The Great Grid Upgrade

Sea Link

Sea Link

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Sea Link Stage 2

Cable Burial Risk Assessment

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EXECUTIVE SUMMARY

This report presents the results of Red Penguin's Cable Burial Risk Assessment (CBRA) for the marine cable section of the NGET Sea Link HVDC point-to-point HVDC transmission link between Pegwell Bay in Kent and Suffolk (Figure 1). This cable system is intended as a reinforcement of the national transmission network and the CBRA has taken this into account.

This report builds on the Stage 1 CBRA released in December 2022 (RPA 155). The route has been optimised after defining the Suffolk landfall as Aldeburgh and maintaining the Kent landfall as Pegwell Bay. The route has been finalised as part of the Design Freeze 3 (DF3) analysis of the project, undertaken during May 2024.

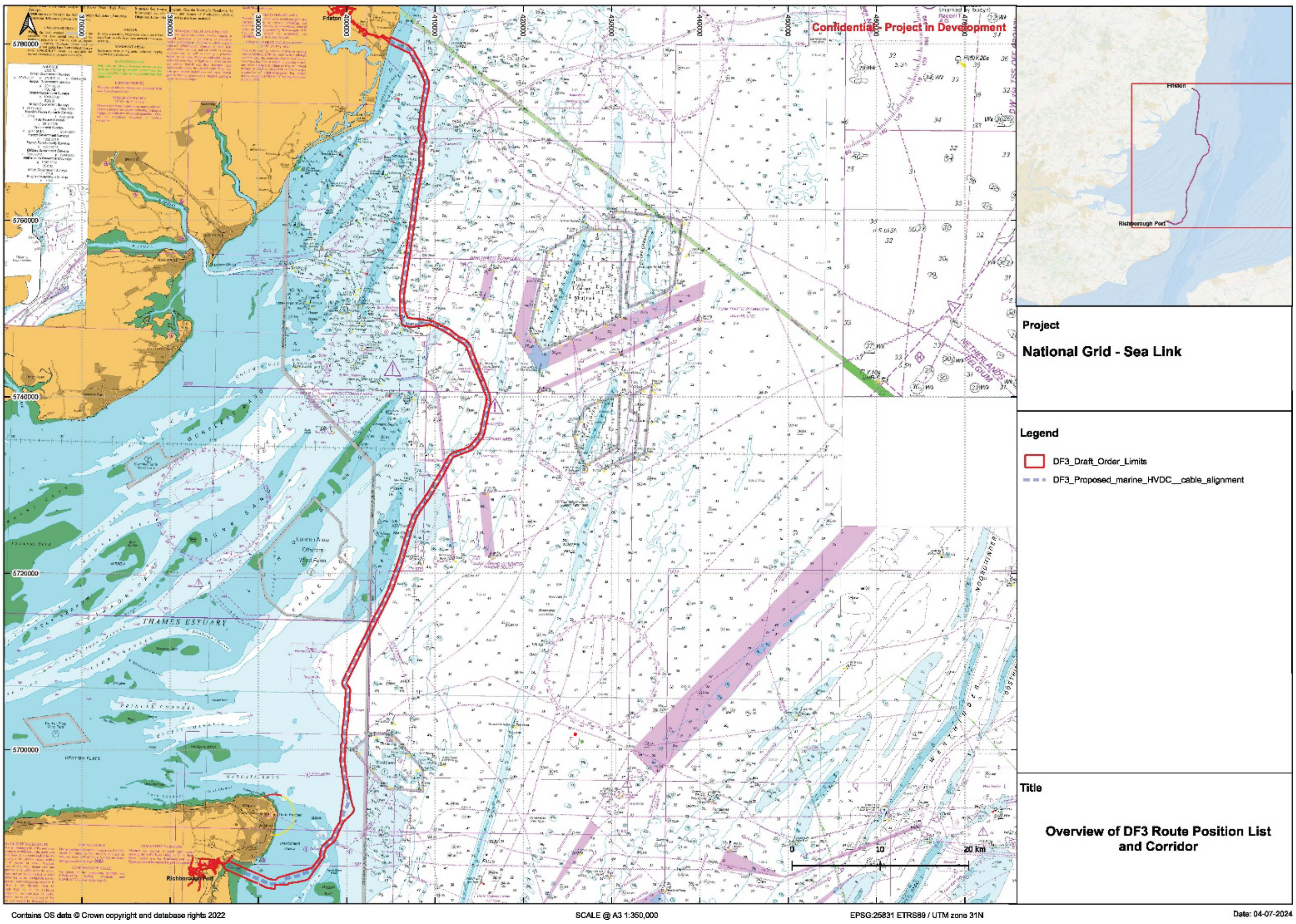


Figure 1 Sea Link HVDC Cable Route – DF3 Route Position List and Corridor

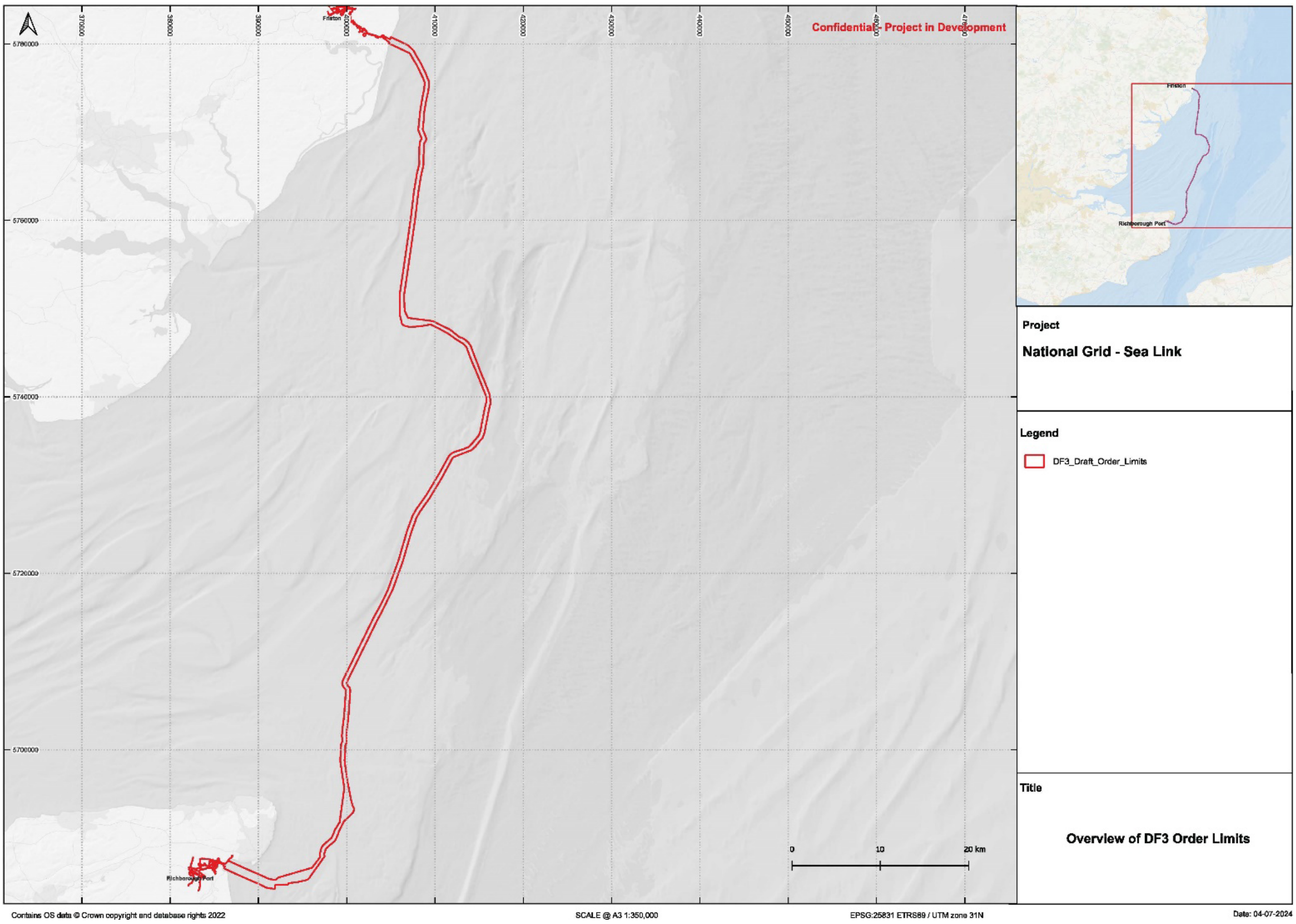


Figure 2: Sea Link HVDC Cable Route – DF3 Order Limits Overview

The marine system will comprise a 2GW, 525kW HVDC system comprising of 2 No. HVDC power cables and 1 No. FO cable bundled and protected by a trench, extending between the landfall Transition Joint Bays (TJB). The emerging installation at the landfalls will be by trenchless solutions, although the recommended solutions are likely to be based on Horizontal Directional Drilling (HDD) solutions.

The Key Hazards are summarised in the following table, ranked by risk:

Table 1 Key Hazards

Rank	Description	Hazard	Risk
1	Proximity to SUNK Deepwater anchorage / Pilot station	Anchor dragging / anchoring outside anchorage	Damage to cables
2	Marine traffic Volumes and shipping channels	Emergency anchoring / unplanned deployment – strike rate	Damage to cables
3	Sediment mobility	Changes in burial depth	Exposed cables / thermal issues due to depth of burial
4	Bedrock subcrops / outcrops	Inadequate protection	Damage to cables
5	UXO – Pegwell Bay	High number of pUXO obstructions on route	Additional work to clear route and accidental detonation during installation activities (danger to equipment / personnel and environment)
6	Fishing	Removal of seabed cover over the life of the asset	Reduced burial over time, snagging
7	Coastal flooding – Pegwell Bay	Flooding of trenchless solution and TJB	Cable faults due to unplanned water ingress
8	Future proofing for asset life and follow-on developments	Deepening and widening of shipping channels to accommodate larger vessels and expanded ports	Disturbance of cables, increased traffic over cables, increased risk of exposure and damage to cables.
9	Seasonal Restrictions	Schedule delays for installation and during the operational life of asset.	Installation of asset and planned maintenance restricted to a 6 to 7 month working window.

Recommended Depth of Lowering (Top of Product)

Based on the identified Key Hazards the recommended Depth of Lowering (DOL) to the Top of Product (TOP) for the preferred Option is shown below:

Table 2 Recommended Depth of Lowering (Top of Product)

Start KP	End KP	Section Distance (km)	DOL to Top of Product (relative to undisturbed seabed, or NMRL whichever is the lower	Further Detail
0.000	1.524	1.524	N/A	Landfall at Aldeburgh, Suffolk, including trenchless technique requirements.
1.524	6.518	4.994	1.50	
6.518	14.094	7.576	1.00	
14.094	14.410	0.316	1.50	
14.410	15.215	0.805	1.00	
15.215	17.915	2.700	1.50	
17.915	26.342	8.427	1.00	
26.342	31.587	5.245	1.50	
31.587	34.075	2.488	1.00	
34.075	35.089	1.014	1.50	
35.089	38.550	3.461	2.00	
38.550	40.103	1.553	2.50	
40.103	42.806	2.703	2.00	
42.806	43.301	0.495	2.50	
43.301	46.302	3.001	2.00	
46.302	49.828	3.526	2.50	
49.828	54.871	5.043	2.00	
54.871	56.887	2.016	2.50	
56.887	57.887	1.000	2.00	
57.887	68.706	10.819	1.50	
68.706	76.644	7.938	1.00	
76.644	81.301	4.657	1.50	
81.301	85.304	4.003	2.00	
85.304	92.313	7.009	2.50	
92.313	96.343	4.030	2.00	
96.343	113.883	17.540	0.50	Pre-sweep and bedrock across this location
113.883	120.469	6.586	1.50	
120.469	121.380	0.911	N/A	Trenchless technique to avoid sensitive habitats at Pegwell Bay landfall.

Base case is 1.0m DOL to TOP in sediment, 0.5m DOL to TOP in rock outcrop/subcrop.

Where competent bedrock, (Coralline Crag, Chalk and flint beds) subcrops or outcrops the seabed, or there is a thin veneer (<0.2m), the DOL to TOP is reduced to 0.5m and the preferred method of protection is by mechanical trenching. Note that where there is an undulating bedrock surface, with variable cover depth between 0.5 m to 1.0 m, a pre-sweep followed by 0.5m DOL has been assumed.

The maximum recommended depth of lowering has been calculated as 2.5 m within the areas of highest risk in the vicinity of the SUNK deepwater anchorage and the shipping channels associated with the SUNK Vessel Traffic System (VTS) and the southeastern approaches to the Outer Thames Estuary adjacent to the North Foreland.

The full CBRA spreadsheet is found in Section 10.3 and the Shapefiles created for the Recommended DOL to TOP intervals and different risk classes are found in Section 10.4.

TABLE OF CONTENTS

TABLE OF FIGURES

Table 3 Abbreviations

AIS	Autonomous Identification System
ALARP	As Low As Reasonably Possible
BGS	British Geological Survey
BSBL	Below SeaBed Level
CBRA	Cable Burial Risk Assessment
CIGRE	The International Council on Large Electric Systems
CLV	Cable Lay Vessel
CPT	Cone PeneTrometer
DCO	Development Consent Order
DDV	Drop-Down Video
DOC	Depth of Cover
DOL	Depth of Lowering
DP	Dynamic Positioning
DWT	Dead Weight Tonnage
EIA	Environmental Impact Assessment
EMF	Electro Magnetic Field
ES	Environmental Statement
FLO	Fisheries Liaison Officer
GW	GigaWatt
HDD	Horizontal Directional Drilling
HVDC	High Voltage Direct Current
ICNIRP	International Commission on Non-Ionising Radiation Protection
ICPC	International Cable Protection Committee
IMR	Inspection, Maintenance and Remediation (Repair)

IS	In Service
km	Kilometre
KP	Kilometre Point
kPa	Kilopascal
kV	Kilovolt
LAT	Lowest Astronomical Tide
LFP	Landfall Point
MBES	Multibeam Echosounder
MMO	Marine Management Organisation
MSBL	Mean Seabed Level
MSL	Mean Sea Level
NE	Natural England
NGET	National Grid Energy Transmission
NRA	Navigational Risk Assessment
NSIP	Nationally Significant Infrastructure Project
OC	Open Cut
ODN	Ordnance Datum Newlyn
OFTO	Offshore Transmission Operator
OOS	Out Of Service
OSGB	Ordnance Survey Great Britain (OSGB36 – Land Datum)
OTS	Offshore Transmission Supplier
OWF	Offshore Wind Farm
PLGR	Pre-Lay Grapnel Run
PLB	Post Lay Burial

ROV	Remotely Operated Vehicle
ROTV	Remotely Operated Towed Vehicle
RPL	Route Position List
SBP	Sub Bottom Profiler
SLB	Simultaneous Lay and Burial
SoW	Scope of Work
SSS	Side Scan Sonar
TCE	The Crown Estate
TJB	Transition Joint Bay
TOP	Top of Product
TSS	Traffic Separation System
UKHO	United Kingdom Hydrographic Office
(p)UXO	(potential) Unexploded Ordnance
VC	VibroCore
VMS	Vessel Monitoring System
VTS	Vessel Traffic System

1 INTRODUCTION

1.1 Background

National Grid Electricity Transmission (NGET) is developing an offshore HVDC cable system on the Southeast coast of the UK. The route under development is from to Suffolk (Friston) to Kent, Pegwell Bay (Richborough). Red Penguin Associates Ltd (Red Penguin) have been awarded the Marine Consultant Contract, to support NGET in the delivery of the survey works, route development and the CBRA, as well as miscellaneous technical marine support.

1.2 Stakeholders

As well as the consenting authorities such as the Crown Estate and the MMO, there are numerous stakeholders both at the landfalls and offshore. Of note onshore are the RSPB at Aldeburgh. Kent Wildlife Trust are the key stakeholders at the landfall within Pegwell Bay. The NEMO Link Interconnector (operated by National Grid Ventures and Elia) and Thanet OWF OFTO export cables are in close proximity to the planned landfall and will be by-passed utilising the trenchless solution.

The nearshore approaches to the landfalls have key Stakeholders who own subsea infrastructure, the Aldeburgh landfall incorporates a sluice owned by the Environment Agency as well as numerous out of service cable systems running from the UK to Netherlands, believed to be owned by BT.

There are significant stakeholders offshore who own power cables, telecom and FO cables. BT are a significant stakeholder with both In- and Out-Of- Service (OOS) cables crossed by the corridor. In addition, there are gravel extraction areas, traffic separation systems and MPZs along the route.

Future HVDC cable systems and HVAC OFTO export cables are currently under planning by stakeholders which are planned to cross the Sea Link route. The Stakeholders are summarised in Section 10.1.

1.3 Scope of Work

The Red Penguin Scope of Work is to ensure the technical feasibility of the route in balance with the consenting/environmental feasibility, based on the collected benthic, bathymetric, geophysical, and geotechnical survey data acquired during and after the seabed survey. The cable route shall be developed considering the installation techniques and impact on the life of the cable once installed, via this CBRA.

This report is the final CBRA report prepared to inform the Design Freeze 3 process (post Statutory Consultation). The report builds on the CBRA developed for non-Statutory Consultation and presents the final assessment of the route which has been modified by a subsequent Burial Assessment Study.

2 METHODOLOGY

2.1 Introduction

The CBRA has been compiled for the complete subsea cable route, from TJB to TJB, using the best industry practice. The document has a hybrid structure, drawing on the Carbon Trust CBRA guidance document and augmented by relevant additional information which adds value to the risk assessment process specifically for HVDC Offshore Transmission Supplier (OTS).

The CBRA aims to evaluate and quantify the potential risks to Sea Link over the lifetime of the system, to inform the cable protection strategy, including the assessment and optimisation of the recommended DOL. The full CBRA spreadsheet is found in Section 10.3 and should be referred to for the detailed derivation, as well as the Recommended Depth of Lowering.

2.2 Carbon Trust Guidance

The Carbon Trust Guidance CBRA Method is an '*iterative and repeatable process that defines a target Depth of Lowering which is practically and economically achievable whilst providing adequate protection*'.

'The method starts with the assumption that it is impractical to protect a cable from all possible threats, e.g. it is not sensible to specify a Depth of Lowering to protect from a 20-tonne anchor if the threat occurs only once in every ten thousand vessel crossings. The method produces a probability of a strike on the cable at the selected Depth of Lowering and is then used iteratively to find the optimum Depth of Lowering, which is acceptable to all parties.'

The approach analyses the site conditions in terms of natural and anthropogenic hazards and then develops a risk register which is used as the basis for specifying the recommended target depth of lowering, as input to cost reduction for the project.

The vessel traffic in the vicinity of the cable is investigated to determine the proportion of the vessels which carry anchors which are large enough to exceed the recommended target depth of lowering and could potentially damage the cable by anchor strike. The probability of an anchor strike is then calculated and assessed by the key stakeholders, in terms of acceptable levels of risk to the cable during lifetime of the cable.

Following on from the probability risk assessment a recommended depth of burial for protection is quantified based on the geological conditions and the hazards to the cable.

The Carbon Trust Guidance does not address all the hazards which are present and may influence the risk to cable burial, such as the presence of UneXploded Ordnance (UXO), planned developments through the life of the cable, regulatory change, cable installation risks (cable handling), and the risks posed by different burial methods and tools.

The following assumptions have been made in determining the strike return period.

Table 4 Strike Return Period Assumptions

Term	Assumption	Basis
P_{Wd}	1	The entire route is below 50m water depth, with the deepest part showing the largest vessel traffic
$P_{traffic}$	0.5, 0.75 or 1	We assigned a value of 0.5 where the cable was not in a shipping lane (where we assigned 0.75) or proximate (<1000m) to an anchorage (where we assigned 1)
D_{ship}	150	Based on the average anchor drag observed by Tennet in real world trials in 2013
V_{ship}	4 knots (7.4kph)	Based on a conservative approach and observation of observed speeds close to the sunk anchorage (highest risk area)
$P_{incident}$	$2 * 10^{-4}$	Based on DNV, October 2010, Recommended Practice DNV-RP-F107, Risk Assessment of Pipeline Protection

2.3 Hybrid Approach

As requested by NGET, this CBRA is based upon the Carbon Trust guidance, which was a development of its predecessor, the Burial Protection Index (BPI) process, used for many years in the subsea cable industry. Whilst improving the BPI and introducing interpretation of AIS data and heat maps, among other factors, to improve the anchor risk assessment, the Carbon Trust CBRA guidance is recognised as having limitations in that its purpose included reducing the cost of offshore wind industry developments. These limitations, i.e. what is economically achievable and adequate protection are not considered as relevant to Sea Link or other grid reinforcement (or interconnection) projects which reasonably require a higher degree of route security and recognition of the longer design life (e.g. >40 years) by comparison to that of an offshore wind project (circa 25 years), and consequently a more interrogative and broader assessment of the risks is considered appropriate.

This CBRA therefore draws upon the hazards and risk assessments identified in additional studies which have been undertaken for the scoping of the marine cable boundary corridor, consequently providing a more extensive identification of hazards prevalent to the cable route and thus to the installed cables. These additional elements include optimised routeing and landfall assessments, UXO risk assessments, nearshore geomorphological assessments, as well as regional geological assessments. Red Penguin has significant feedback reports and first-hand observation from installation experience gained on other interconnector and grid link projects in the southern North Sea, which adds further value to the cable burial hazard identification and assessment process.

2.4 Assessment Methodology

The assessment methodology applied to both the preferred and alternative routes is as follows:

- Review the available site data from the survey work undertaken specifically for Sea Link, as well as open-source data available from UKHO, BGS and Third-Party Stakeholders, studies related to fishing and shipping, hydrosedimentary studies, route optimisation, etc. etc. Complete a data gap analysis.
- Review the route optimisation undertaken in-house.
- Assessment of site conditions including bathymetry, geomorphology, shallow geology, and geotechnical conditions (ground model), seabed features, magnetometer targets, existing and planned infrastructure, and areas of environmental importance.
- Undertake a Hazard Assessment of the route to produce the Risk Register of Primary and Secondary Hazards for both Natural and Anthropogenic Hazards, including mitigation measures e.g. burial, external protection, micro-routing.
- KPs of the corridor route were assessed in terms of polygons of 100m to 1500m in size.
- Dependent on changes in sedimentology on the route. Assessment of vessel activity and anchor strike period is based off individual polygons containing relevant AIS data.
- Assessment of shipping activity occurring within the route corridor with Probabilistic Assessment of anchor-strike as per Carbon Trust Guidance.
- Production of CBRA report and associated GIS deliverables to present the recommended target depths of lowering and potential problematic areas for Protection Works.

2.5 Updates Between the DF2 and DF3 CBRA Compilation

Additional information has been provided between the DF2 and DF3 CBRAs as indicated below:

- Navigation Risk Assessment AIS data supplied by XODUS and processed using the hybrid format
- Insurance value set at $1x10^{-4}$

- Stakeholder input into the routing in the vicinity of the SUNK deepwater anchorage
- Revision of CBRA using NRA AIS Data

In light of the responses to the Statutory Consultation, the remodelling of the CBRA using the NRA AIS dataset, this CBRA report has continued to be based on the results of the initial analysis, to maintain a conservative approach, given the high-risk levels presented by the current and expected volumes of marine traffic.

2.6 Data Exclusions in this DF3 CBRA Compilation

To date (November 2024), the Geotechnical Campaign for the Additional Marine Surveys have been completed, but final results are not yet available, nor has the integrated geophysical and geotechnical report been compiled by the Contractor, which will cover the DF3 route through the areas of route improvement. As such the geological ground model is inferred on the extrapolation of the known conditions, from the BGS regional mapping of the southern North Sea.

