, it considers generic burial tools and therefore is indicative at this stage. The assessment will be 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 Principal Offshore 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.

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



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Indicative / estimated rock placement (average t/m across the OCC segment)

- 1 - extremely little rock placement expected (<1.2 t/m)
- 2 - little rock placement expected (1.2-2.4 t/m)
- 3 - some rock placement expected (2.4-3.6 t/m)
- 4 - moderate degree of rock placement expected (3.6-4.8 t/m)
- 5 - extensive rock placement expected (4.8-6 t/m)
- 6 - high degree of rock placement expected (6-7 t/m)

EU Sea Map (2023)

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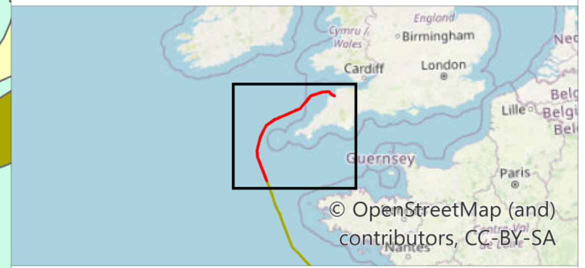

P01	FINAL	RM	RW	Nov 2024
Rev	Description	By	CB	Date

Xlinks

Client: Xlinks 1 Limited

Project: Xlinks' Morocco-UK Power Project

Title: EU Sea Map (2023), designated sites and indicative rock placement along Offshore Cable Corridor

Status	Scale @ A3	Date Created
FINAL	1:1,000,000	Nov 2024

Figure Number: 7

Rev: P01

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