3 METHODOLOGY

3.1 Data Sources

The following table presents the supplied and open-source documents and data used to perform this CBRA:

Table 5: List of Data Sources

Reference No.	Title	Date	Source
1	MMT Integrated Geophysical and Geotechnical Survey Report	2022	MMT
2	MMT Geotechnical Report	2022	MMT
3	MMT Benthic and Environmental Survey Report	2022	MMT
4	OI Intertidal and Landfall Survey Report	2024	OI / SEP
5	NEXT Additional Marine Survey Report (Geophysical) and data	*In production*	NEXT
6	NEXT Additional Marine Survey Report (Geotechnical)	*In production*	NEXT
7	UKHO Bathymetric data	2022	Open source - UKHO
8	AIS vessel data	2022	Marine Traffic
9	ICES Fishing data	2022	Open source - MMO
10	Navigational Risk Assessment & AIS data (2022 - 2023), VMS fishing points (2017 – 2021) and vessel sighting data (2011 – 2019)	2023	Xodus Group
11	UXO DTS: 9160-UXOTARA-NG Sea Link Red Penguin V2.0	2021	6Alpha

Reference No.	Title	Date	Source
12	UXO DTS post survey review: EES1339 – Desk Study for Potential UXO Contamination – Sea Link Cable Route	2022	RPS
13	Detailed Unexploded Ordnance Risk Assessment (Friston & Richborough)	2023	Safelane Global
14	Sizewell C Project – Coastal Geomorphology and Hydrodynamics: Synthesis for Environmental Impact Assessment (MSR1 – Edition 4)	2023	EDF Energy
15	Cefas_EDF_Coast_Coralline_Thorpeness.shp	2023	CEFAS
16	Beach Walkover Report	2021	Red Penguin
17	Landfall Options Study – Technical Note TN-01	2022	Tim Riggall Associates
18	Nearshore Geomorphology Study	2022	Red Penguin
19	KIS-ORCA cable crossings database	Live database (online)	KIS-ORCA Seafish
20	Environmental Areas of Interest and Marine Constraints	Live database (online)	AECOM GIS
21	Solid Geology 1:250 000 Series	Live database (online)	BGS Open Source
22	Quaternary Geology 1:250 000 Series	Live database (online)	BGS Open Source
23	The Geology of the Southern North Sea – UK Offshore Regional Report	1992	BGS Publication
24	Alignment Sheets Pegwell Bay (internal reference only)	2022	Third Party Stakeholder – NEMO Link

Reference No.	Title	Date	Source
25	GridLink Interconnector RPL	2022	Third Party Stakeholder - GridLink
26	Q & E North RPL	2023	Third Party Stakeholder - Oceaniq
27	Marine and Landscape Archaeology Gazetteer	2022	Wessex Archaeology
28	EMF Study: EEN/466/NOTE2022 - Sea Link EMF Assessment	2022	NGET
29	CBRA Guide	2015	Carbon Trust
30	Marine traffic anchor study		Red Penguin
31	Coupled Eulerian-Langrangian simulation of the penetration and braking behaviour of ship anchors in clay, J Grabe and L. Wu.	2019	Geotechnic 39, Heft 3
32	Metocean Data	2022	RPS UXO DTS Appendix 10, ABPMer SEASTATES
33	1-14A ICPC Recommendations – OOS crossings	2014	ICPC – open source
34	Recommended Practice DNV-RP-F107, Risk Assessment of Pipeline Protection	2010	DNV-GL
35	DNV-RP-J301 Subsea power cables in shallow water renewable energy applications	2014	DNV-GL
36	Sea Link Corridor and Preliminary Routeing and Siting Study (CPRSS)	2023	NGET
37	Route Development Report to DF2	2023	Red Penguin

Reference No.	Title	Date	Source
38	20220105RA-C-BN01 Briefing Note reviewing Sea Link Landfall at Aldeburgh	2024	Red Penguin / Riggall&Associates Ltd
39	20220105RA-C-BN02 Briefing Note reviewing Sea Link Landfall at Pegwell Bay	2024	Red Penguin / Riggall&Associates Ltd
40	20220105RA-C-BN03 Briefing Note reviewing Sea Link Landfall Options	2024	Red Penguin / Riggall&Associates Ltd
41	202220105RA-C-TN02 Technical Note reviewing HDD Landfalls for Sea Link	2024	Red Penguin / Riggall&Associates Ltd

3.2 Data Gap Analysis

The data used in this study has been reviewed and appraised. Any deficits in the data have been highlighted in the following table:

Table 6: Table of Source Data Adequacy

Data Requirement	Data Fit For Purpose	Comments
Geophysical Data – 2021		
Bathymetry	Y	Integrated Survey Report, SSDM DTM, and UKHO data. Excellent quality.
Seabed Features	Y	Integrated Survey Report / Alignment Sheets, SSDM. Note some of SSS data is of poorer quality due to high currents causing snagging on ROTV,
Shallow Soils	Y	Integrated Survey Report / Alignment Sheets, SSDM, Soils Index. Note: Offshore interpretation does not relate to BGS Regional Stratigraphy

Magnetometer	Y	Integrated Survey Report / Alignment Sheets, SSDM. Note: single system does not give 100% coverage of the survey corridor
Geophysical Data – 2023/4		
Bathymetry	Y	Final processed data Areas 1 to 5. Excellent quality. Preliminary integrated report. SSDM.
Seabed Features	Y	Final processed data Areas 1 to 5. SSS data of good quality. Preliminary integrated report. SSDM.
Shallow Soils	Y	Final processed data Areas 2 to 5, SBP and UHRS data, SSDM, preliminary integrated report. Awaiting geotechnical data to compile the Soils Index using 2021 model. Note: Contractor's Offshore interpretation does not relate to BGS Regional Stratigraphy
Magnetometer	Y	Final processed data Area 1 to 5. Preliminary integrated report. SSDM. Note: single system does not give 100% coverage of the survey corridor
Geotechnical Data – 2021		
CPT	Y (except nearshore waters < 8m)	Integrated Survey Report, CPT logs. Insufficient in shallow waters – Contractor unable to access with geotechnical vessel. Pegwell Bay covered by adjacent 3rd Party Data
VC	Y (except nearshore waters <8m)	Integrated Survey Report, VC logs. Insufficient in shallow waters – Contractor unable to access. Pegwell Bay covered by adjacent 3rd Party Data
Thermal Resistivity	Y (except nearshore waters <8m)	Geotechnical Report. Very good coverage.

Laboratory Tests (excluding chemical tests in VCs)	Y (except nearshore waters <8m)	Geotechnical Report. No chemical tests undertaken for contamination within the VCs).
Planned Geotechnical Data – Q3/Q4 2024		
CPT		Completed 2024 Reports pending
VC		Completed 2024 Reports pending
Thermal Resistivity		Completed 2024 Reports pending
Laboratory Tests		Completed 2024 Reports pending
Pre-sweeping MMO		Completed 2024 Reports pending
Wessex Archaeology		Completed 2024 Reports pending
Benthic and Environmental Data – 2021		
Benthic Habitat Data	Y	Benthic and Environmental Report
Grab Samples	Y	Benthic and Environmental Report
Red List Species	Y	Benthic and Environmental Report
Benthic and Environmental Data – 2024		
Benthic Habitat Data	Acquired Q3 2024	Acquired Q3 2024, pending reporting
Grab Samples	Acquired Q3 2024	Acquired Q3 2024, pending reporting
Red List Species	Pending	Acquired Q3 2024, pending reporting

Other Data		
GIS	Y	Red Penguin, AECOM, MMT
Metocean Data	Y	RPS Appendix 10 DTS study, ABPMer SEASTATES
Sediment Mobility	Y	BGS (Regional), Nearshore Suffolk (AH), Pegwell Bay (AH), Open Source
UXO	Y	6Alpha DTS (pre-survey) RPS DTS review (post survey), Groundsure (Motts)
Shipping	Y	AIS data - Marine Traffic (2019, 2021), Marine Traffic via XODUS (2022-2023)
Fishing	Y	AIS data - Marine Traffic (2019, 2021), VMS [Marine Traffic] via XODUS (2017-2021)
Vessel Sighting Data	Y	Marine Traffic via XODUS (2022-2023)
Extraction Sites	Y	Open Source and Third-Party Stakeholders
Existing and Planned Infrastructure	Y	Open source and Third-Party Stakeholders
Red Line Boundary	Y	Red Penguin / Motts / AECOM / NGET
DF3 RPL	Y	Red Penguin

The data acquired and supplied for the CBRA is sufficient to undertake the study, although there are some gaps as indicated in the above table. Where practical, additional data or regional studies have been used to mitigate data deficiencies. Where sampling gaps remain, due to acquisition schedule, conditions are assumed to be similar to samples already collected along the route, unless there are significant differences expected form the regional geological mapping. Once the data is available, the samples should be compared to the regional geology.

4 CABLE ROUTEING and NOMENCLATURE

4.1 Overview

The initial marine cable route has been developed by NGET as indicated in the *Sea Link Corridor and Preliminary Routeing and Siting Study*. From this, the main survey and landfall options corridor was derived and surveyed during Q3/Q4 2021. After the analysis of the survey data, it was decided to survey additional areas in 2023/4 to augment the existing data and to minimise and mitigate the effects of anchor risk and sediment mobility. The route has been updated on several occasions and as such the development is outlined in the *Cable Route Development Report*. Due to changes in the naming convention as the routes have developed a standardised nomenclature has been developed, as shown in Table 8. Note that the Suffolk Sizewell Alternative landfall was scoped out of the project prior to DF3.

Table 7: Landfall Nomenclature - Equivalency Table

<table>
<tr><th>Landfall</th><th>Documentation Post 01/10/2022</th><th>Previous Marine Documentation</th><th>Reports Affected</th></tr>
<tr><td>Suffolk - Sizewell</td><td>S3N</td><td>S7N</td><td rowspan="3">Cable Burial Risk Assessment (Rev A1)
Burial Assessment Study (Rev A1)
Geomorphology Technical Note (Rev3)
Beach Walk-Over Report (Rev4)
Landfall Options Assessment Technical Note (Rev3)
3rd Party UXO DTS Reports
Integrated Geophysical and Geotechnical Report Rev A.
All Operations reports and operational documentation from the MMT surveys undertaken in 2021</td></tr>
<tr><td>Suffolk - Aldeburgh</td><td>S2</td><td>S6</td></tr>
<tr><td>Kent – Pegwell Bay</td><td>K1c</td><td>Pegwell Bay</td></tr>
</table>

Consistent with the CPRSS, 2022 and all documentation related to the DCO process.

The origin of the naming protocol relates to the landfall search areas, and the landfall route alignment sector, as shown in the following figures for Suffolk and Kent. ‘S’ relates to Suffolk and ‘K’ relates to Kent. The number relates to the search area, and any suffix indicates the specific alternative route which reaches landfall in the search area.

The survey Scope of Work referred to S7N (Sizewell), S6 (Aldeburgh) and Pegwell Bay, therefore two sets of nomenclature have been used; the Environmental Team based on the search areas and the Marine Team worked with the Survey landfall nomenclature.

All documents after 01/10/2022 use the naming convention aligned to Table 8, but where older figures have been used, older names may have been carried over.

The integrated report of 2023 (incorporating 2021 main route & 2023 landfall and intertidal surveys) contains references to the MMT survey of 2021 with the earlier naming protocol.

All documents relating to the Additional Marine Survey (2023/24), and subsequent DCO submissions, relate to the DF3 RPL and landfall nomenclature.

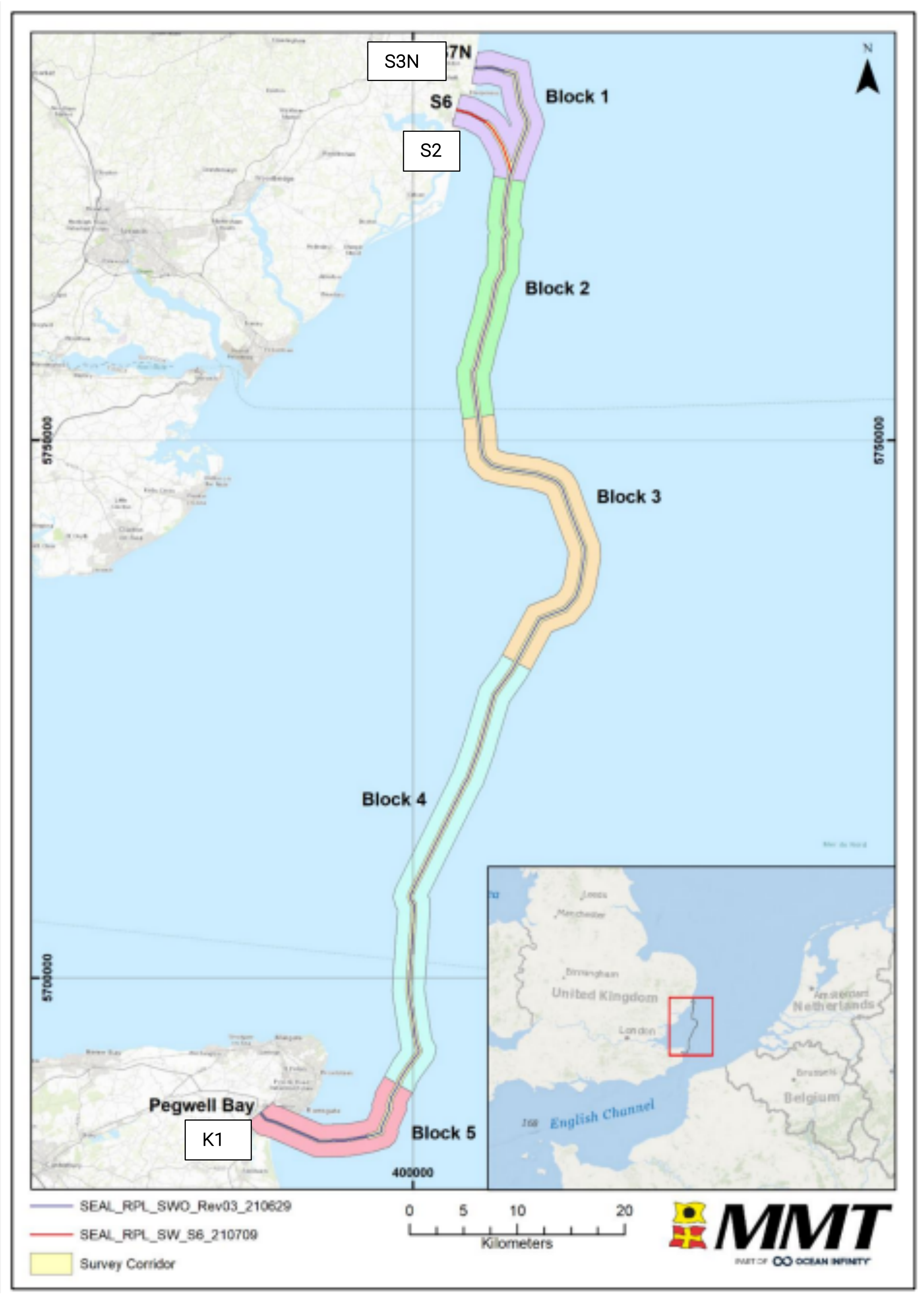


Figure 3: Sea Link HVDC Cable Route – Survey Corridor with Suffolk Landfall Nomenclature

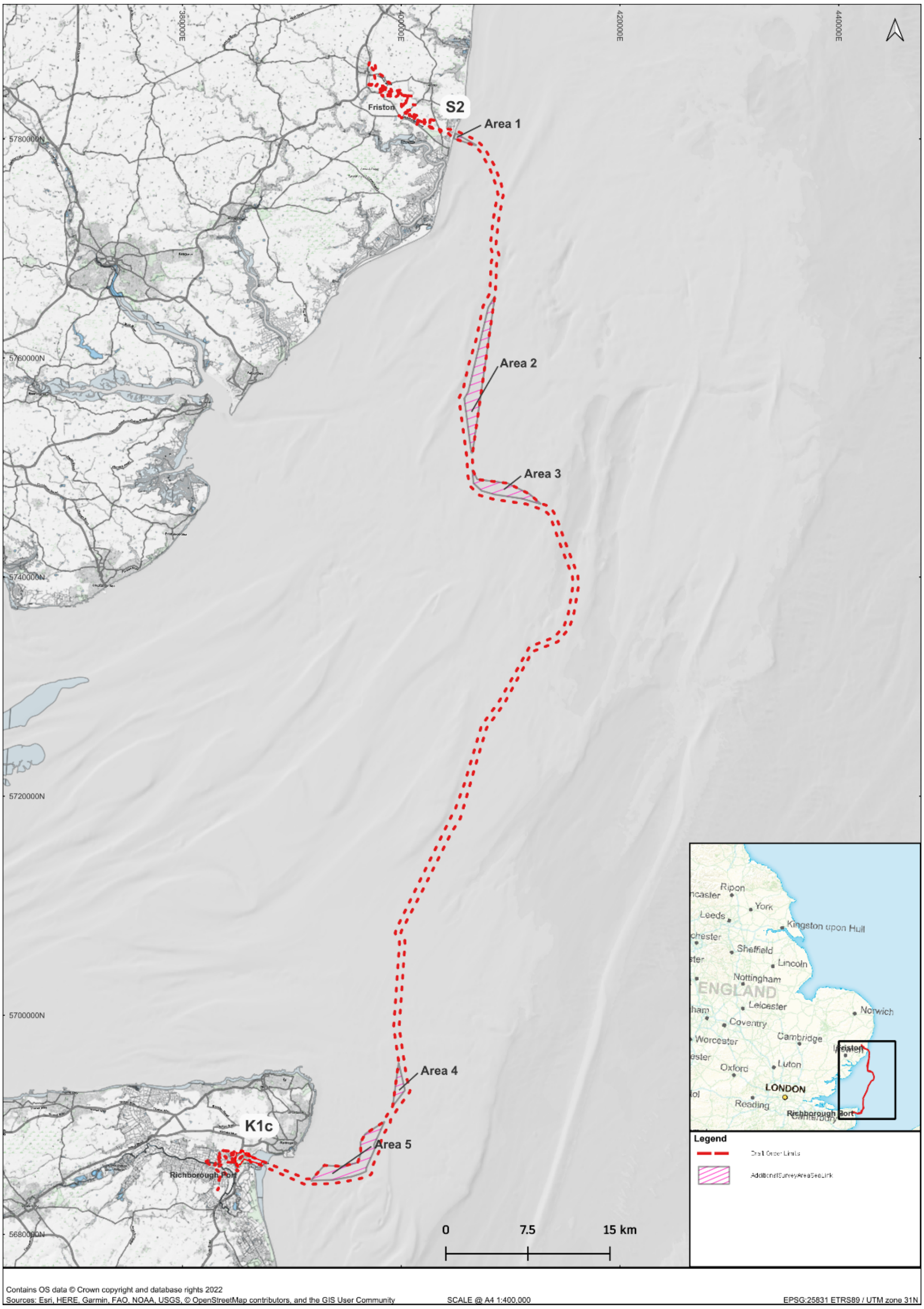


Figure 4: Sea Link HVDC Cable Route – Survey Corridor with Additional Survey Areas

4.2 Cable routing criteria

After the review of the integrated report of the surveyed corridor Red Penguin / NGET have undertaken optimisation of the route corridor. The key routing criteria are as follows:

- Minimise cable length and the number of alter courses
- Avoid natural hazards such as pockmarks, mobile sediment features, areas prone to scour, areas prone to mass movement, rock outcrops, boulder fields, high slope angles, areas of indurated layers and imbricated layers
- Avoid, or maintain acceptable offset from, existing or planned infrastructure
- Maintain 90 degree crossing angle over pipelines, power cables and TSS
- Maintain minimum 45 degree crossing angle over FO or telecom cables
- Avoid man-made obstructions and wrecks
- Avoid crossing environmental designated areas
- Reduce long lengths of cable in highly trafficked areas
- Avoid anchorages
- Avoid areas of gravel extraction
- Avoid munitions dump sites and contaminated grounds
- Avoid areas of archaeological significance
- Avoid where possible river mouth and harbour entrances
- Avoid designated leisure areas
- Avoid congested areas
- Avoid areas of National Restrictions
- Optimise the routeing in consultation with other marine stakeholders.

Where the routing criteria cannot be achieved, minimise the risk to the cable by reducing the exposure to negative criteria to a minimum.

4.3 Route Position Lists and KP Protocol

The KP protocol for the DF3 marine cable starts with KP0.0 at the Suffolk Transition Joint Bay. The shape files of the corridor and route are presented in 10.4.

5 REGIONAL ASSESSMENT OF SEABED CONDITIONS

5.1 Cable Route Area Overview

This CBRA report focusses on the DF3 cable route defined in May 2024, incorporating the engineered route for the Sea Link HVDC cable system between Suffolk and Kent as indicated in the following Figure:

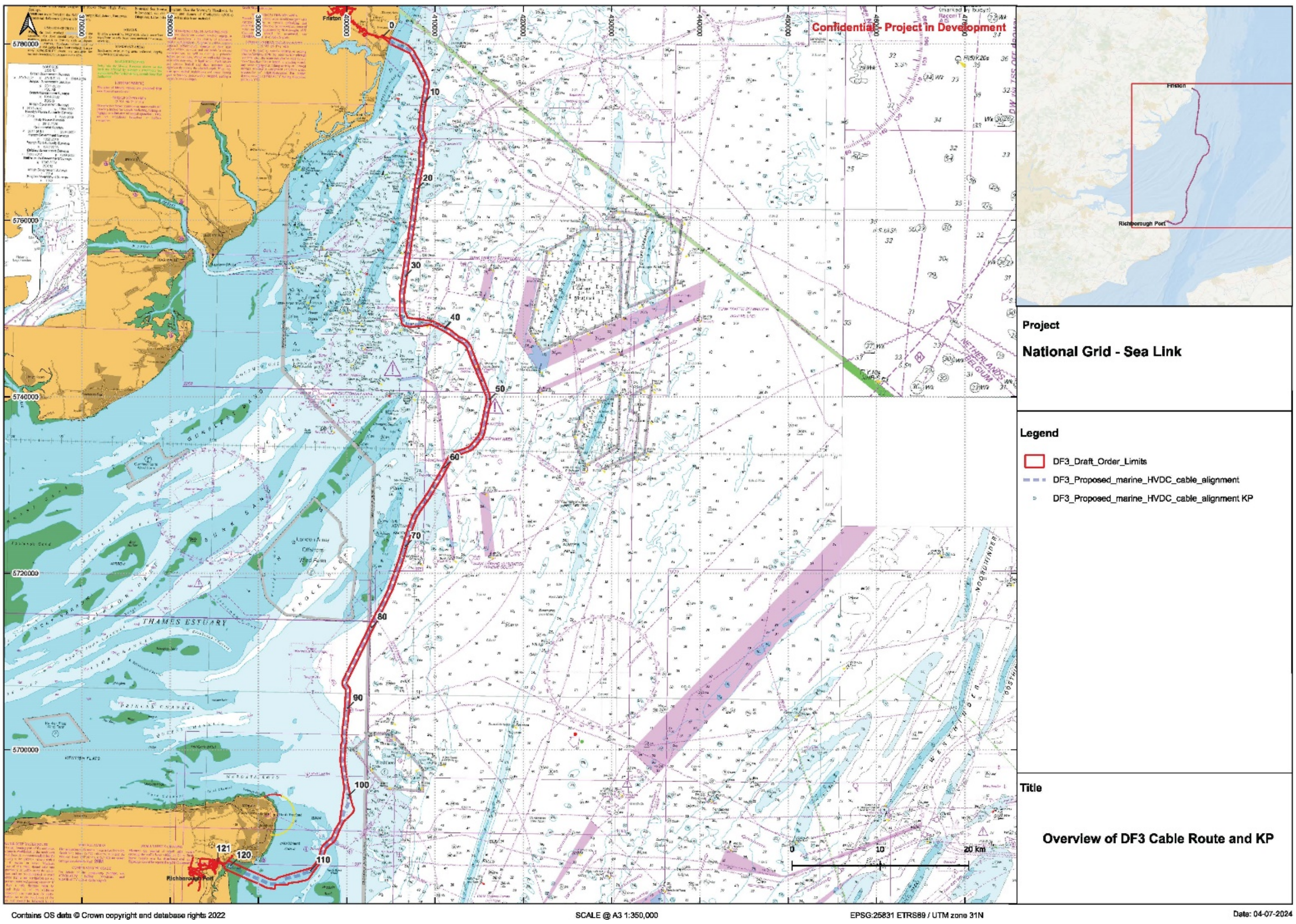


Figure 5: DF3 Cable Route and KP overview

5.2 Regional Geology and Bathymetry

The Southern North Sea has extensive thickness of Tertiary sediments, dominated by shallow marine conditions, unconformably overlying Upper Cretaceous Chalk. The north Kent offshore approaches have exposed or thinly covered subcrop of Upper Cretaceous weathered Chalk, which has been identified as of Campanian Age. The Chalk has localised flint beds in the upper layers.

Palaeocene sediments are present to the south of the Thames estuary, and locally beneath Pegwell Bay, where they unconformably overlie the Upper Cretaceous Chalk Group (BGS, United Kingdom Offshore Regional Report). The Palaeocene deposits in the vicinity of Pegwell Bay are from the Thanet Formation which extends for onshore, thinning offshore. Onshore the Formation comprises of partially decalcified glauconitic sands and sandy clays, becoming glauconitic muds.

There are Palaeocene sediments in the vicinity of the Shipwash which have been sampled as sand-rich units, although whether these extend further east as significant deposits is unclear and will be assessed when further survey data is available. Note that there is evidence of mobile sediments which have migrated into the 2021 marine survey corridor.

Eocene sediments form the thickest deposits along the route and are dominated by the London Clay Formation. The London Clay Formation in the Thames Estuary comprises of clayey silts, silty clays and silts within which a number of transgressive / regressive cycles are recognised, with appropriate changes in particle sizes. The London Clay Formation sediments are over consolidated, associated with subsequent compaction events. Locally, faulting can be observed in the sediments, which is thought to be the result of soft-sediment deformation during the compaction events. The top of the Eocene sediments in the Southern North Sea is normally truncated and overlain by Quaternary sediments.

The mid-Pliocene Red Crag and Coralline Crag skeletal carbonate sands and silty sands outcrops in the vicinity of the Suffolk landfall, as shown in the following figures, and are a significant constraint on the northern landfall options, The Crag is complex and has been sampled by VCs and shown to comprise aragonite-leached sands and silty sands. Seismic sections across the Coralline Crag indicate a thickness of up to 25m with a strong seismic reflector marking the top of the formation, with some dipping internal reflectors. There are also areas of unlithified sediment which reduce the confidence in identifying the extent of the Formation.

Figure 6: Overview of the Crags Group and the Coralline Crag (after BGS)

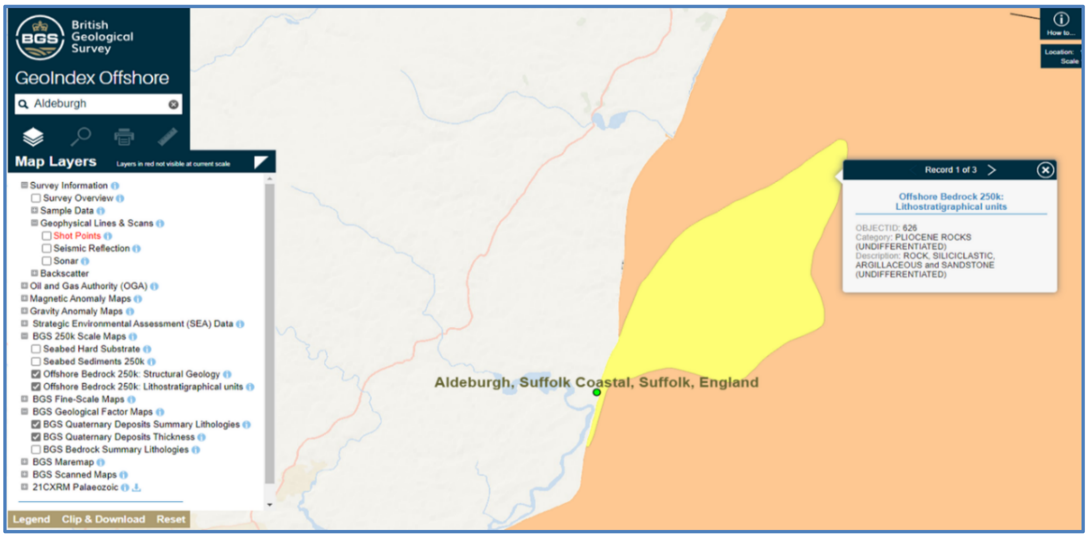


Figure 7: Detailed description of the Coralline Crag (after BGS GeoIndex Offshore)

The Quaternary succession comprises Lower Pleistocene sediments, which are mainly restricted to the north extent of the route, which forms the southern limit of the Pleistocene depositional basin, and the Thames Estuary and associated palaeo-fluvial channel system. The Lower Pleistocene sediments are thin and the extent poorly defined, they are assigned to the Westkapelle Ground Formation, but the seismic / acoustic facies is unclear. The sediments are potentially associated with deltaic top sediments and often include organic material.

The Pleistocene sediments of the Thames Estuary and the palaeo-fluvial channel-fill system comprise of fine sediments. Holocene and Recent sediments are dominated by fine sediments which have accumulated as mudflats in estuarine and depositional embayments, such as Pegwell Bay. Offshore, there are significant sand banks and mobile sediment bedforms. Some of the bedforms are palaeo-features developed at the end of the Last glaciation, others are active and are maintained by the dominant currents and sediment circulatory systems in the Southern North Sea.

EDF Energy provided a shapefile delineating the Coralline Crag's marine extent off Aldeburgh and Sizewell from their studies with CEFAS. The mapped exposed Coralline Crag extent within the Order Limits of the route from Aldeburgh is considerably lower than is shown on the regional mapping by the BGS (BGS Offshore Bedrock 1:250 000 chart). The spatial extent of Coralline Crag within the route corridor will be further refined after the completion of the additional surveys in 2023 and the resulting data will be utilized in the feasibility studies for the planned trenchless solution at Aldeburgh.

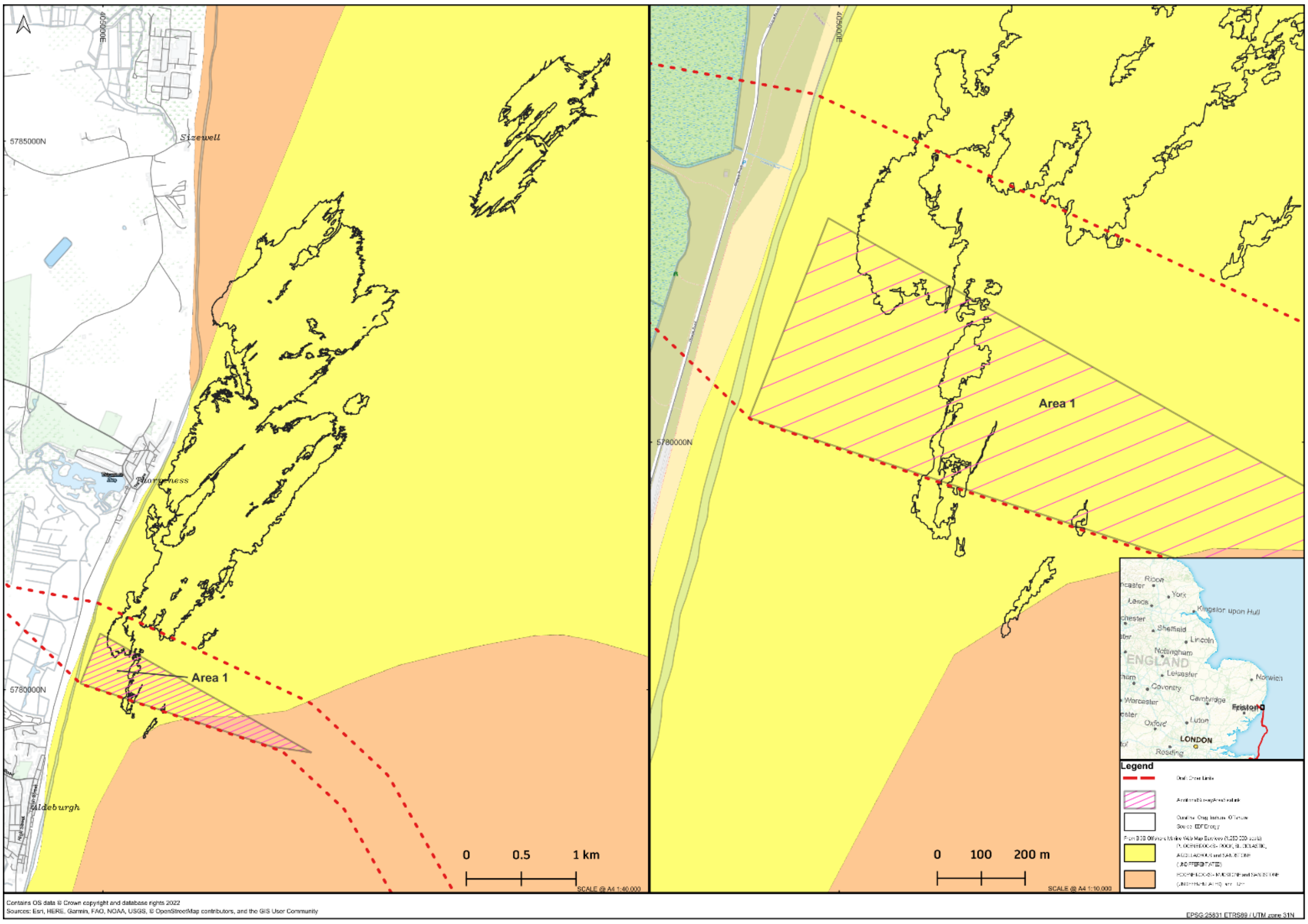


Figure 8: Exposed Coralline Crag extent at the landfall approaches to Aldeburgh (from EDF Energy)

The cable route corridor bathymetry is predominantly shallow water depth (<50 m) and is part of the Southern North Sea and the Outer Thames Estuary and Approaches. The deeper sections (>25 m) are found between KP 40.44 to KP 60.79, with maximum depth of 46.4m, at KP 46.87.

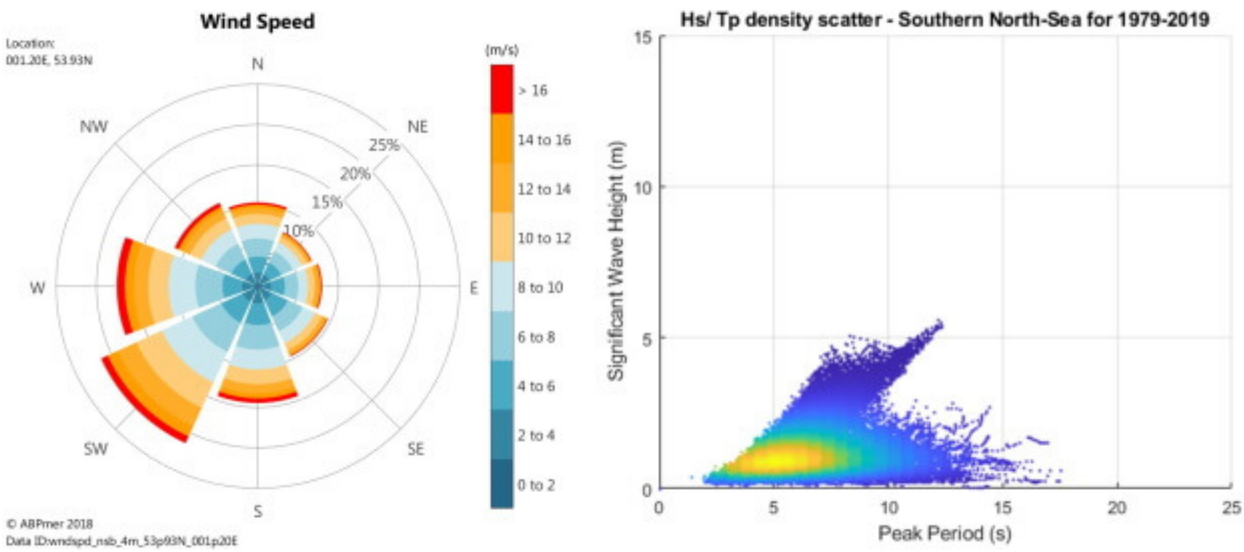
Seabed angles tend to be low (<5°) slope, except where local mobile sediment features are crossed when they cannot be avoided. Slope angles greater than 10° in any direction are avoided as they become a barrier to the choice of cable installation equipment.

Water depth range and seabed gradients for each assessed alignment chart section are provided in more detail in the CBRA table, Section 10.3.

5.3 Regional Metocean Conditions

The regional metocean conditions are described using ABPMer's SEASTATES opensource data providing both wind and wave data across the area. The general description of the Southern North Sea conditions is as follows:

'The Southern North Sea's waters are exposed with the northern entrance open to the North Atlantic, though it has a similar distribution of westerly Atlantic winds to the Baltic, if slightly stronger. The scatter shows predominantly wind generated waves, but a lobe of longer-period swell energy. Note that the longer-period swell energy should be factored in when considering vessel operations.' Regional metocean considerations for offshore wind farms - ABPmer



Southern North Sea example wind rose and wave height scatter plot

Figure 9: ABPMer SEASTATES open source metocean data Southern North Sea wind speed example and summary of Hs and Peak Period

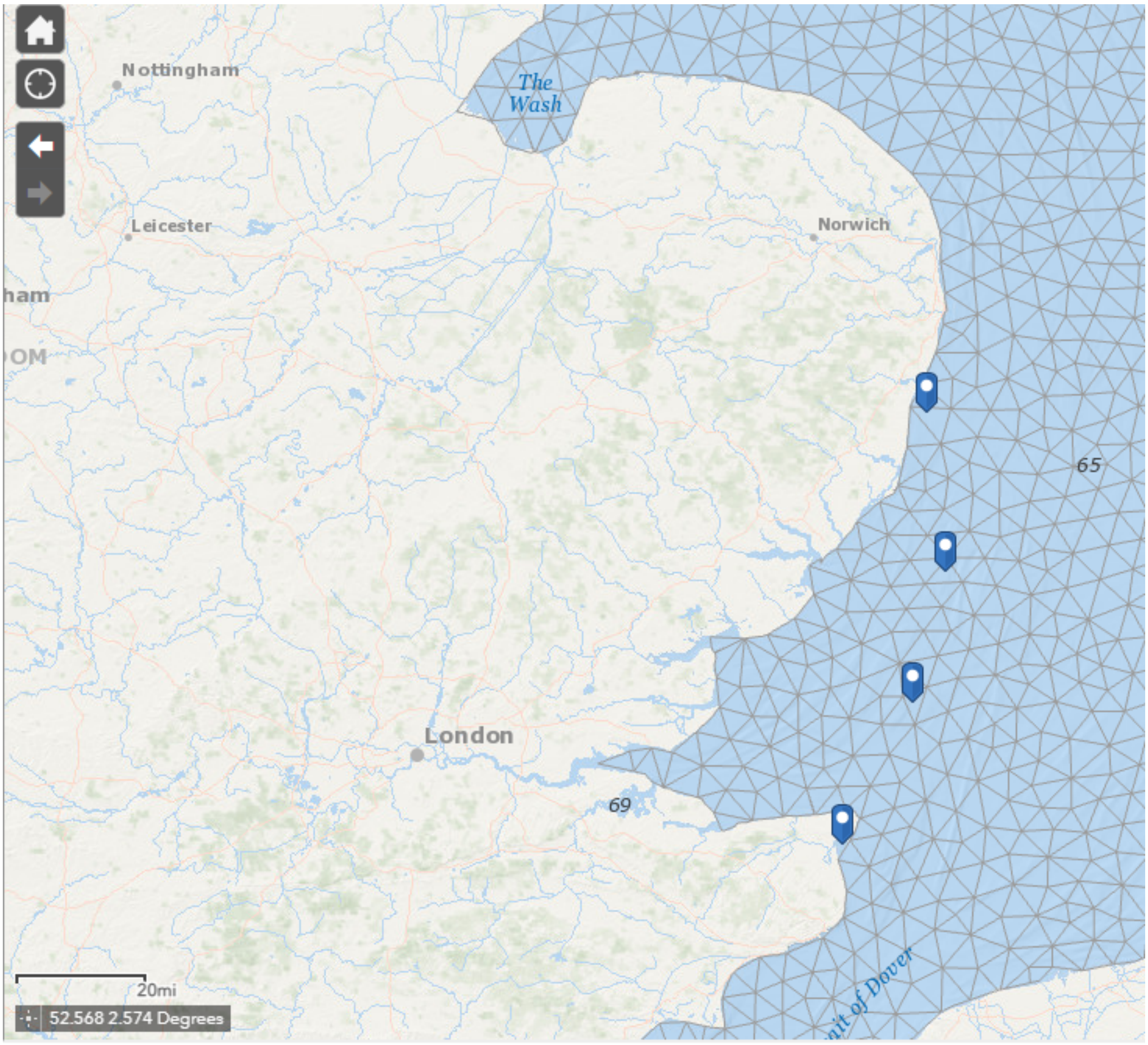
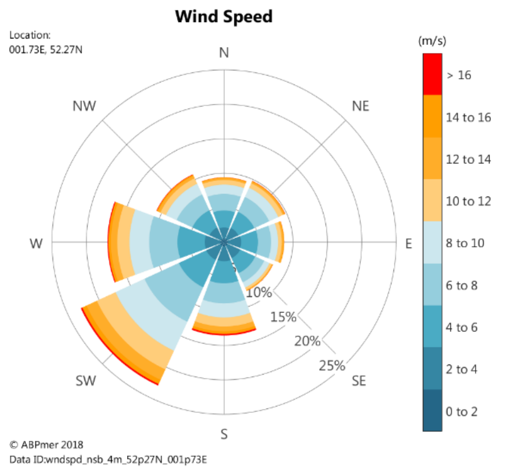
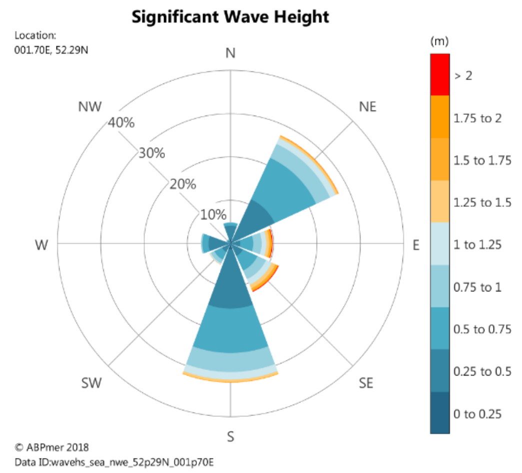
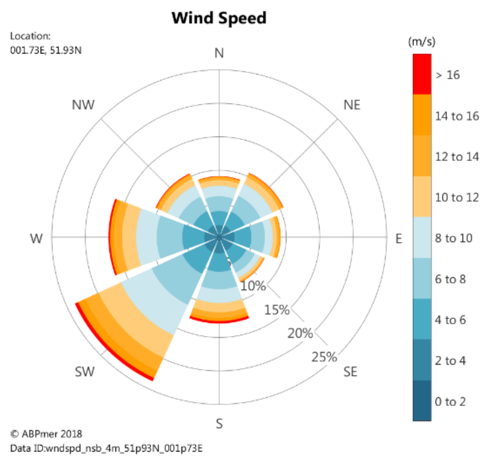
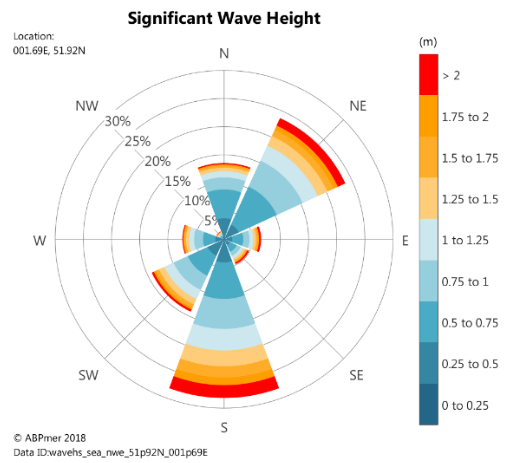


Figure 10: ABPMer SEASTATES open source metocean data network and datapoints used to describe the regional trends

The four sites illustrated in the figure above show the following trends across the region for wind and wave conditions:

<table>
<tr><th>Location</th><th>Wind Rose</th><th>Wave Rose</th></tr>
<tr><td>N -Suffolk</td><td>
</td><td>
</td></tr>
<tr><td>N – Thames Approaches</td><td>
</td><td>
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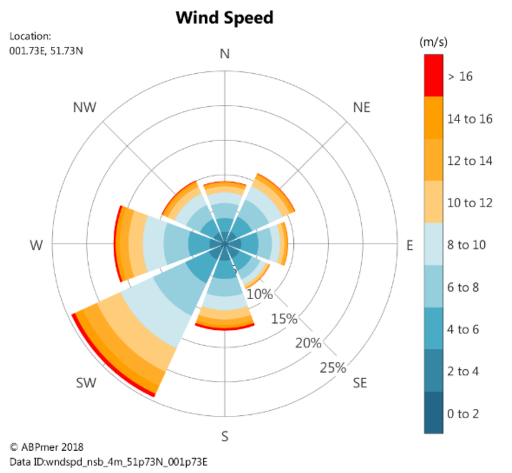
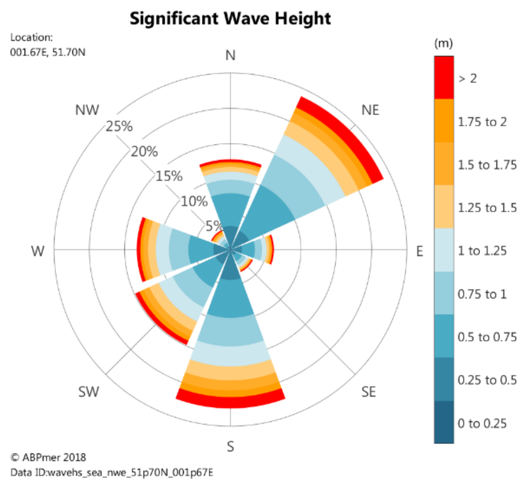
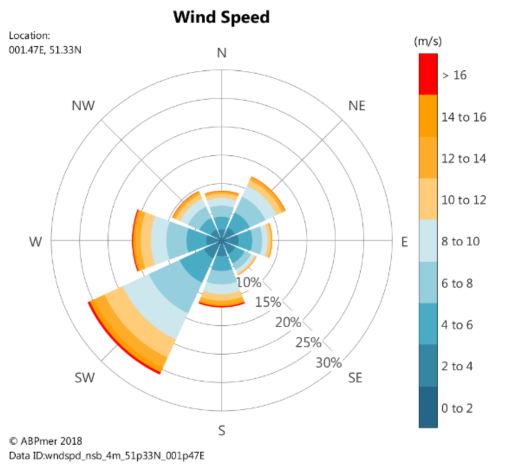
S – Thames Approaches





S.- Pegwell Bay



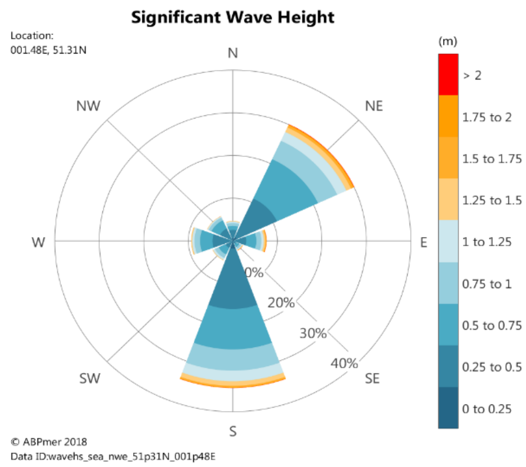


Figure 11: ABPMer SEASTATES open source metocean data showing regional trends from Suffolk to Kent

The wind data is referenced to 10m above surface and is assumed to represent hourly mean value. The dominant wind direction is south-westerly, irrespective of location in the area, with an increase of north-easterly wind direction further south. The windspeed distributions are also broadly similar.

The significant wave heights are derived from a long-term hourly database. The wave height direction is dominated by southerly and north-easterly directions, with the only notable regional difference in the Hs being due to the effects of coastal waters at the landfalls.

5.4 Regional Areas of Interest and Constraint

The regional areas of interest and Constraints are summarised in the following NGET briefing figure which clearly indicates the complexity of different environmental (SAC, MCZs, SSSI) and anthropogenic (OWFs, in-service power and FO cables, marine traffic areas, anchorages, and local fishing areas) constraints in the region:

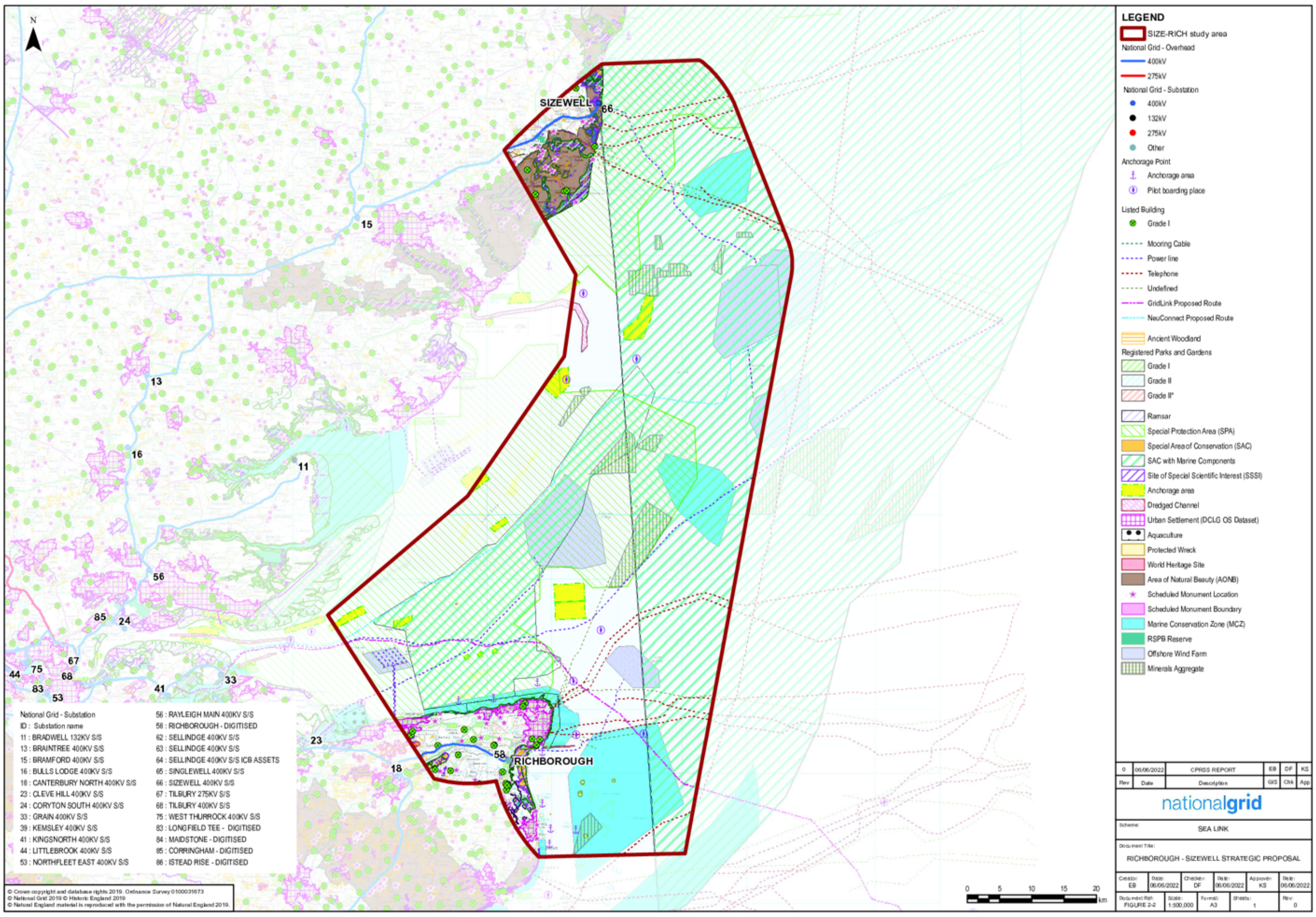


Figure 12: NGET Constraints Map

6 DETAILED ROUTE DESCRIPTION

The detailed route descriptions are based on the DF3 RPL but draw on the compilation of the Integrated survey results from 2022 and 2024. A complete set of Alignment Sheets which will be a composite of the original route survey and additional surveys will be compiled prior to the DCO submission.

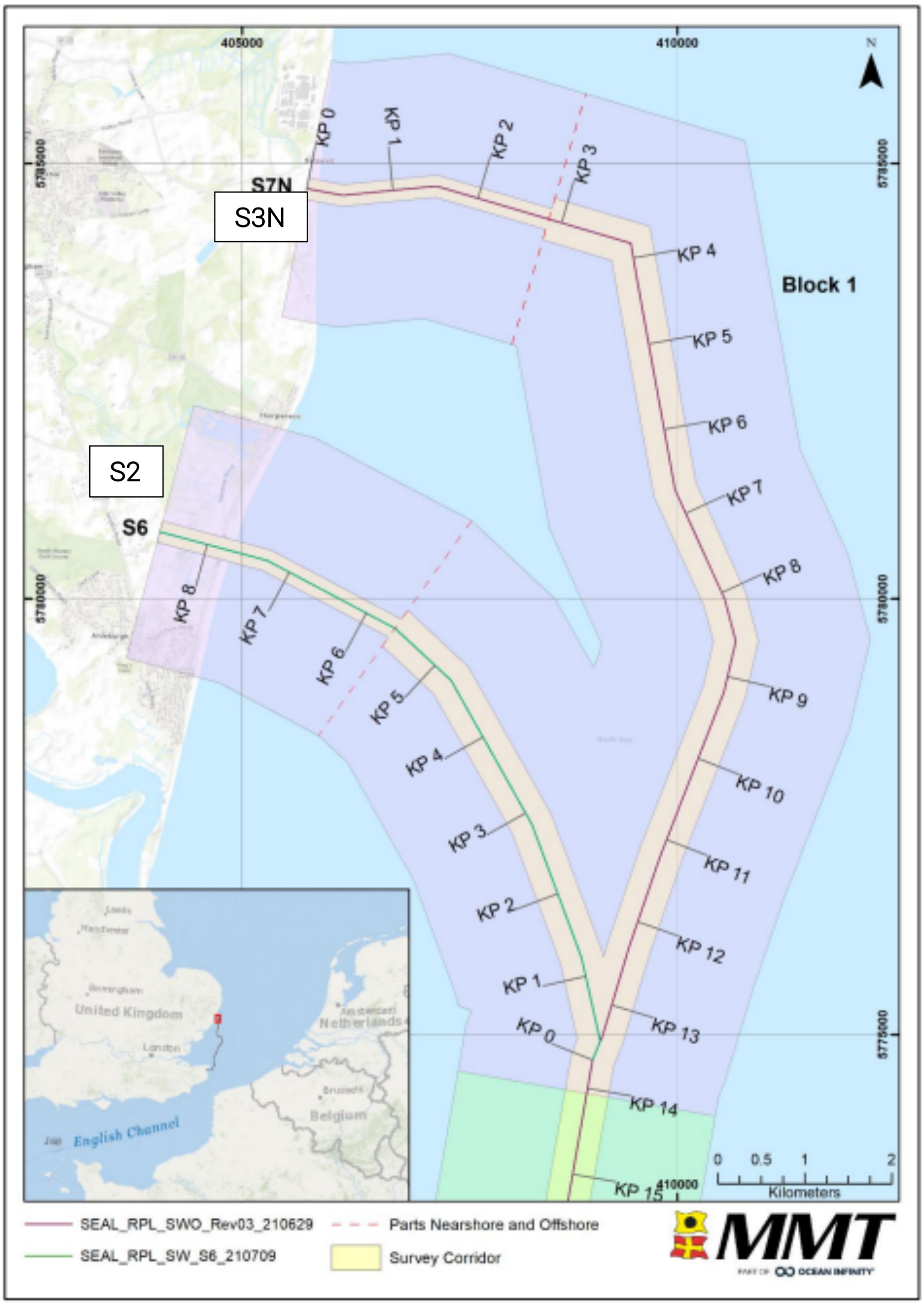


Figure 13: Survey route from 2021 showing the alternative landfalls in Suffolk and KP Intersection Point

6.1 Bathymetry

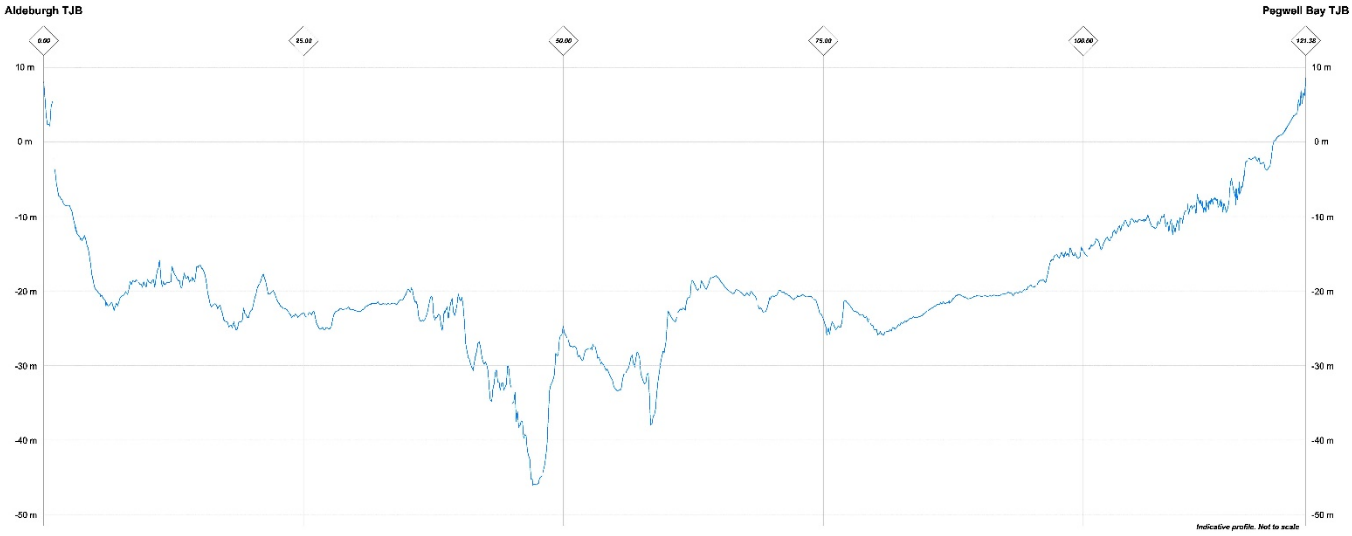


Figure 14: Bathymetric profile along the DF3 RPL

MBES coverage extends from the Aldeburgh beach front profile, with a water depth of 2.14 m LAT, and a minor gap between the 2021 and 2023 data, presumed due to changes in the beach profile between the surveys. The water depth increases gradually towards increasing KPs and reaches 46.0 m at KP 47.043 before gradually reducing towards Pegwell Bay. The MBES coverage towards Pegwell Bay terminates at KP 119.679 with a water depth of 2.20 m above LAT (acquired at high tide).

Topographic data of the landfalls and intertidal mudflats of Pegwell Bay to the TJBs was acquired in 2023, to complete the profiles across the route. The TJB in Suffolk is 8.09 m ODN whilst the TJB in Kent is 8.60 m ODN.

Seafloor geomorphology heavily influences the bathymetry and slope along the route with the maximum gradient of 20.5° for the leeward slope of a mega ripple encountered in bedforms between ~KP 42.50 to KP 45.50. Micro-rerouting will be able to reduce this angle. Areas of megaripples within Pegwell Bay are illustrated in the following figure.

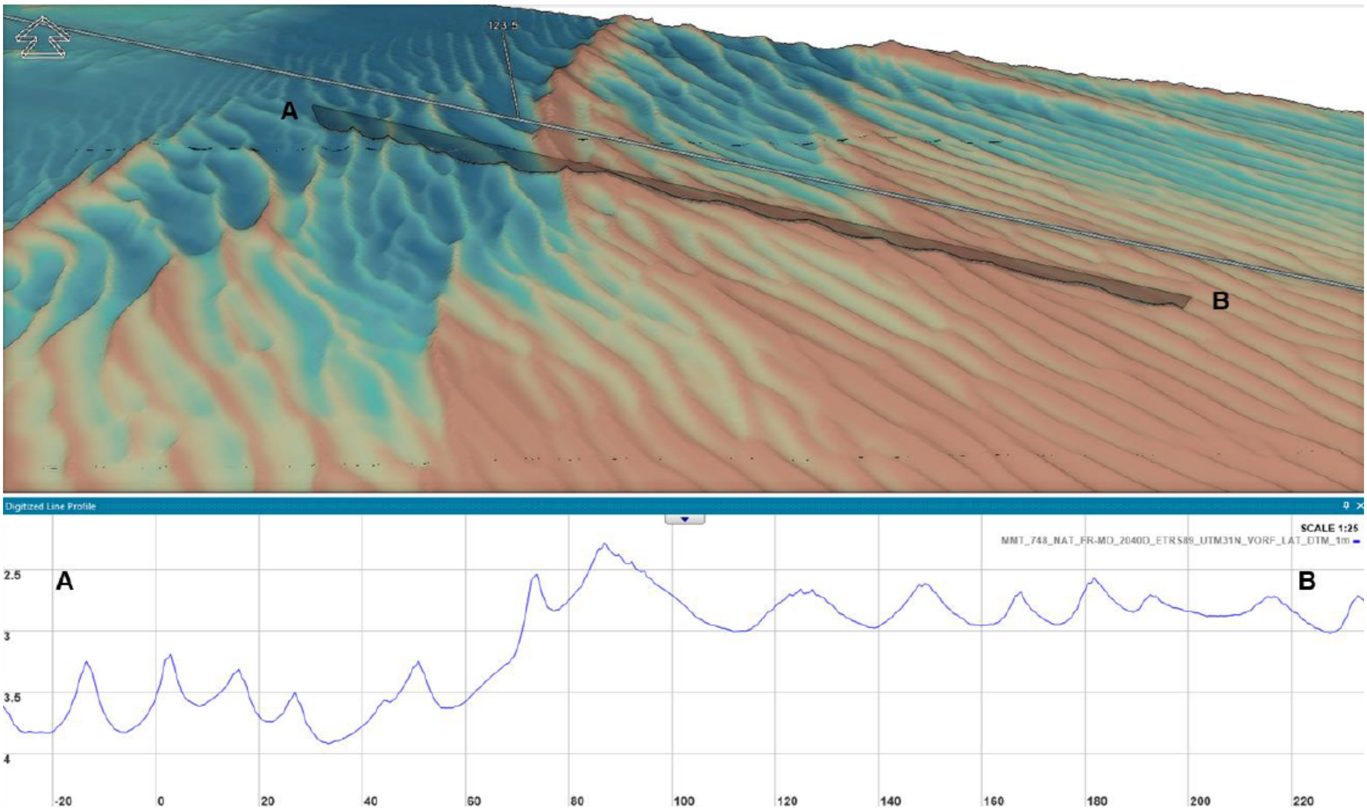


Figure 15: MBES depicting the topography and slopes created by megaripples within Pegwell Bay.

Bathymetric data starts at KP 0.912 with a water depth of 2.14m and descends to a depth of ~22.70m near KP 6.70 before decreasing to 18.66m at ~KP 8.520. Average seabed gradients within the corridor in this section are less than 1° apart from the gradient of 16.22° caused by a megaripple/dune like structure located 80m west of KP 7.500, which has been avoided by micro-engineering.

From ~KP 8.520 the depth slightly decreases to 18.56m at ~KP 8.900 with the seafloor remaining relatively even and slightly deepening to ~25m at ~KP 18.500 and between ~KP 26.500 and KP 27.500. The seabed remains even until ~KP 35.500 with noticeable increase in water depths between ~KP 39.800 and KP 62.100 (maximum water depth of 46.0 m at KP 47.043) and decreases to 18.00m at ~KP 64.565. The maximum gradient in this section from KP ~31.500 to KP 63.000 is 20.52° observed to the west of ~KP 50.000 caused by megaripples.

Thereafter the seabed with mobile bedforms remains relatively even and decreases to 10.00m at ~KP106.000. The maximum gradient in the corridor (20.95°) is located to the west of ~KP 75.500 induced by ripples and megaripples. After KP 106.000 the seabed is dominated by sand ripples and megaripples (varying gradients induced by mobile sediments) and reaches 7.84m at ~KP 112.052.

The seafloor shoals from KP 112.052 towards Pegwell Bay and reaches 2.2m above LAT at KP 119.679 (limit of MBES coverage). Sandwaves are prominent in this section and induce gradients of 9.3° at KP 114.900 and KP 117.392.

6.2 Seabed Features – Natural

The seabed features comprise of mobile bedforms (ripples, sandwaves, sandbanks) and immobile bedforms (boulders, boulderfields, depressions and mounds), as indicated in the following tables:

Table 8: Natural Seabed Feature Classification

Observed Mobile Seabed Feature	Criteria
Ripples	Wavelength <5 m Height <1 m
Megaripples	Wavelength 5-25 m Height 1-3 m
Sandwaves	Wavelength >25 m Height :3-5 m
Observed Immobile Seabed Feature	Criteria
Boulder Field Occasional	Concentration of 5-20 boulders within a maximum area of 100 m^2
Boulder Field Numerous	Concentration of ≥20 boulders within a maximum area of 100 m^2
Eroded Depressions	
Mottled Seabed	

The Criteria shown in the above table have been defined and used throughout the interpretation of the seabed features.

Details of the seabed features encountered along the route are provided in the CBRA table. Note that MMT attributed clustered magnetic anomalies that had an irregular signal to near seabed geological source that could inhibit the detection of low or medium amplitude anthropogenic objects. The Additional Marine Survey work undertaken in the vicinity of these features also suggested that these related to shallow geological source (potentially infilled channel feature). Again, it is not possible to differentiate between a geological origin and low or medium amplitude anthropogenic targets.

Mobile bedforms like ripples, megaripples, sandwaves and dunes have been identified along the route along with immobile features such as isolated boulders and occasional boulder fields.

Table 9: Seabed Feature Distribution

Route RPL	KP From	KP To	Mobile Bedforms	Immobile Features
DF3	0.000	1.524	None	None
DF3	1.524	2.779	None	None
DF3	2.779	5.214	Megaripples Eroded/ minor scour depressions	Linear scars and anthropogenic features
DF3	5.214	8.860	Megaripple/dune-like structure Eroded lineated depressions	Linear scars and trawl marks
DF3	8.860	9.361	Megaripples Very stiff CLAY zones located away from RPL	None
DF3	9.361	12.361	Megaripples, eroded/ scour depressions Several outcropping features lie directly on the route between KP 15.000 and 15.85 rising approximately 2m above the surrounding seabed	None
DF3	12.361	15.215	Megaripples Isolated areas of stiff CLAY, sometimes with mottled character	None
DF3	15.215	17.901	Isolated area with mottled character	None
DF3	17.901	20.848	Megaripples and exposures of very stiff CLAY depicting mottled texture	None
DF3	20.848	23.646	Stiff CLAY with mottled character	None

DF3	23.646	25.948	Ripples, megaripples	None
DF3	25.948	28.143	Megaripples	None
DF3	28.143	31.584	Ripples, CLAY with mottled texture	None
DF3	31.584	35.089	Ripples, megaripples, mottled character	None
DF3	35.089	37.171	Isolated patch of ripples	Boulder, linear scars (trawl?)
DF3	37.171	40.103	Patches of ripples	Linear scars and anthropogenic features
DF3	40.103	42.685	Ripples, sandwaves	Anthropogenic features
DF3	42.685	44.802	Ripples	Anthropogenic features
DF3	44.802	47.797	Ripples	Anthropogenic features
DF3	47.797	50.858	Ripples, megaripples, sandwaves	Anthropogenic features
DF3	50.858	53.354	Ripples, megaripples, sandwaves	Anthropogenic features
DF3	53.354	55.881	Ripples, megaripples, sandwaves	Anthropogenic features
DF3	55.881	58.822	Sediment banks, megaripples, ripples, sandwaves	Anthropogenic features
DF3	58.822	62.321	Ripples	Anthropogenic features
DF3	62.321	64.812	Ripples	Sediment mounds, anthropogenic features

DF3	64.812	68.304	Ripples	Anthropogenic features
DF3	68.304	71.305	Featureless seabed	None
DF3	71.305	74.038	Ripples, megaripples	None
DF3	74.038	76.644	Ripples, megaripples, sandwaves, eroded depressions	None
DF3	76.644	79.701	Ripples, megaripples, sandwaves, eroded depressions	Boulders
DF3	79.701	82.804	Ripples, megaripples, sandwaves, eroded depressions	Boulders
DF3	82.804	85.801	Ripples, megaripples	Boulders
DF3	85.801	88.811	Megaripples	Boulders
DF3	88.811	91.313	Megaripples	Boulders
DF3	91.313	94.446	None	Boulders
DF3	94.446	97.346	Megaripples	None
DF3	97.346	100.349	None	Linear scars
DF3	100.349	102.670	None	Boulders
DF3	102.670	105.018	Megaripples	Linear scars
DF3	105.018	107.946	Ripples, megaripples, sandwave	None
DF3	107.946	109.813	Ripples, megaripples	Boulders
DF3	109.813	112.139	Ripples, megaripples	None
DF3	112.139	115.408	Ripples, megaripples, sandwaves	Numerous boulder field
DF3	115.408	118.399	Ripples, megaripples	Boulder field
DF3	118.399	120.469	None	None
DF3	120.469	121.380	None	None

6.3 Seabed Features – Anthropogenic

Trawl marks have been found on a relatively higher scale between ~KP 33.500 and KP 68.00. Their visibility on the seafloor could be indicative of recent fishing activity or dependent on the current regime/sediment reworking in that region.

Many magnetic anomalies have been associated with debris, wrecks and cables in both the route segments.

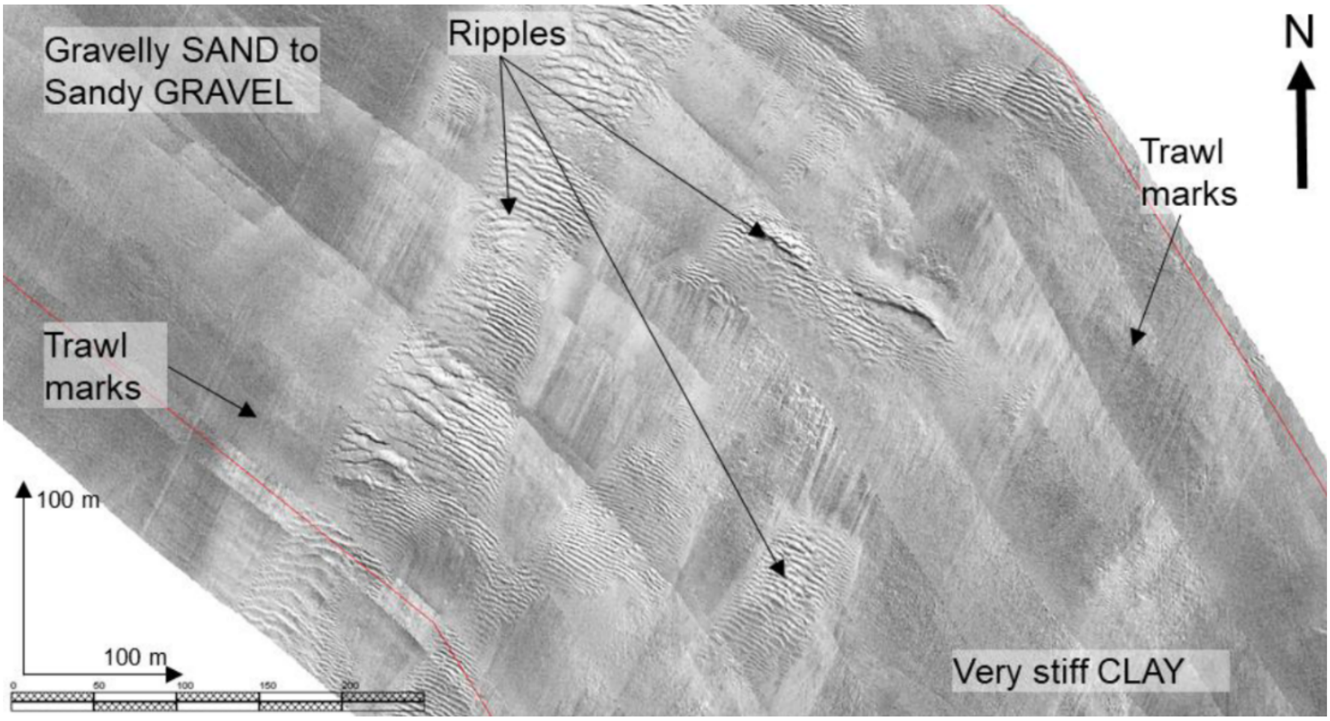


Figure 16: SSS mosaic illustrating trawl marks in an area of ripples

Table 10: Anthropogenic Seabed Feature Classification

Anthropogenic Seabed Feature	Criteria
Trawl Mark Area	
Debris Field	

Criteria in the above table as defined by MMT and applied to the subsequent Additional Marine Survey (NEXT).

Table 11: Anthropogenic Feature Distribution

Route RPL	KP From	KP To	Anthropogenic Features
DF3	0.000	1.524	(Topographic interpretation 2023)
DF3	1.524	2.779	Debris, contacts
DF3	2.779	5.214	Trawl marks, debris, wreck
DF3	5.214	8.860	Trawl marks, debris
DF3	8.860	9.361	Debris
DF3	9.361	12.361	Debris
DF3	12.361	15.215	Debris
DF3	15.215	17.901	Debris
DF3	17.901	20.848	Debris
DF3	20.848	23.646	Debris, wreck
DF3	23.646	25.948	None
DF3	25.948	28.143	None
DF3	28.143	31.584	Debris
DF3	31.584	35.089	Debris, wreck
DF3	35.089	37.171	Linear scars (trawl?)

DF3	37.171	40.103	Trawl marks, debris
DF3	40.103	42.685	Trawl marks
DF3	42.685	44.802	Trawl marks, debris
DF3	44.802	47.797	Trawl marks
DF3	47.797	50.858	Trawl marks, debris
DF3	50.858	53.354	Trawl marks, debris
DF3	53.354	55.881	Trawl marks, debris (incl. fishing gear)
DF3	55.881	58.822	Trawl marks, debris (incl. fishing gear), wreck
DF3	58.822	62.321	Trawl marks
DF3	62.321	64.812	Trawl marks, debris
DF3	64.812	68.304	Trawl marks, debris
DF3	68.304	71.305	None
DF3	71.305	74.038	Debris
DF3	74.038	76.644	Debris
DF3	76.644	79.701	None
DF3	79.901	82.804	None
DF3	82.804	85.801	None
DF3	85.801	88.811	None
DF3	88.811	91.313	Debris
DF3	91.313	94.446	3 wrecks, debris
DF3	94.446	97.346	Debris
DF3	97.346	100.349	Debris
DF3	100.349	102.670	Debris, possible wreck debris
DF3	102.670	105.018	Debris

DF3	105.018	107.946	Debris
DF3	107.946	109.813	Debris
DF3	109.813	112.139	Debris, wreck associated debris
DF3	112.139	115.408	Debris
DF3	115.408	118.399	Potential wreck, debris
DF3	118.399	120.469	Debris
DF3	120.469	121.380	N/A

6.4 Environmental habitats

A total of 26 EUNIS habitats/habitat complexes were identified along the survey routes. One (1) Annex I habitat, Annex I (1110) – Sandbanks which are slightly covered by sea water all the time, as well as four (4) Habitats of Principal Importance for the conservation of biodiversity in England under The Natural Environment and Rural Communities Section 41 (NERC S41) list, Peat and Clay Exposures, Subtidal Chalks, Subtidal Sand and Gravels, and Blue Mussel Beds were identified within the survey corridor.

The result from the Particle Size Analysis showed a varying sediment composition along the routes. Sand was the dominant sediment fraction at the majority of the grab sample sites. Sites located in the northern part of the main route, including the alternative landfall option, generally had higher mud and gravel content compared to sites located in the southern part of the main route.

Concentrations of metals varied along the routes but were often elevated. Threshold values for one or several metals were exceeded at all grab sample sites, but for site S004. Total Organic Carbon and organic matter levels varied along the routes. Hydrocarbon concentrations varied along the routes, with Polycyclic Aromatic Hydrocarbons exceeding threshold values at 18 sites.

The faunal analysis showed that the phyletic composition, with regards to both total numbers of taxa and abundance, was dominated by annelids. Species richness, evenness and dominance varied across the grab sample sites and the multivariate analysis identified 33 faunal groups in the SIMPROF test. Five (5) non-native species were identified during the survey, all already well established in the UK.

The Ross worm Sabellaria spinulosa was identified at several grab sampling sites, and aggregations were observed in video transect T004, but these did not classify as reefs. The sediment composition indicates suitable habitats for sand eel and spawning grounds for herring, and sand eels Ammodytes sp. were identified at two (2) grab sample sites.

Additional Benthic survey has been conducted during Q3 2024 (reporting pending), to ensure that the areas where the DF3 route differs from the route surveyed by MMT does not contain any habitats which may be adversely impacted by the recommended route. This report has not been updated with the findings.

6.4.1 Seabed sediments

The seabed sediments encountered on the route have been classified based on their acoustic characteristics and further corroborated with grabs and geotechnical investigations by MMT. The classification has been applied to the Additional Marine Survey (NEXT) and will be ground-truthed by grabs and geotechnical investigations carried out in Q3 2024.

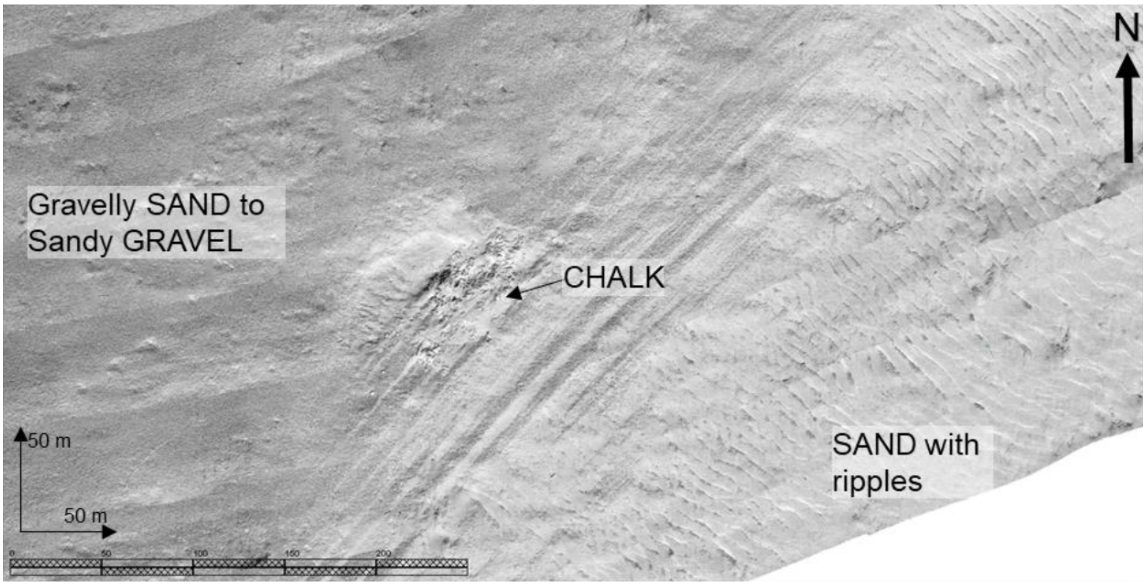


Figure 17: SSS mosaic illustrating CHALK outcrop in the approaches to inner Pegwell Bay.

Table 12: Seabed Sediment Classification

Sediment Type	Characteristics
CLAY	Predominantly Clay, may have minor fractions of silt and sand
Stiff CLAY	Predominantly stiff clay, creating relief
SILT	Predominantly Silt, may have minor fractions of clay and Sand
SAND	Predominantly Sand, may have minor fractions of silt, clay and/or gravel.
Gravelly SAND to sandy GRAVEL	Predominantly sand. Slightly gravelly sand to very gravelly sand.
GRAVEL	Predominantly gravel. May contain minor fractions of sand, silt or clay. May also contain gravel sized shell fragments.
CHALK	Structureless CHALK composed of sandy SILT.

Table 13: Seabed Sediment Distribution

Route RPL	KP From	KP To	Seabed Sediment
DF3	0.000	1.524	N/A trenchless solution interval
DF3	1.524	2.779	CLAY with patches of SAND and GRAVEL
DF3	2.779	5.214	CLAY transitioning to SAND and reverting to CLAY
DF3	5.214	8.860	Gravelly SAND to sandy GRAVEL transitioning to sandy GRAVEL/soft CLAY
DF3	8.860	9.361	Soft CLAY transitioning to gravelly SAND/sandy GRAVEL
DF3	9.361	12.361	Gravelly SAND/sandy GRAVEL with areas of stiff CLAY
DF3	12.361	15.215	Gravelly SAND/sandy GRAVEL with areas of stiff CLAY
DF3	15.215	17.901	Gravelly SAND to sandy GRAVEL
DF3	17.901	20.848	Gravelly SAND/sandy GRAVEL with areas of stiff CLAY

Route RPL	KP From	KP To	Seabed Sediment
DF3	20.848	23.646	Transition from gravelly SAND/Sandy GRAVEL to firm CLAY
DF3	23.646	25.948	Transition from CLAY to SAND
DF3	25.948	28.143	SAND
DF3	28.143	31.584	SAND with CLAY tracts
DF3	31.584	35.089	SAND with gravelly SAND/Sandy GRAVEL patch
DF3	35.089	37.171	Gravelly SAND/Sandy GRAVEL
DF3	37.171	40.103	Gravelly SAND/Sandy GRAVEL
DF3	40.103	42.685	Gravelly SAND/Sandy GRAVEL
DF3	42.685	44.802	Gravelly SAND/Sandy GRAVEL transitioning to stiff CLAY
DF3	44.802	47.797	Stiff CLAY with patch of SAND and areas of gravelly SAND/Sandy GRAVEL
DF3	47.797	50.858	Stiff CLAY transitioning to gravelly SAND/sandy GRAVEL and then by SAND
DF3	50.858	53.354	SAND alternating with gravelly SAND to sandy GRAVEL and later dominated by gravelly SAND/Sandy GRAVEL
DF3	53.354	55.881	Gravelly SAND/Sandy GRAVEL with SILT ribbons and transitioning to CLAY
DF3	55.881	58.822	CLAY changes to Gravelly SAND/Sandy GRAVEL with band of SAND and GRAVEL patch
DF3	58.822	62.321	CLAY transitioning to gravelly SAND/Sandy GRAVEL
DF3	62.321	64.812	Gravelly SAND/Sandy GRAVEL with bands of stiff CLAY
DF3	64.812	68.304	Gravelly SAND/Sandy GRAVEL with patches of stiff CLAY
DF3	68.304	71.305	Gravelly SAND/Sandy GRAVEL
DF3	71.305	74.038	Gravelly SAND/Sandy GRAVEL
DF3	74.038	76.644	Gravelly SAND/Sandy GRAVEL
DF3	76.644	79.701	Gravelly SAND/Sandy GRAVEL with patch of SAND
DF3	79.701	82.804	Alternating sequences of SAND, CLAY and gravelly SAND/Sandy GRAVEL
DF3	82.804	85.801	SAND with large areas of CLAY
DF3	85.801	88.811	SAND
DF3	88.811	91.313	SAND
DF3	91.313	94.446	SAND
DF3	94.446	97.346	SAND transitioning to gravelly SAND/Sandy GRAVEL
DF3	97.346	100.349	Gravelly SAND/Sandy GRAVEL
DF3	100.349	102.670	Gravelly SAND/Sandy GRAVEL
DF3	102.670	105.018	Gravelly SAND/Sandy GRAVEL transitioning to SAND
DF3	105.018	107.946	SAND

Route RPL	KP From	KP To	Seabed Sediment
DF3	107.946	109.813	SAND, Gravelly SAND/Sandy GRAVEL
DF3	109.813	112.139	Gravelly SAND/Sandy GRAVEL transitioning to coarser SAND, GRAVEL and COBBLES
DF3	112.139	115.408	Coarser sediment transition to Gravelly SAND/Sandy GRAVEL
DF3	115.408	118.399	Gravelly SAND/Sandy GRAVEL with clusters of stiff CLAY
DF3	118.399	120.469	Gravelly SAND/Sandy GRAVEL
DF3	120.469	121.380	N/A trenchless solution interval

6.4.2 Shallow Soils and Geology

MMT have utilised BGS 1:250k scanned maps of East Anglia Sheet 52 N - 00 and Thames Estuary Sheet 51 N - 00 Solid Geology to aid their shallow geology interpretation.

Table 14: Shallow Geology Soil Classification

Stratigraphy	Lithology (up to 5m BSB)
Holocene/ Late Pleistocene	Base of soft CLAY
Holocene/ Late Pleistocene	Base of SAND
Late Pleistocene	Base of soft to firm CLAY
Pliocene/ Early Pleistocene	Crag Formation Sandstones (extent only indicated on Alignment Sheets on approaches to Suffolk landfalls)
Eocene	Stiff to very stiff CLAY (London CLAY)
Cretaceous	CHALK

The geophysical interpretation was reinforced with geotechnical data from shallow CPT and Vibrocore sampling. Sub-bottom profiler data was used to infer and assess the areas in between geotechnical sampling locations. The Seabed Index created by MMT is based on the geological and geotechnical characteristics of the encountered material at depths of 0.5m to 3m depth BSB. Geotechnical sampling target depth was 5m for CPTs and Vibrocores respectively.

The Additional Marine Survey will allow the geophysical interpretation to be updated, with verification of the finer sediments to the east of the Shipwash East ridge (Area 2), and to the south of the SUNK deepwater anchorage (Area 3). To date, the geotechnical sampling and in-situ testing has been carried out in these areas, but reporting is pending, and the geological model awaits to be updated. Critically, Area 5 was surveyed with both SBP sensors and Ultra High-Resolution Seismic source (Sparker). This has produced a far better understanding of the distribution of the CHALK in terms of subcrop and areas where only a thin veneer of mobile sediments occur. Again, the geotechnical sampling and in-situ testing reporting has not been completed and the geological model will require to be updated once this information is available, in accordance with the system developed by MMT to produce the SBI classification.

In the route between ~KP 0.600 and KP 2.700, there is uncertainty whether stiff CLAY may in fact be subcropping Red Crag Formation Sandstone (nearshore geotechnical sampling is recommended to improve confidence). The SW route has also been characterised by the presence of gas saturated sediments and the presence of PEAT.

SAND, GRAVEL and soft CLAY of varying thickness overly very stiff CLAY (London CLAY) to ~KP 21.000. Very stiff CLAY has been observed either at, near or below the seabed in most of the surveyed route (~KP 21.000 to KP 74.770) with the CHALK unit detected from ~KP 96.353 to KP 114.000 followed by SAND deposits over very stiff CLAY.

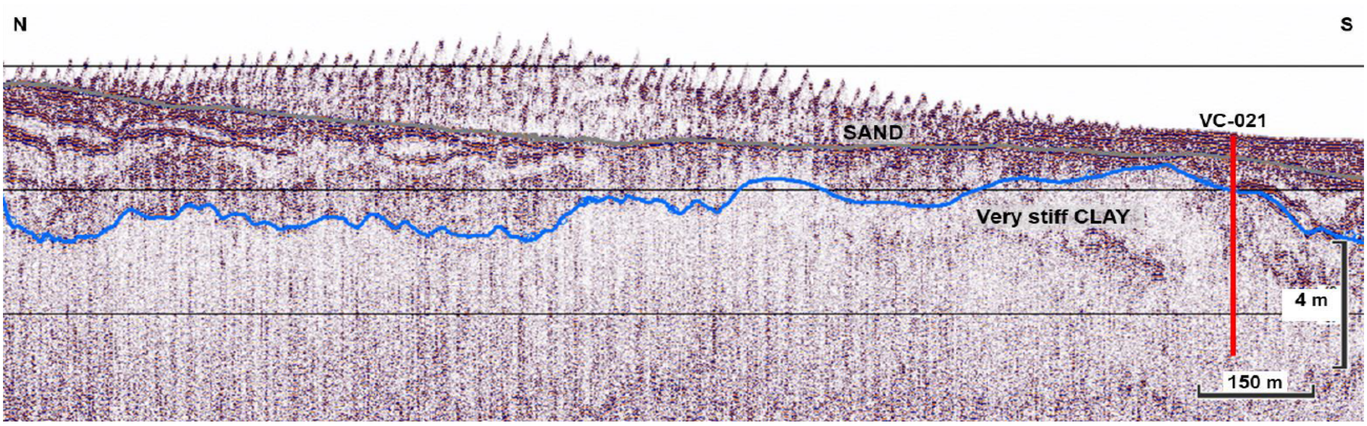


Figure 18: Innomar profile illustrating SAND overlying very stiff CLAY

Table 15: Route Geology

Route RPL	KP From	KP To	Shallow Geology
DF3	0.000	1.524	Superficial deposits of medium dense sandy GRAVEL (Beach Deposits) and soft to stiff CLAY and PEAT (Tidal Flat Deposits) extend to between 2.5m and 5.5m depth below surface

DF3	1.524	2.779	CLAY and SAND 2.5 to 4 m thick overlying stiff CLAY thins from ~KP 2.700 with stiff CLAY at or near the seabed towards landfall. Uncertainty in this section whether stiff CLAY may in fact be subcropping Red Crag Formation Sandstone.
DF3	2.779	5.214	Soft to Firm CLAY overlying SAND 2.5-4 m thick with very stiff CLAY at base VC-S6-005 shows a 0.4 m layer of firm PEAT at 1.74 m BSB. Acoustic blanking by gas saturated sediments
DF3	5.214	8.860	SAND and GRAVEL overlying very stiff CLAY A 0.4 m thick layer PEAT is present in VC-S6-005 1.7m BSB and may be present towards the end of the section. Acoustic blanking by gas saturated sediments
DF3	8.860	9.361	Soft to firm CLAY is initially 2.5 m thick overlying SAND and GRAVEL with very stiff CLAY at base. With increasing KP there is a thinning of the overlying soft to firm CLAY/ SAND and GRAVEL units as the very stiff CLAY (London CLAY) comes to the surface.
DF3	9.361	12.361	1-5m SAND and GRAVEL overlying very stiff CLAY (London CLAY)
DF3	12.361	15.215	0.5-3m SAND and GRAVEL overlying very stiff, high to very high strength cohesive CLAY (London CLAY). London CLAY within 0.5 m BSB to KP 13.500
DF3	15.215	17.901	0.2-3m SAND overlying very stiff, high to very high strength cohesive CLAY (London CLAY). London CLAY is at or near the seabed from ~KP 15.900
DF3	17.901	20.848	0.2-1m SAND overlying very stiff, high to very high strength cohesive CLAY (London CLAY). Some areas of stiff CLAY outcrops. London CLAY is at or near the seabed in this section to ~KP 19.000
DF3	20.848	23.646	Veneer (<0.5 m) of SAND transitioning to firm CLAY overlying stiff CLAY. London CLAY is at or near the seabed in this section.
DF3	23.646	25.948	Firm CLAY transitioning to SAND (0.2-5m) overlying very stiff CLAY. London CLAY is at or near the seabed in this section.
DF3	25.948	28.143	SAND (>4m-veneer) transitioning to CLAY overlying high to very high strength cohesive London CLAY. London CLAY <0.5 m BSB from KP 28.000
DF3	28.143	31.584	Firm CLAY overlying very stiff CLAY. London CLAY <0.5 m BSB in this section
DF3	31.584	35.089	Very stiff CLAY is at or near the seabed. London CLAY <0.5 m BSB in this section
DF3	35.089	37.171	Thin veneer of GRAVEL (0.2 m) overlying very stiff CLAY. London CLAY <0.5 m BSB in this section

DF3	37.171	40.103	Thin veneer of GRAVEL (0.2 m) overlying very stiff CLAY. London CLAY <0.5 m BSB in this section
DF3	40.103	42.685	Thin veneer of SAND (0.2 m) transitioning to GRAVEL overlying very stiff CLAY. London CLAY <0.5 m BSB in this section
DF3	42.685	44.802	Thin veneer of GRAVEL (0.2 m) transitioning to very stiff CLAY from KP 48.281 overlying very stiff CLAY. London CLAY <0.5 m BSB in this section
DF3	44.802	47.797	Very stiff CLAY at surface apart from veneer of gravelly SAND overlying very stiff CLAY between ~KP 46.200 and KP 47.000. London CLAY <0.5 m BSB in this section
DF3	47.797	50.858	Very stiff CLAY is at or near the seabed intermittently overlain by a thin veneer (<0.2 m) of SAND. London CLAY <0.5 m BSB in this section
DF3	50.858	53.354	Thin veneer of SAND (0.2 m) overlying very stiff CLAY. London CLAY <0.5 m BSB in this section
DF3	53.354	55.881	Thin veneer of SAND (0.2 m) overlying very stiff CLAY up to ~KP 54.727. Thereafter SILT up to 0.7m overlies very stiff CLAY up to ~KP 55.290 followed by veneer of firm CLAY. London CLAY <0.5 m BSB in this section
DF3	55.881	58.822	Thin veneer of SAND (0.2 m) overlying very stiff CLAY to ~KP 56.900 thereafter gravelly SAND to sandy GRAVEL (1-5m) overlying very stiff CLAY. London CLAY <0.5 m BSB through to KP 56.900 and from KP 58.819
DF3	58.822	62.321	Thin veneer of SAND (0.2 m) overlying very stiff CLAY to ~KP 59.931, thereafter gravelly SAND to sandy GRAVEL (1-4m) thick overlying very stiff CLAY until it thins again at ~KP 61.000, and very stiff CLAY is at or near seabed. London CLAY <0.5 m BSB through to KP 59.931 and from KP 61.000.
DF3	62.321	64.812	Gravelly SAND/sandy GRAVEL up to >3m BSB overlying London CLAY
DF3	64.812	68.304	SAND (veneer-2.5m) overlying very stiff, high to very high strength cohesive London CLAY
DF3	68.304	71.305	SAND (veneer-2m) overlying very stiff, high to very high strength cohesive London CLAY
DF3	71.305	74.038	SAND (0.2-1.7m) overlying very stiff, high to very high strength cohesive London CLAY
DF3	74.038	76.644	SAND (0.2-4m) overlying very stiff, high to very high strength cohesive London CLAY
DF3	76.644	79.701	SAND (2.5 to >7.5 m) overlying very stiff CLAY
DF3	79.701	82.804	SAND overlying very stiff CLAY thins from 7.5m to 0.5m at ~KP 80.954 and thickens again to 5m

DF3	82.804	85.801	SAND is 3 to 6.5 m thick overlying very stiff CLAY
DF3	85.801	88.811	SAND is 3 to 6.5 m thick overlying very stiff CLAY. From ~KP 86.963 to 88.256 SAND thins to 2 m coinciding with an underlying sub-unit of SILT up to 6.5 m thick. Very stiff CLAY remains 7.5 – 10 m BSB.
DF3	88.811	91.313	SAND varies 2.5 to 7.5 m thick overlying SILT up to ~KP 90.083. From this KP onwards soft CLAY is overlain by SAND, and very stiff CLAY is at the base 7.5 to 10 m BSB. From ~KP 90.651 the base of the soft CLAY unit is not observed, possibly due presence of coarse grain fractions such sand.
DF3	91.313	94.446	SAND varies 0.5 to 7 m between ~KP 91.178 and KP 92.377 overlying soft CLAY. Thereafter a thin (0.2 m) veneer of SAND overlies channel infill sediment such as firm CLAY between ~KP 92.377 and KP 93.588. SAND unit is at the base. The base of the SAND is not seen due to attenuation. SAND is at or near the seabed to ~KP 94.446.
DF3	94.446	97.346	SAND is at or near the seabed until ~KP 95.862 thereafter CHALK unit is detected 10 m BSB and is at or near (0.2 m) the seabed from ~KP 96.500.
DF3	97.346	100.349	CHALK is at or near the seabed covered with a thin (< 0.2 m) veneer of SAND and GRAVEL.
DF3	100.349	102.670	CHALK is at or near the seabed overlain by a thin (0.2- 0.7 m) unit of SAND.
DF3	102.670	105.018	CHALK is at or near the seabed overlain by a thin (0.2- 0.5 m) unit of GRAVEL. Occasional discrete deposits of SAND up to 1.5 m.
DF3	105.018	107.946	GRAVEL alternating with SAND is overlying CHALK throughout the entire section. The unit composed of SAND and GRAVEL gently thickening from 0.2 m at ~KP 105.200 towards the end of the section.
DF3	107.946	109.813	CHALK is overlain by SAND <0.2 m transiting to GRAVEL bank and later by gravely SAND and GRAVEL <0.2 m becoming the main sediment overlying CHALK
DF3	109.813	112.139	SAND and GRAVEL <0.2 m overlying CHALK with the BEDROCK/ CHALK unit at or near the seabed. The uppermost unit is composed of SAND, GRAVEL and COBBLES of approximately 0.2m thick overlying CHALK and stiff CLAY towards the end of this section.
DF3	112.139	115.408	SAND and GRAVEL 0.3 m thick gradually transits to gravelly SAND overlying very stiff CLAY to ~KP 114.000. Thereafter there are units of SAND that are 1 to 3.5 m thick overlying very stiff CLAY (London CLAY).

DF3	115.408	118.399	SAND units 1.5 to 3 m thick overlying very stiff CLAY to ~KP 117.392. Between ~KP 117.392 and KP 118.000 SAND is thin (<0.2 m) with very stiff CLAY at or near the seabed. SAND unit increases in thickness from 0.2 to 2.5 m thick overlying very stiff CLAY (London CLAY).
DF3	118.399	120.469	SAND unit is 2.5 m thick overlying very stiff CLAY.
DF3	120.469	121.380	(Refraction interpretation 2023)

6.5 Landfalls

A separate study has been undertaken of the landfalls (Red Penguin Technical Note Sea Link) and the key information is summarised in this Section. A further study is currently underway by ABPMer, the Sea Link Landfall Sediment Modelling Project. The results have not been incorporated in this report.

6.6 Suffolk Coastline

The area covered in detail includes the coastal frontage and an area extending approximately 10km offshore, as shown in Figure 19.

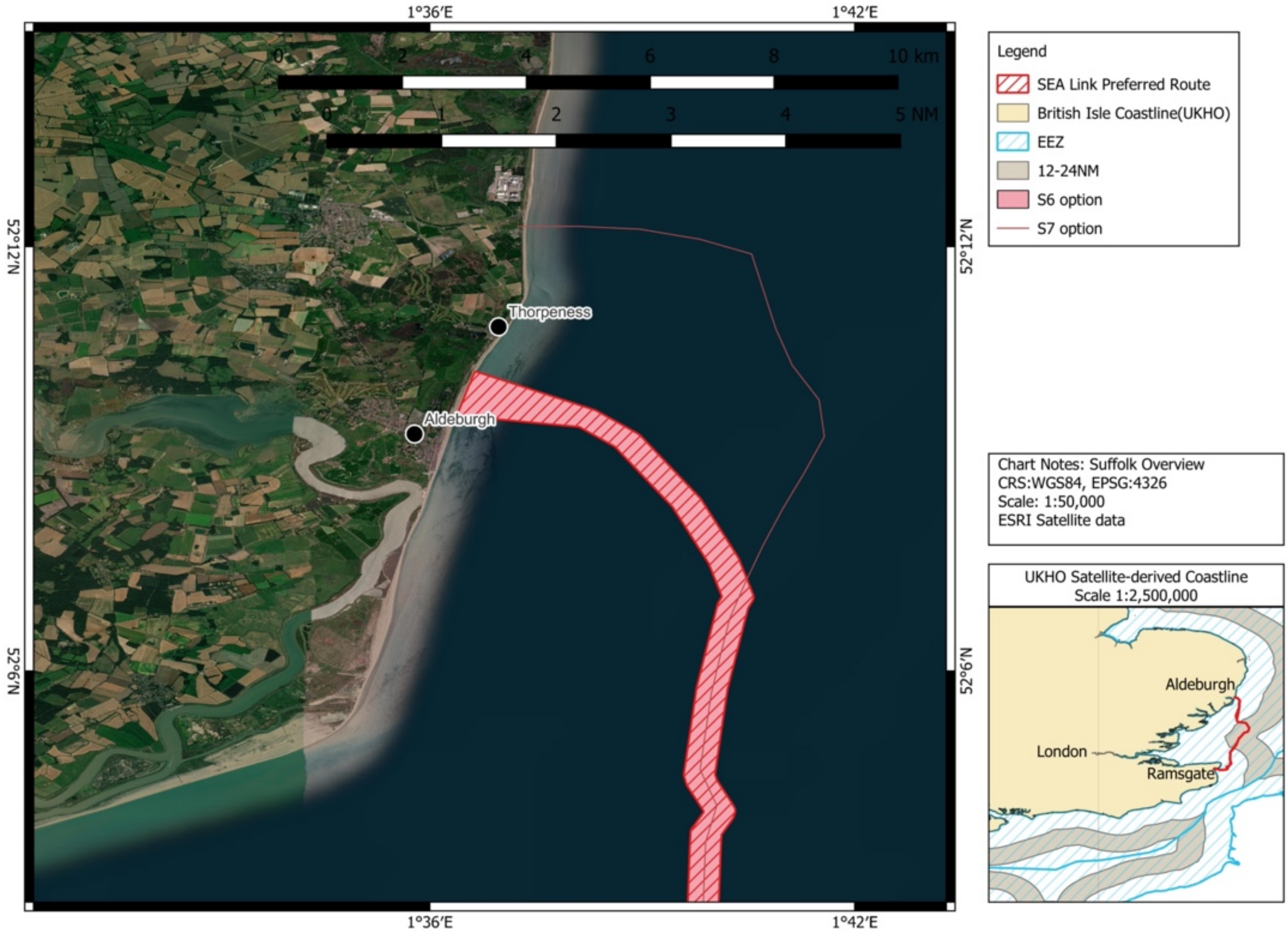


Figure 19: Overview of the detailed area – Aldeburgh

The Aldeburgh to Sizewell frontage is approximately 6km in length and the coastline is orientated north-south between Sizewell and Thorpeness, rotating to face NNE-SSW between Thorpeness and Aldeburgh.

Within the shallow embayment between Aldeburgh and Thorpeness, the shingle has accumulated to form a wide shingle backshore that protects the low, sandy cliffs from erosion. The intertidal area is a mixture of sand and shingle that shelves steeply down to around -4m AOD. Beyond this depth the gradient decreases and the seabed becomes virtually flat approximately 700m from the MHWS mark, at the beach toe, or closure depth.

The offshore seabed is composed of clayey, silty, fine sand of the Westkapelle Ground Formation, overlying shelly, medium to coarse grained sands of the Red Crag Formation. Some flint gravels are to be found in the offshore areas having been deposited by the Middle Pleistocene Thames/Medway River that flowed towards the north-east. Close to the coast, the surficial sediment size is highly variable, ranging from sandy mud to sandy gravel.

Note that in the vicinity of Aldeburgh, to the south of the landfall, there is evidence of a potential drowned river valley, infilled with estuarine silts and clays.

Thorpeness and various locations in the vicinity of Aldeburgh are underlain by the Coralline Crag Formation. This deposit comprises a series of bioclastic calcarenites and silty sands with a high proportion of shelly material – principally bryozoan and mollusc debris. It Is relatively resistant to erosion and its presence within the core of the ness is likely to have helped fix its position. Indeed, the Coralline Crag is one of the principal control features along the coast from Dunwich to Aldeburgh.

Tidal currents along this part of the Suffolk coast are rectilinear with the flood and ebb flows running in a southerly and northerly direction respectively. There is a marked asymmetry in tidal current velocities over a tidal cycle so that offshore, the maximum flood tidal flow speeds reach 1.7m/s on spring tides and 0.9m/s on neaps and maximum ebb tidal flow speeds reach and 1.4m/s on spring tides and 0.8m/s on neaps.

The offshore zone, seaward as far as approximately 2^{o} E, has a great number of mobility indicators including barchan dunes, sand streaks and ribbons, megaripples and sandwaves. Where there is any indication of asymmetry, the movement is more frequently, towards the south, towards the Thames Estuary approaches though there are contrary indicators. These indicators are largely coast parallel and are part of the Southern North Sea nearshore sediment pathway. Storm surge events are known to generate strong southerly sediment transport, with gross sediment movement being orders of magnitude higher than normal, tidally driven bedload transport. Farther offshore, there appears to be a bedload parting zone as sediment movement is indicated by bedforms as being more frequently towards the north. A conceptual sediment transport map is shown below in Figure 20.

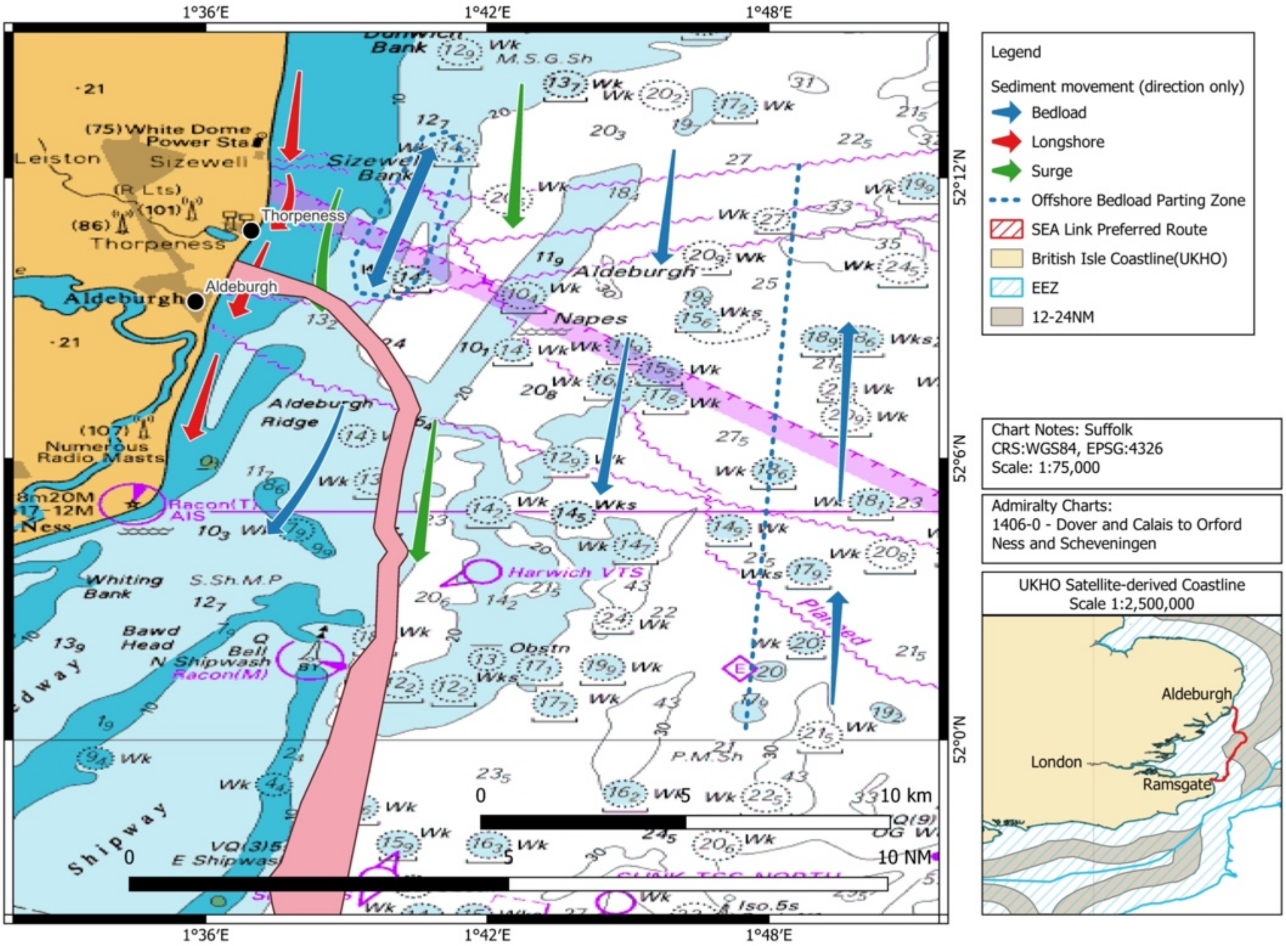


Figure 20: Regional scale, conceptual sediment transport map - Suffolk

Note that closer inshore the Coralline Crag exposure and the Ness at Thorpeness both influence local circulation patterns.

The indicative landfall site at Aldeburgh has been envisioned by NGET to encompass four ducts for Sea Link, with capacity to also install further ducts, in order to facilitate an additional project. The Sea Link project anticipates that the ducts will exit approximately 1500 metres from the TJB into ~ 7 m LAT water depth, having passed beneath the mapped exposed extent of the Coralline Crag.

6.6.1 Pegwell Bay

The detailed area includes the coastal frontage and an area extending approximately 10km offshore, as shown in the following figure.

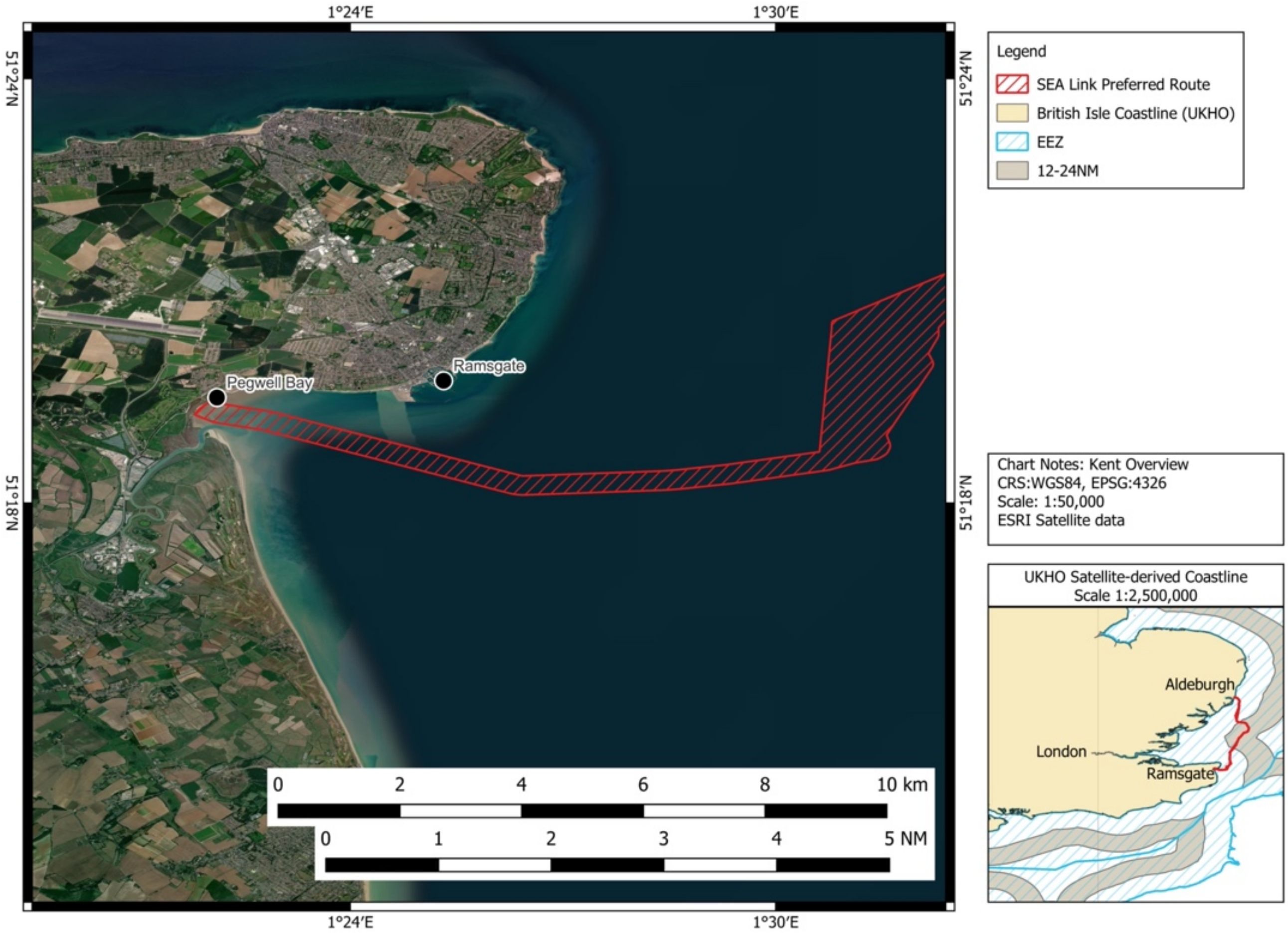


Figure 21: Overview of the detailed area – Pegwell Bay

Pegwell Bay is located at the southern end of the chalk cliff line to the west of the town of Ramsgate, and north of the Minster Marshes and Ash Level, which form the floodplain of the Stour. The river flows northwards from Sandwich to emerge into Pegwell Bay. The Bay is backed by a rugged well-jointed chalk cliff with a wave-cut platform and a rocky foreshore, whereas to the south there are extensive sand dunes and a shingle foreshore forming part of the Sandwich Bay Nature Reserve. Within the floodplain of the Stour there are extensive saltmarshes with a hinterland of dunes. The former international hovercraft port is located in the centre of the frontage, representing a hard shoreline structure.

To the west of the Bay at Cliffs End, the steep chalk cliffs give way to relic, undefended sandstone cliffs, which contain some of the thickest loess deposits in the UK. Loess is defined as a sediment which is dominated by silt sized (63-2 µm) particles that have been entrained, transported, and deposited by wind. The Pegwell Bay loess uppermost layers consist of typical Holocene argillic brown earth with a small proportion of illuvial clay. Sand sized grain fractions are also present in the loess, along with flint pebbles and white chalk fragments that suggested that only 10-20% was derived from local sources such as the sandy Thanet Beds. The exposed loess cliff top is susceptible to weathering and cliff falls, which provides a source of material for the foreshore within the inner bay.

The southern part of the bay is characterised predominantly by low-lying intertidal saltmarsh and extensive mud and sand flats. The intertidal is protected from easterly waves by a shingle spit at Shell Ness (just to the east of the landfall), of which the barrier is between 100 - 175 m wide and 4 to 4.5 m ODN (6.88 - 7.38 m above LAT) high. The spit has a highly dynamic morphology and is dependent on seasonal variations in the local wave climate entering the Bay. The morphology of the Stour channel is similarly dynamic, with migration of several tens of metres observed between 2007 and 2013.

The general stratigraphy in the area around Pegwell Bay consists of Upper Cretaceous White Chalk bedrock overlain by silty marls, fine sand, and shells (called the Thanet Beds) of variable thickness of Eocene age. The Upper Chalk is brecciated, which suggest ice segregation during perennial or seasonal freezing. The Thanet Beds have interbedded channel sands and lenses of gravel and flint pebbles are also present. The flint pebbles are derived from the Tertiary Pebble Beds of the London Basin.

Moving further offshore, extensive areas of Cretaceous chalk are encountered at or close to the surface although are overlain in places by Tertiary sands, silts and clays belonging to the Thanet Formation. Quaternary sediments in the form of Holocene deposits are also present and are generally expected to be mobile, creating various types of bedforms Both the Tertiary and Quaternary sediment groups vary in thickness along with mobile Holocene deposits reaching a thickness of up to approximately 3 m where bedform features are present.

Within Pegwell Bay itself, the seabed sediments are composed of fine to very fine sands. Significant volumes of very fine material exist within the saltmarsh intertidal through which the Stour exits in the south of the bay, at the landfall. Such material is likely to have built up in the lee of the mixed sand/ shingle spit and ultimately provides a platform upon which the spit can migrate over time.

Numerous seabed ridges and outcrops can be seen throughout the area of interest, where the underlying chalk geology is present at the seabed. These ridges may be several metres high and are typically associated with scatted boulder clusters. One such outcrop forms a plateau-like features stretching around 600 m is present in the offshore area.

Current-induced bedform features are present across the whole area. These include:

- Sand waves of wavelengths 200 - 250 m and a height of between 1 - 3 m. These features generally have straight lee faces and are orientated south-west to north-east in line with the axis of tidal ellipses throughout Pegwell Bay and along the coast of North Foreland.
- Sand waves of wavelengths 8 - 25 m and heights in excess of 2 m. This category has a mixture of straight and irregularly shaped crests with a general south-west to north-east orientation; and

- Sand waves of wavelengths 3 - 10 m and heights of 0.1 - 0.6 m. These small waves have a mixture of straight and irregularly shaped crests. The orientation of these features is predominantly south-west to north-east, but is highly variable and illustrates the varying current regimes throughout the area of interest

Pegwell Bay receives a natural supply of sediment from updrift, offshore and fluvial sources Material is transported southwards across the Bay from Ramsgate harbour, noting that the construction of harbour structures has significantly altered the natural longshore movement of sediment. In contrast, transport is generally northward in direction along the gravel barrier between South Foreland and the Stour estuary mouth. During storm conditions this northerly transport may reverse, switching to a predominantly southerly orientated drift back down the barrier.

Much of the intertidal zone at the mouth of the Stour has been accreting over time, with gradual channel evolution. The gravel spit on the eastern side of the river channel has historically lengthened due to an overall south to north littoral drift along the gravel barrier. This is reflected in sediment budget estimates, with negative rates (i.e., erosion) beyond Sandwich and a residual rate of circa 3,000 m^3/yr northwards approaching the end of the barrier in 2013.

Tidal currents carry sand and silt in suspension, which are then deposited on the extensive tidal flats within Pegwell Bay. However, the majority of sediment transport throughout Pegwell Bay occurs during storm surge conditions.

Regional scale sediment transport studies suggest that offshore net bedload transport is in a south-westerly direction, to the north of the study area and a north easterly direction to the south. A regional scale, conceptual sediment transport map is shown in Figure 22. There is a projected convergence of sediment transport in the vicinity of Goodwin Sands. Bedform asymmetry analysis performed for other studies has proved inconclusive, although there is tentative evidence of a general migration of bedforms to the north-east.

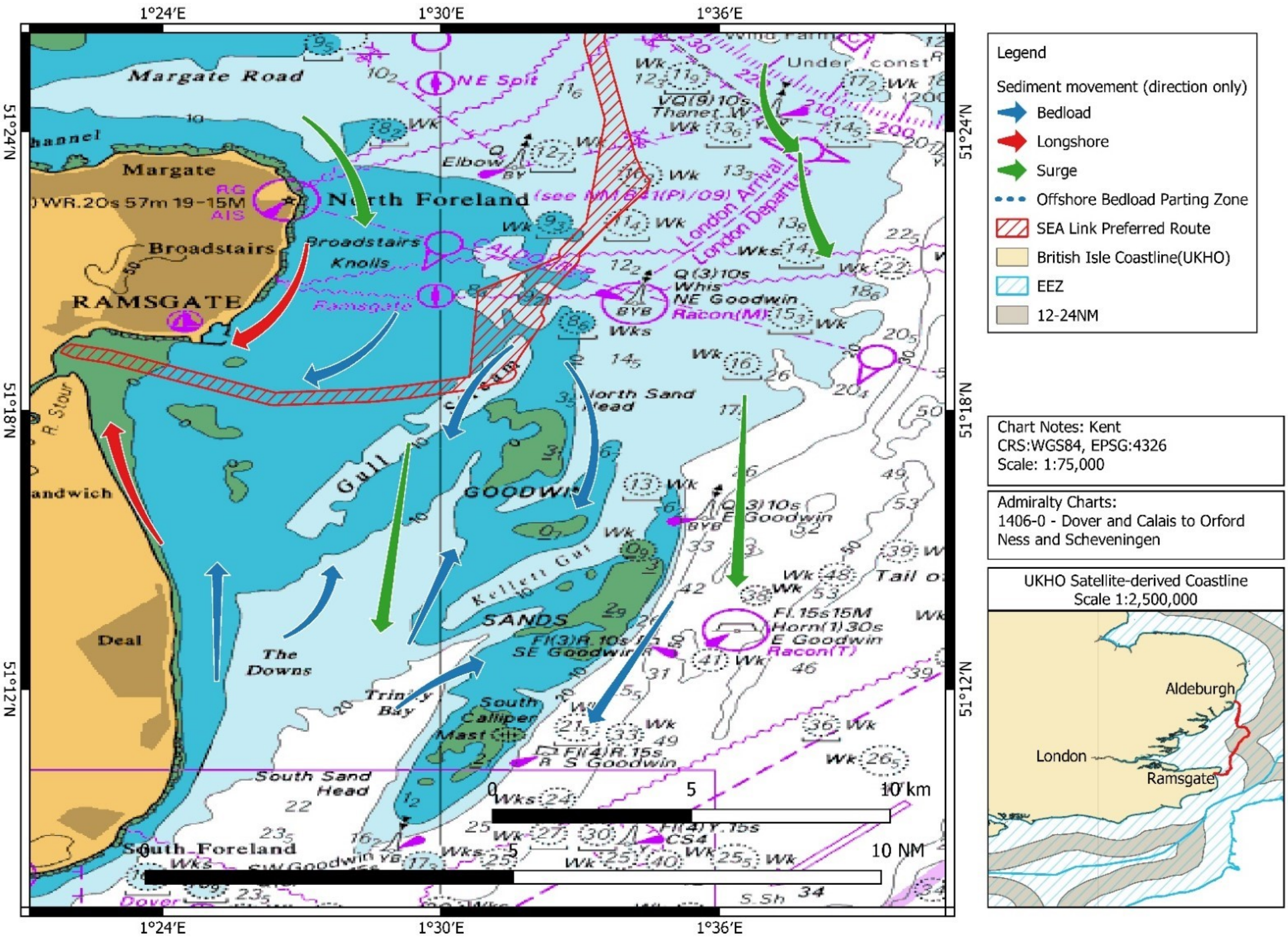


Figure 22: Regional scale conceptual sediment transport map – North Kent

The landfall site at Pegwell Bay is planned with 4 ducts with the preferred alignment exiting the seabed ~920m from the TJB.

7 BURIAL ASSESSMENT

The BAS identifies the risks associated with the factors which will affect derivation of the recommended DOL.

7.1 Natural Risks / Geohazards

7.1.1 Bathymetry and topography (slopes)

Slopes greater than 10° represent a hazard to burial tools (mechanical trenchers, jetting, and ploughs) in terms of traction but this is an upper limit as directionality of the slope to the cable route can affect stability of the tool.

Nearly all the significant bathymetric gradients along the route are induced by mobile bedforms. Where feasible gradients both along and across the route which exceed 10° will be avoided during micro-routing. Where the gradients cannot be avoided and the bedforms obstruct the route, the risk can be reduced by pre-sweeping.

7.1.2 Shallow geology classification and distribution (soft / hard areas)

Soft areas are those in which the sediment is granular and where cohesive sediments are present, they have a low shear strength enabling fluidisation of the seabed sediment, typically below 100kPa. Sediment can be displaced through towed cable ploughs or jetting to fluidise sediment to enable effective burial.

Hard areas are where burial by jetting is not effective as the shear strengths of sediments exceeds the jetting pressure > 100kPa. This also includes pre-Holocene glacial drift deposits and pre-Quaternary deposits of ‘solid’ geology (London Clay / Chalk). Hard areas will require mechanical break-up of material, e.g. through chain or wheel cutters. In addition, ejection of cut material from the trench will be required but can be problematic as material can fall back into the trench, reducing depth before touchdown of the cable into the trench.

The nature of the seabed sediments is deterministic in the lowering methodology and is integral to the burial risk, i.e. can the cable be buried, and is the achievable lowering greater of equal to the recommended DOL, or will remedial works be required to achieve the recommended DOL?

The Sea Link route crosses both granular and cohesive sediments along with exposures of bedrock (CHALK [towards Pegwell Bay landfall] and sub-cropping Red Crag Formation Sandstone [towards Aldeburgh landfall]).

The upper 3m sediments along the route are predominantly overlain (from a veneer to several metres) by Holocene SAND with GRAVEL fractions followed by firm to very stiff CLAY (London CLAY) with SAND

and SILT components. The CLAY unit was observed at, near and below the seabed along the majority of the route.

The SAND layers were very loose to loose in the upper sections and became medium dense with depth while the London CLAY formation showed a general trend of increasing shear strength with increasing depth at most locations.

The following figure is based on the MMT SBI geological model, which will be updated once the Additional Marine Survey geotechnical samples and in-situ testing is acquired and interpreted. However, there are not expected to be significant differences in the geological model, except to the east of the Shipwash East ridge, where the sediment is expected to be London CLAY, as opposed to sand-dominated mobile sediments found in the 2021 survey.

Route	SW				SWO																										
CPT/VC	CPT	VC	CPT	VC	CPT	VC	CPT	VC	CPT	CPT	VC	VC	CPT	VC	CPT	CPT	VC	VC	CPT	VC	CPT	VC	CPT	VC	CPT	VC	CPT	VC	CPT	VC	CPT
SI/Sample KP	5.751	4.441	3.814	3.300	11.566	13.999	14.929	16.219	17.003	17.768	17.771	19.208	20.309	20.993	21.998	22.999	23.003	23.846	25.479	26.003	27.003	27.999	28.004	28.748	29.951	31.103	32.003	33.180	33.182	33.999	35.214
0.0m to 0.5m	9	8	9	9	9	7	5	5	4	4	4	7	6	4	4	4	4	4	4	4	4	4	7	4	7	8	8	8	8	4	4
0.5m to 1.0m	9	8	8	9	9	6	5	5	4	4	4	7	5	4	4	4	4	4	4	4	4	4	4	4	7	8	8	8	8	4	4
1.0m to 1.5m	7	9	9	8	7	6	5	5	4	4	4	7	3	4	4	4	4	4	4	4	4	4	4	4	8	8	6	8	8	4	4
1.5m to 2.0m	5	9	9	P	7	6	5	5	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	8	7	7	4	4	4	4
2.0m to 2.5m	5	8	8	8	5	6	5	5	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	6	7	7	4	4	4	4
2.5m to 3.0m	5	9	8	8	5	6	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	6	6	4	4	4	4

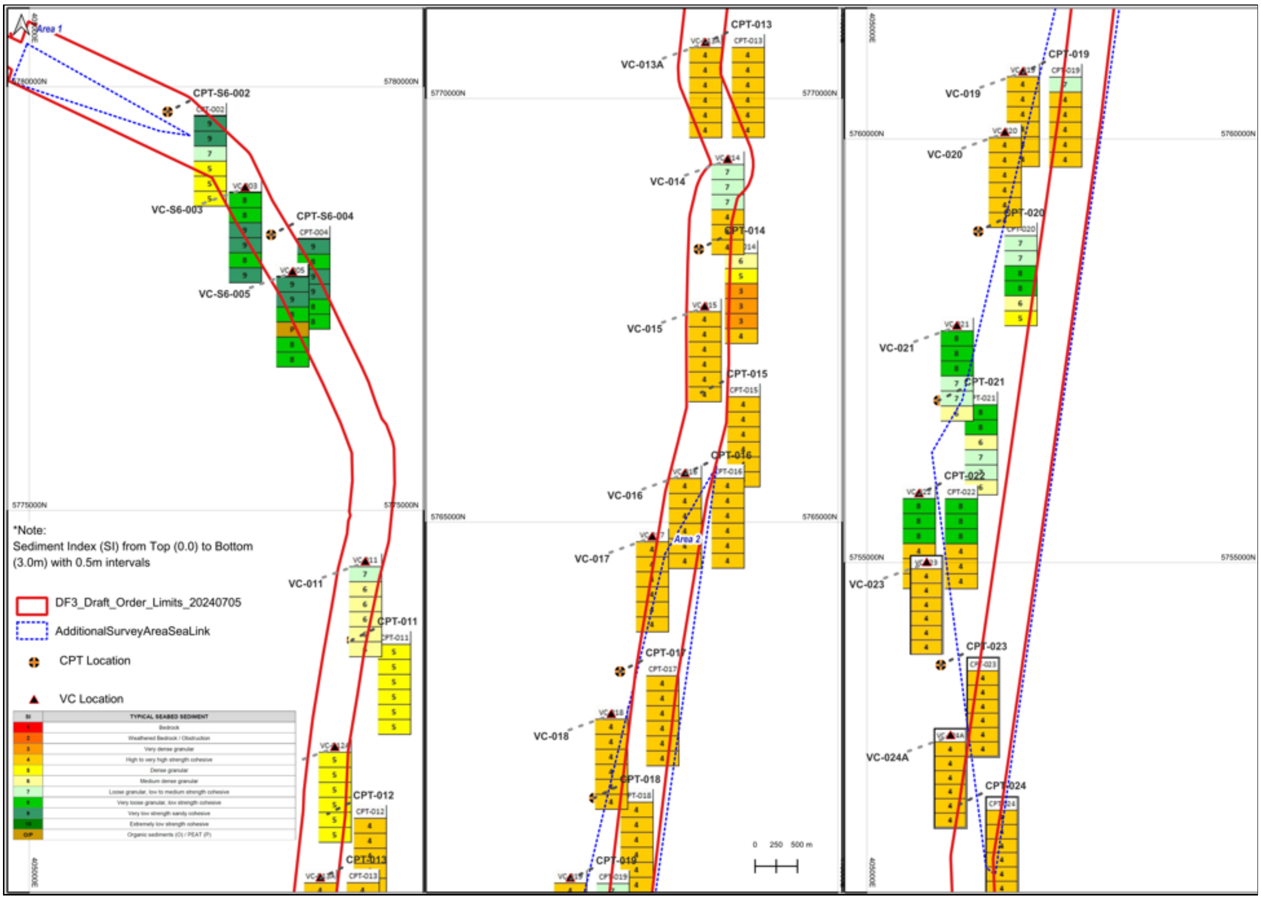
Route	SWO																														
CPT/VC	VC	CPT	CPT	VC	VC	CPT	VC	CPT	CPT	VC	VC	CPT	VC	CPT	VC	CPT	VC	CPT	VC	CPT	VC	CPT	VC	CPT	VC	CPT	CPT	VC	CPT	VC	CPT
SI/Sample KP	36.061	36.874	37.967	37.973	39.052	39.999	41.002	42.001	42.998	43.002	43.913	44.985	46.002	47.024	47.881	47.885	49.287	49.935	51.476	51.938	53.093	53.096	54.224	55.003	56.148	56.998	57.997	58.000	58.998	60.130	61.146
0.0m to 0.5m	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
0.5m to 1.0m	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
1.0m to 1.5m	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
1.5m to 2.0m	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
2.0m to 2.5m	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
2.5m to 3.0m	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Route	SWO																														
CPT/VC	VC	CPT	VC	CPT	VC	CPT	VC	VC	CPT	CPT	VC	CPT	VC	VC	CPT	CPT	VC	CPT	CPT	VC	CPT	VC	CPT	VC	CPT	VC	CPT	VC	CPT	VC	CPT
SI/Sample KP	61.176	63.318	63.322	64.212	64.999	65.798	67.018	67.719	67.722	69.088	70.003	71.004	71.964	72.862	72.964	73.918	74.466	75.499	75.502	77.586	78.000	78.001	79.243	80.037	80.999	81.842	82.999	82.999	83.799	84.938	86.023
0.0m to 0.5m	4	7	7	4	4	7	4	7	7	4	7	4	4	7	7	4	4	3	4	4	4	4	6	6	6	7	7	7	7	7	7
0.5m to 1.0m	4	6	6	4	4	6	4	5	5	4	4	4	4	7	7	4	4		4	4	4	4	5	6	6	7	7	7	7	7	7
1.0m to 1.5m	4	5	5	4	4	5	4	5	5	4	4	4	4	7	7	4	4		4	4	4	4	6	6	6	7	7	7	7	7	6
1.5m to 2.0m	4	5	5	4	4	6	4	3	3	4	4	4	4	7	7	4	4		4	4	4	4	5	6	6	6	7	7	7	7	6
2.0m to 2.5m	4	5	6	4	4	6	4	3	3	4	4	4	4	4	4	4	4		4	4	4	4	3	6	6	6	7	7	7	7	6
2.5m to 3.0m	4	5	5	4	4	4	4	3	3	4	4	4	4	4	4	4	4		4	4	4	4	3	7	7	6	7	7	7	7	6

Route	SWO																												
CPT/VC	VC	CPT	VC	CPT	VC	CPT	VC	VC	CPT	CPT	VC	CPT	VC	VC	CPT	CPT	CPT	VC	CPT	VC	VC	CPT	CPT	VC	CPT	CPT	CPT	VC	CPT
SI/Sample KP	86.999	88.013	88.014	89.001	90.418	90.999	91.855	93.182	93.183	94.003	95.002	96.199	96.807	98.460	98.462	99.634	99.640	100.229	100.650	102.000	102.998	103.000	103.999	105.003	105.999	106.000	106.001	107.460	108.045
0.0m to 0.5m	7	8	8	8	7	8	7	7	7	7	7	8	7	8	8	2	2	7	7	1	1	1	6	6	6	6	3	7	3
0.5m to 1.0m	6	6	6	6	7	8	7	7	7	7	7	8	7	8	8			7	7	1	1	1	1	1	1	1	2	5	2
1.0m to 1.5m	6	6	6	5	6	8	7	8	7	7	7	8	7	7	7			6	7	1	1	1	1	1	1	1		1	1
1.5m to 2.0m	6	6	6	6	6	5	7	7	8	7	7	6	6	7	7			6	1	1	1	1	1	1	1	1		1	1
2.0m to 2.5m	6	5	5	5	6	5	7	7	7	7	7	3	6	7	7			6	1	1	1	1	1	1	1	1		1	1
2.5m to 3.0m	6	5	5	6	6	5	4	7	7	7	7	3	6	7	7			6	1	1	1	1	1	1	1	1		1	1

Route	SWO																	
CPT/VC	CPT	VC	CPT	CPT	VC	CPT	VC	CPT	VC	CPT	CPT	VC	CPT	VC	CPT	CPT	CPT	VC
SI/Sample KP	108.046	108.048	108.431	108.436	109.691	111.002	111.563	113.256	113.259	113.262	114.397	115.300	116.327	117.896	117.899	120.028	120.030	120.031
0.0m to 0.5m	3	7	1	6	6	3	6	5	3	5	1	3	1	5	1	6	6	6
0.5m to 1.0m	2	5	1	1	1	1	3	3		5	1		1	1	1	4	4	4
1.0m to 1.5m	1	5	1	1	1	1	1	3		3	1		1	1	1	4	4	4
1.5m to 2.0m	1	1	1	1	1	1	1			1	1		1	1	1	4	4	4
2.0m to 2.5m	1	1	1	1	1	1	1			1	1		1	1	1	4	4	4
2.5m to 3.0m	1	1	1	1	1	1	1			1	1		1	1	1	4	4	4

For full details, please refer to the MMT Integrated Geophysical and Geotechnical Survey Report.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Area 2
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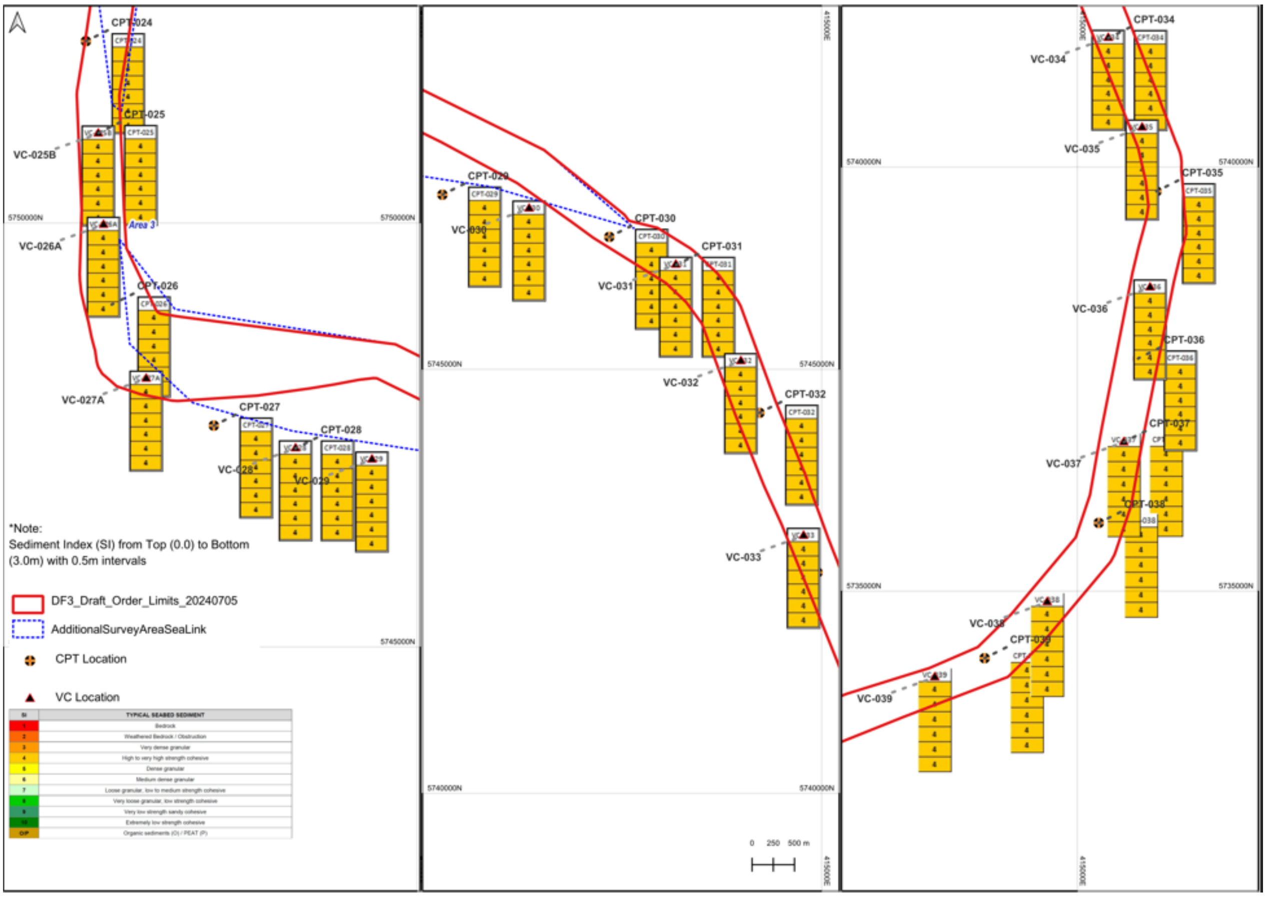
VC-S6-003
CPT-S6-004
VC-S6-005
VC-011
CPT-011
CPT-012
CPT-013
VC-013A
VC-014
CPT-014
VC-015
CPT-015
VC-016
CPT-016
VC-017
CPT-017
VC-018
CPT-018
CPT-019
VC-019
VC-020
CPT-020
VC-021
CPT-021
CPT-022
VC-023
CPT-023
VC-024A
CPT-024
5780000N
5775000N
5770000N
5765000N
5760000N
5755000N
0 250 500 m
*Note:
Sediment Index (SI) from Top (0.0) to Bottom (3.0m) with 0.5m intervals
DF3_Draft_Order_Limits_20240705
AdditionalSurveyAreaSeaLink
CPT Location
VC Location
TYPICAL SEABED SEDIMENT
Bedrock
Weathered Bedrock / Obstruction
Very dense granular
High to very high strength cohesive
Dense granular
Medium dense granular
Loose granular, low to medium strength cohesive
Very loose granular, low strength cohesive
Very low strength sandy cohesive
Extremely low strength cohesive
Organic sediments (O) / PEAT (P)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CPT-025
VC-025B
VC-026A
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VC-027A
CPT-027
CPT-028
VC-028
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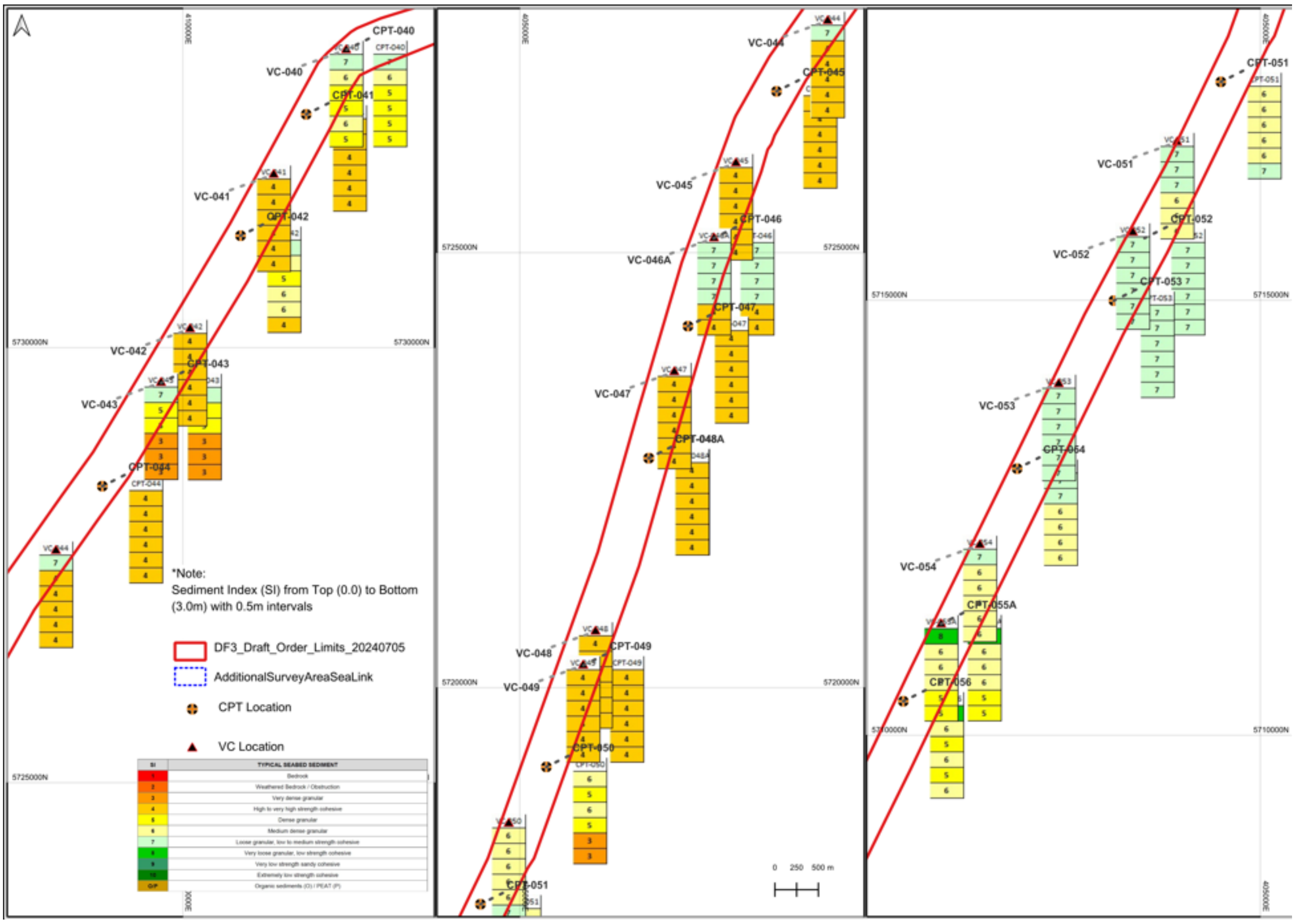
VC-030
CPT-030
CPT-031
VC-031
VC-032
CPT-032
VC-033
CPT-034
VC-034
VC-035
CPT-035
VC-036
CPT-036
CPT-037
VC-037
CPT-038
VC-038
CPT-039
VC-039
5750000N
5745000N
5740000N
5735000N
415000E
*Note:
Sediment Index (SI) from Top (0.0) to Bottom (3.0m) with 0.5m intervals
DF3_Draft_Order_Limits_20240705
AdditionalSurveyAreaSeaLink
CPT Location
VC Location
SI
TYPICAL SEABED SEDIMENT
1 Bedrock
2 Weathered Bedrock / Obstruction
3 Very dense granular
4 High to very high strength cohesive
5 Dense granular
6 Medium dense granular
7 Loose granular, low to medium strength cohesive
8 Very loose granular, low strength cohesive
9 Very low strength sandy cohesive
10 Extremely low strength cohesive
O/P Organic sediments (O) / PEAT (P)
0 250 500 m



CPT-040
VC-040
CPT-041
VC-041
CPT-042
VC-042
CPT-043
VC-043
CPT-044
*Note:
Sediment Index (SI) from Top (0.0) to Bottom (3.0m) with 0.5m intervals
DF3_Draft_Order_Limits_20240705
AdditionalSurveyAreaSeaLink
CPT Location
VC Location
VC-044
CPT-045
VC-045
CPT-046
VC-046A
CPT-047
VC-047
CPT-048A
VC-048
CPT-049
VC-049
CPT-050
CPT-051
VC-051
CPT-052
VC-052
CPT-053
VC-053
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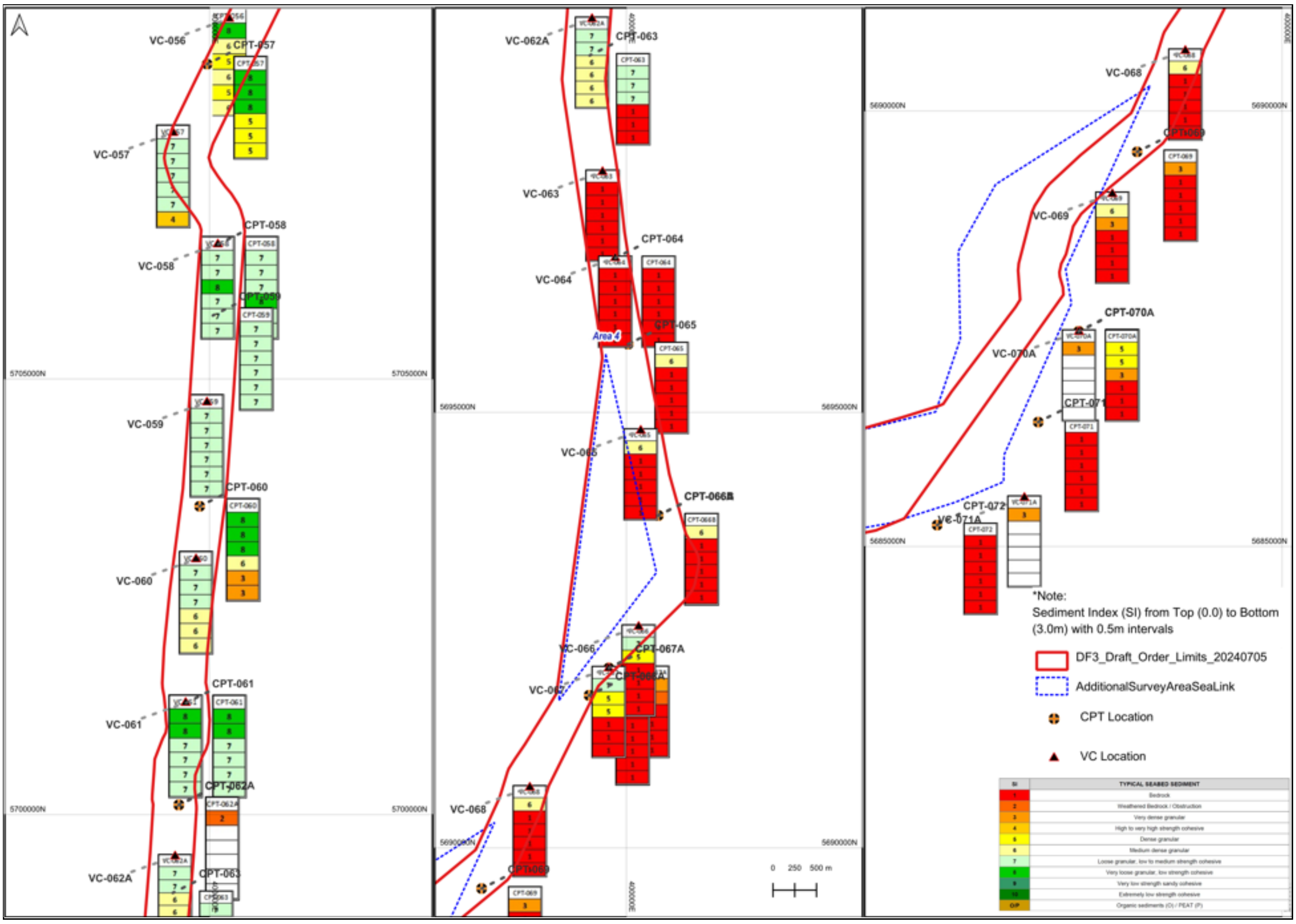
5715000N
5710000N
0 250 500 m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CPT-058
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VC-061
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VC-062A
CPT-063
VC-063
CPT-064
VC-064
CPT-065
Area 4
CPT-066B
CPT-067A
VC-068
CPT-069
VC-069
CPT-070A
VC-070A
CPT-072
VC-071A
5705000N
5700000N
5695000N
5690000N
5685000N
0 250 500 m
*Note:
Sediment Index (SI) from Top (0.0) to Bottom (3.0m) with 0.5m intervals
DF3_Draft_Order_Limits_20240705
AdditionalSurveyAreaSeaLink
CPT Location
VC Location

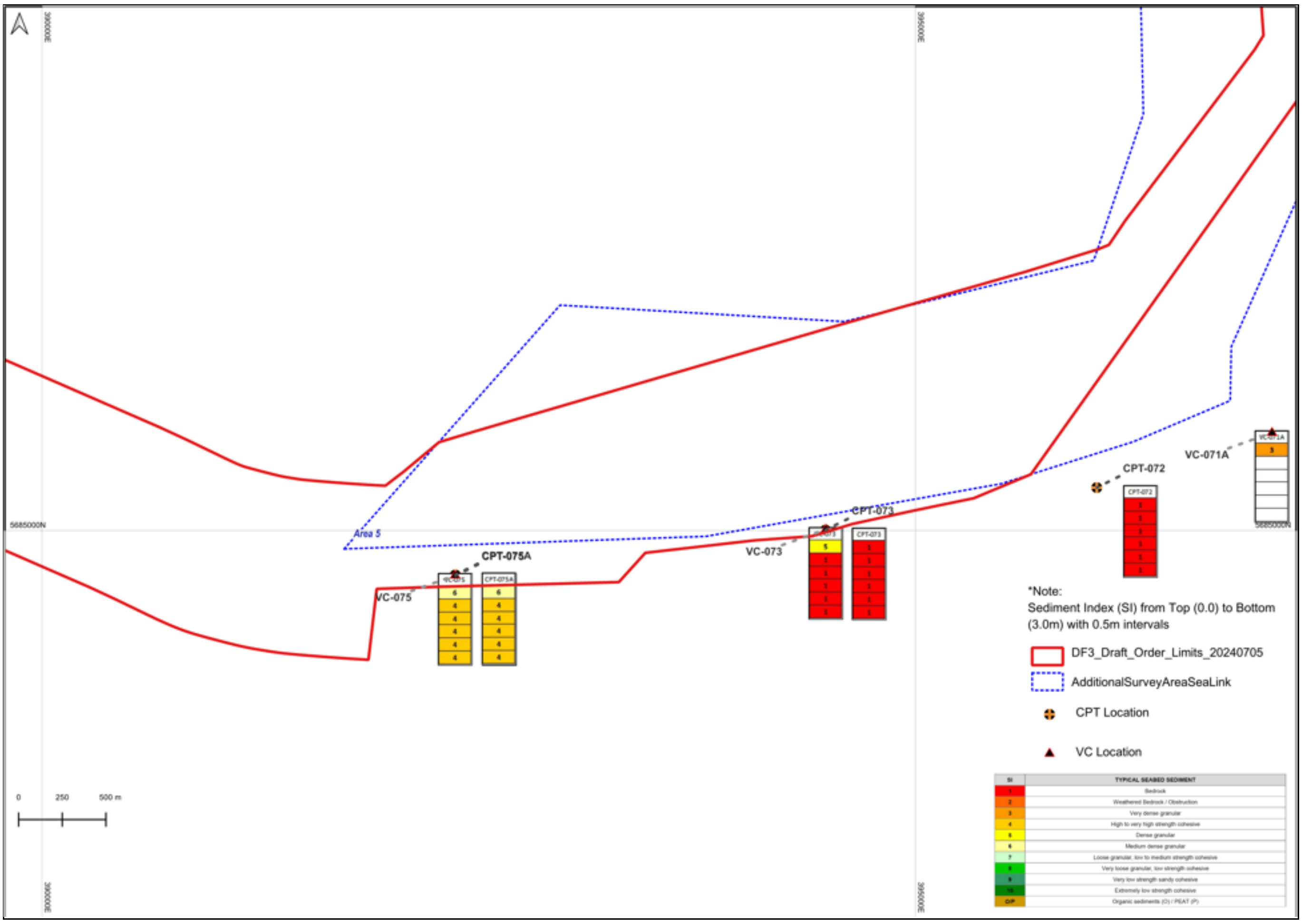


Figure 23: Seabed Index (SI) along the route from geotechnical survey (split into 23a to 23e)

Very low strength granular cohesive to medium dense granular sediments are found on the SW section from KP 0.961 to ~KP 8.500. These sediments are inferred to overlay bedrock from KP 1.500 towards the survey extent at KP 0.961 from SBP data. PEAT was observed in the VC near KP 5.216 that exhibited extremely high resistivity typical for low density organic material.

Coarse sediments with laminations of slightly cohesive CLAY and overlying very stiff CLAY are encountered from ~KP 22.000 to KP 28.500. From ~KP 73.800 beds of loose/very loose granular, low to medium strength cohesive sediments dominate the route up to ~KP 96.853 apart from an area around KP 94.500where the CPT registered high tip resistance from inferred weathered bedrock.

From ~KP 111.800 to KP 119.662, medium dense granular sediments are observed to overlie high to very high strength cohesive sediments.

High to very high strength cohesive sediments dominate from ~KP 11.367 to KP 12.633, ~KP 15.900 to KP 23.500 and ~KP 28.500 to KP 73.800. The section between ~KP 28.500-73.800 is interspersed with localised zones of loose granular, low to medium strength cohesive sediments.

Presence of possible COBBLES/BOULDERS is suggested by very shallow refusal of CPTs near ~KP 70.302 and ~KP 94.485 and COBBLES of flint were recovered from the VCs near ~KP 99.8632 and ~KP 102.737. From near ~KP 96.853 weathered bedrock and bedrock (structureless CHALK) is present up to the vicinity of ~KP 111.800 with few zones of loose to dense granular sediments in the top layers.

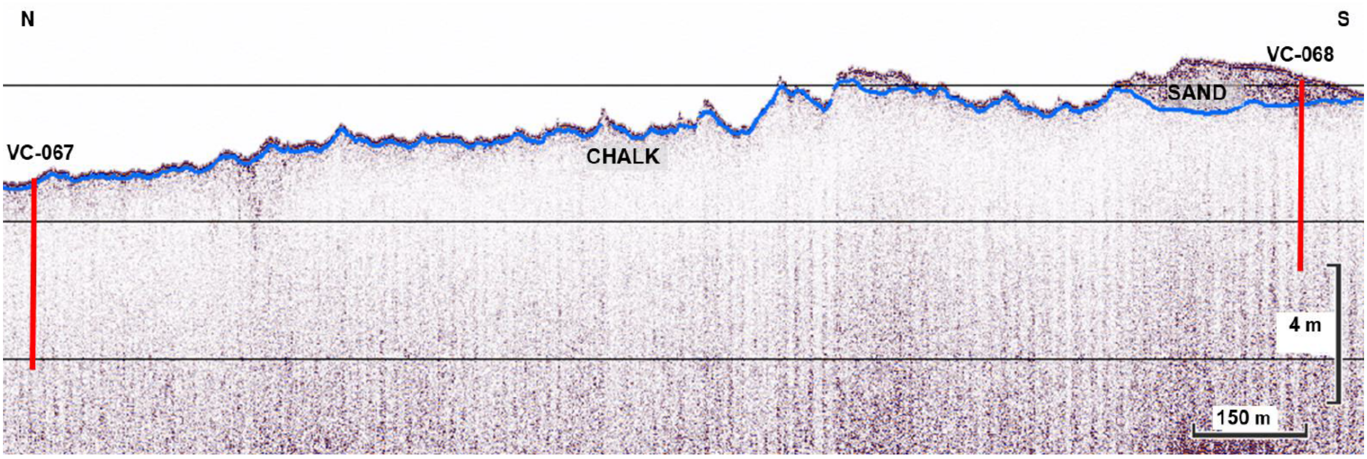


Figure 24: Innomar profile showing SAND overlying CHALK from KP 107.985 to KP 109.718

The route encounters heterogenetic sediments with variable geotechnical properties below seabed. Depending on the target DOL, the installation contractor should ensure proper remediation in areas where there is likelihood of lower DOL to maintain the thermal and physical integrity of the cable.

7.1.3 Mobile bedforms

Changes in sediment mobility effect the depth of cover over the cable, with sediment cover either increasing or decreasing; both changes in sediment movement have potential to affect cable integrity.

Sediment loss occurs where the material covering the cable is removed and the cable is at risk of exposure on the surface and this has the following adverse effects of the cable:

- Snagging risk – an exposed cable presents a snagging risk to fishing equipment
- Loss of mechanical protection – the burial provides a level of protection from dropped objects such as anchor strikes, or a dragging anchor. Reduction in the depth of cover reduces protection from impacts.

- Cable flexing – a section of cable that becomes exposed can further become suspended, with a section in which there is no underlying sediment, and therefore support for the cable, which is being held at two points either side of the exposure. Tidal currents or wave induced motion will begin to create movements in the cable (VIV – Vortex Induced Vibration). Over time these create micro-fractures through metal fatigue within the lead water blocking layer of the cable. This finally leads to ingress of water molecules, a differential in the insulation properties and then cable failure.

Cable failure through snagging or loss of mechanical protection are events that generally occur in s short time of each other, and the causal event can, if the vessel has AIS, be determined quickly. Cable failure through damage created by metal fatigue is a process that typically takes some years, depending upon the magnitude of movement and oscillation frequency.

Increase of sediment cover occurs when sediment circulation results in net deposition, resulting in increasing the thickness of cover over the cable. The principal risk for cable failure is by a decrease in the dispersion of heat generated by the cable by a thicker sediment cover. Localised differences in thermal conductivity of the seabed/water interface around the cable effects the heating of the cable, which in turn can result in differences in the insulation properties of the cable. At such high-power loads that the HVDC cables carry this difference of internal insulation can result in a cable fault.

The bedforms created by mobile sediments within the survey corridor range from ripples to sandwaves with varying density, amplitude and magnitude. A detailed sediment movement study of the area is currently being undertaken by ABPMer. The potential mobile bedforms in the survey corridor have been delineated primarily based on their geomorphological characteristics and grain size constitution, See Section **Error! Reference source not found.**.

There is a possibility that some or all the identified mobile bedforms could possibly migrate, new bedforms be created or unchartered bedforms move into the corridor in the period leading to installation. The presence of scour marks around some of the wrecks, eroded depressions on the seafloor and MMT's observation on SSS tugging during surveys point to the magnitude of oceanographic forces acting in the area.

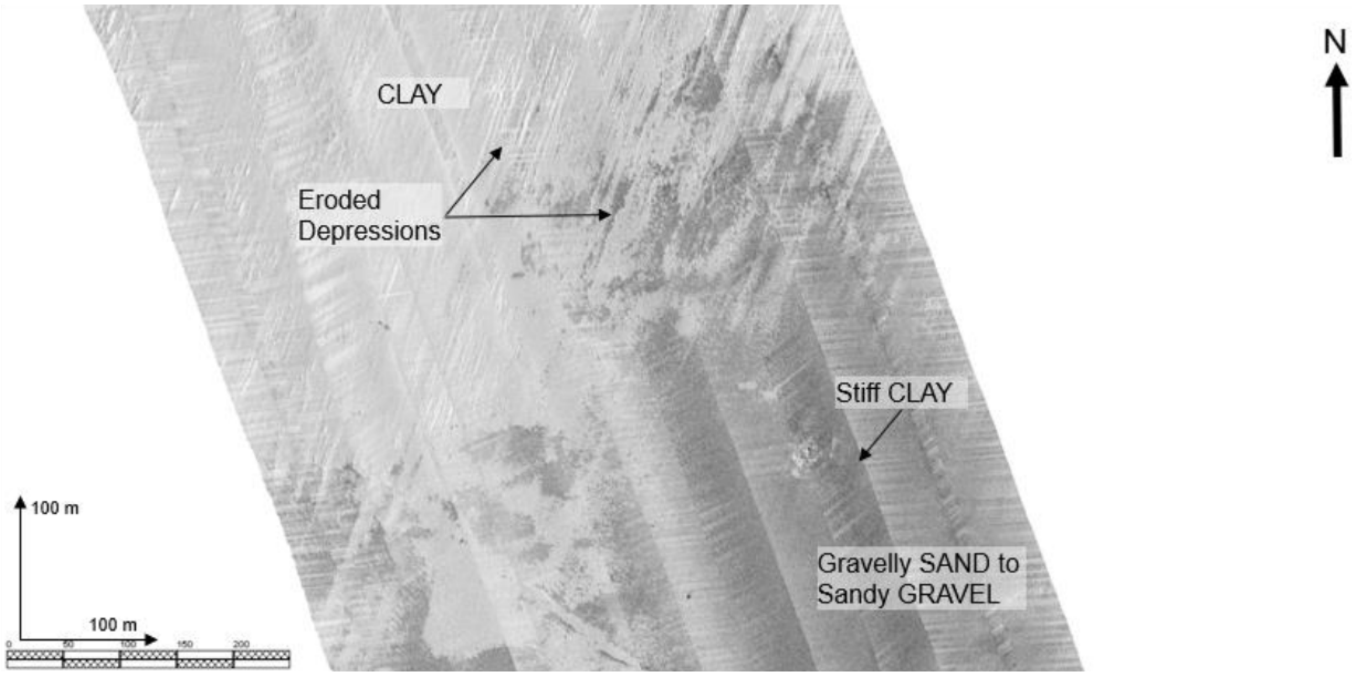


Figure 25: SSS mosaic illustrating sediment types and eroded depressions

A contemporary engineering survey prior to installation would be needed to mitigate the uncertainty in the location and heights of the mobile bedforms as the thermal performance of HV cables is dependent on the effectiveness of heat transfer through the sediments in which they are buried.

The distribution of these migratory bedforms is listed under Table 9.

7.1.4 Metocean Conditions

Tidal currents by the Suffolk landfall are rectilinear with the flood and ebb flows running in a southerly and northerly direction respectively. There is a marked asymmetry in tidal current velocities over a tidal cycle so that offshore, the maximum flood tidal flow speeds reach 1.7m/s on spring tides and 0.9m/s on neaps and maximum ebb tidal flow speeds reach and 1.4m/s on spring tides and 0.8m/s on neaps.

Water levels and tidal currents in the Southern North Sea are strongly influenced by wind set up and surge events which can raise the tidal water level over sedimentary features such as the Sizewell Dunwich Banks by several metres, allowing greater transmission of wave energy to the coast and nearshore area.

Available data shows that the sea off Suffolk has a moderate wave climate with offshore waves from the northeast and southeast sectors being dominant. Less frequent waves from the north-northeast sector tend to be larger. Owing to the longer fetch, waves generated by a given wind speed from the northeast are larger than those from the southeast for the same wind speed.

Further south, the offshore wave regime is dominated by waves from the north- east and south-west. However, the inshore areas are increasingly sheltered from westerly waves that propagate through the Thames Estuary such that within Pegwell Bay prevailing waves are almost entirely from the north-east and south-east. As waves move into shallower water, refraction, shoaling and wave breaking occur, modifying individual waves and the collective wave climate.

Across shallow areas, maximum wave heights will become 'depth limited' with the potential for wave breaking to occur during storm events and/ or around low tide. Because of the above processes, the wave regime within inshore and nearshore areas will exhibit a degree of spatial variability owing to the sheltering effect of any large seabed features such as Goodwin Knoll.

In offshore areas, waves will tend to only periodically stir the bed and will not contribute regularly to the net transport of sediment. However, in shallower nearshore areas they have a more important role to play in alongshore and cross-shore sediment transport and will play a key role in driving morphological change, particularly within the shallow waters off Pegwell Bay.

7.1.5 Seismicity

Seismicity is the measure of the frequency of earthquakes in a region and is monitored in the UK by the BGS, which has recently undertaken probabilistic seismic hazard analysis to develop the 2020 National Seismic Hazard Model (NSHM) for the UK, an update on the previous model developed in 2007.

The UK and North Sea is classified as a relatively low seismicity area, but there are a number of events which are recorded in the BGS catalogue, and which have been incorporated into the development of the 2020 NSHM, as presented in the following figure:

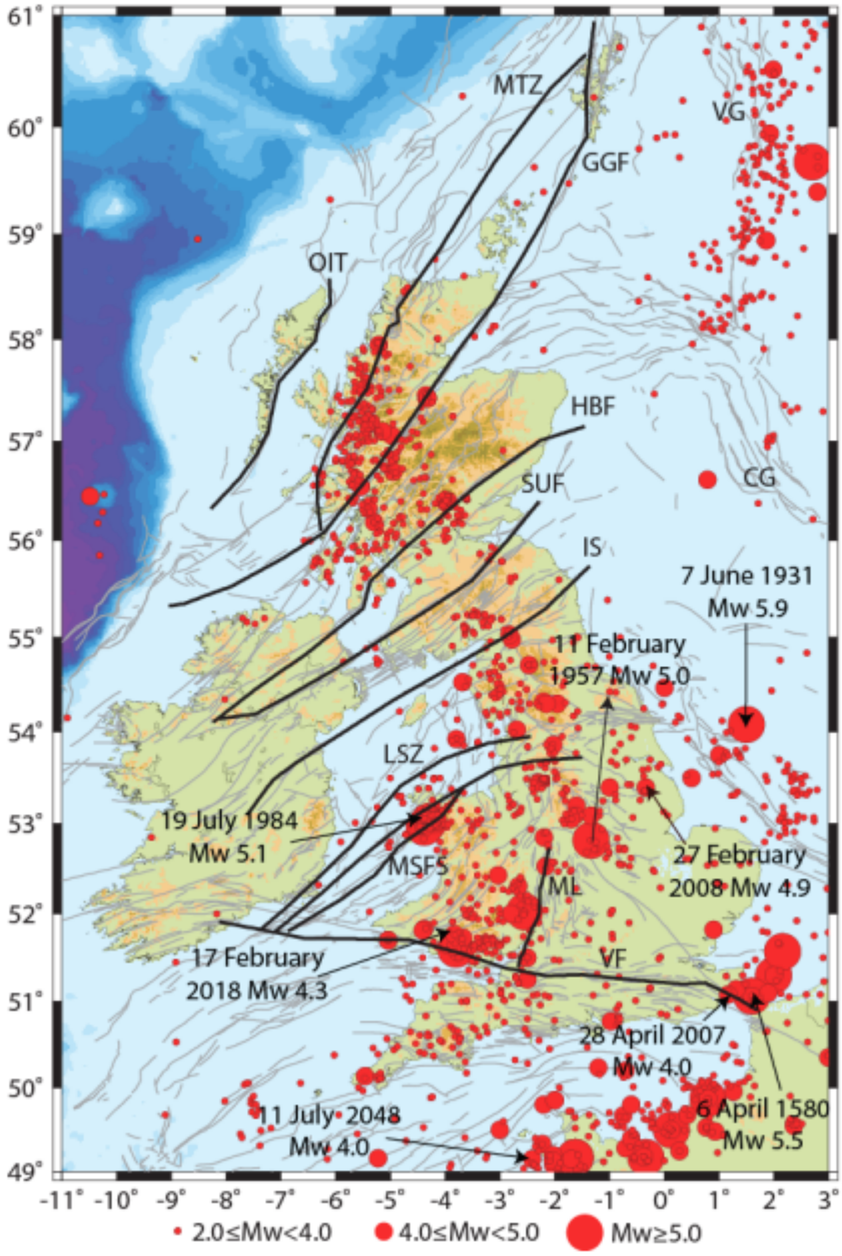


Figure 26: Seismotectonic map of the UK (extracted from BGS_OR_20_053_ National Seismic Hazard Maps UK)

As can be seen, clusters of historical earthquakes, of magnitude 2.0 to <5.0 Mw, in the vicinity of the route have occurred in the Dover Straits and smaller events offshore East Anglia. The source of the events has been linked to the Sangatte Fault, part of the North Artois Shear Zone, which runs from Folkestone to Sangatte in northeast France. The most recent event on the fault occurred in Folkestone on 28/04/2007 and was magnitude 4.0Mw.

The National Seismic Hazards Model indicates that the seismic hazard in the UK, and the cable route, area is generally relatively low, with hazard levels of 0.00 to 0.02 (lowest level) for all measures of seismic hazard (PGA, 0.2s SA and 1.0s SA) with a return period of 95 years. Hazard maps with return periods of 475, 1100 and 2475 years are also available, but are not included in this CBRA.

7.1.6 Mass Movement

Mass movement deposits include various type of deposits that have resulted from downslope transport driven by gravity by mechanisms ranging from turbulent flow to rigid block motion. However, due to the limited size of the survey corridor and depth of investigation all the characteristics linked to a gravity driven sediment deposit could not be assessed.

MMT have not observed any highly disrupted seismic facies and internally chaotic structures in the SBP data, which are a key marker for gravity driven sediments. Similarly, any lateral extent of such a deposit could not be assessed (to be classified as a distinct sedimentary unit) due to the limitations imposed by the survey scope. MMT have not reported any geomorphological features associated with slope failures, slab slides or slumps from MBES and SSS data.

Stress history of sediments from consolidation tests on cores could also be an indicator for slide deposits. However, the consolidation tests on the VC samples in the geotechnical scope were aimed at the engineering within the top 3m sediments.

7.1.7 Shallow Gas

Gas saturated sediments have been observed from the SBP data from approximately KP 2.670 to ~KP 8.500 (within 2m of the seabed). The zones of local acoustically turbid sediments attenuate the seismic signals and impede the characterisation of underlying strata.

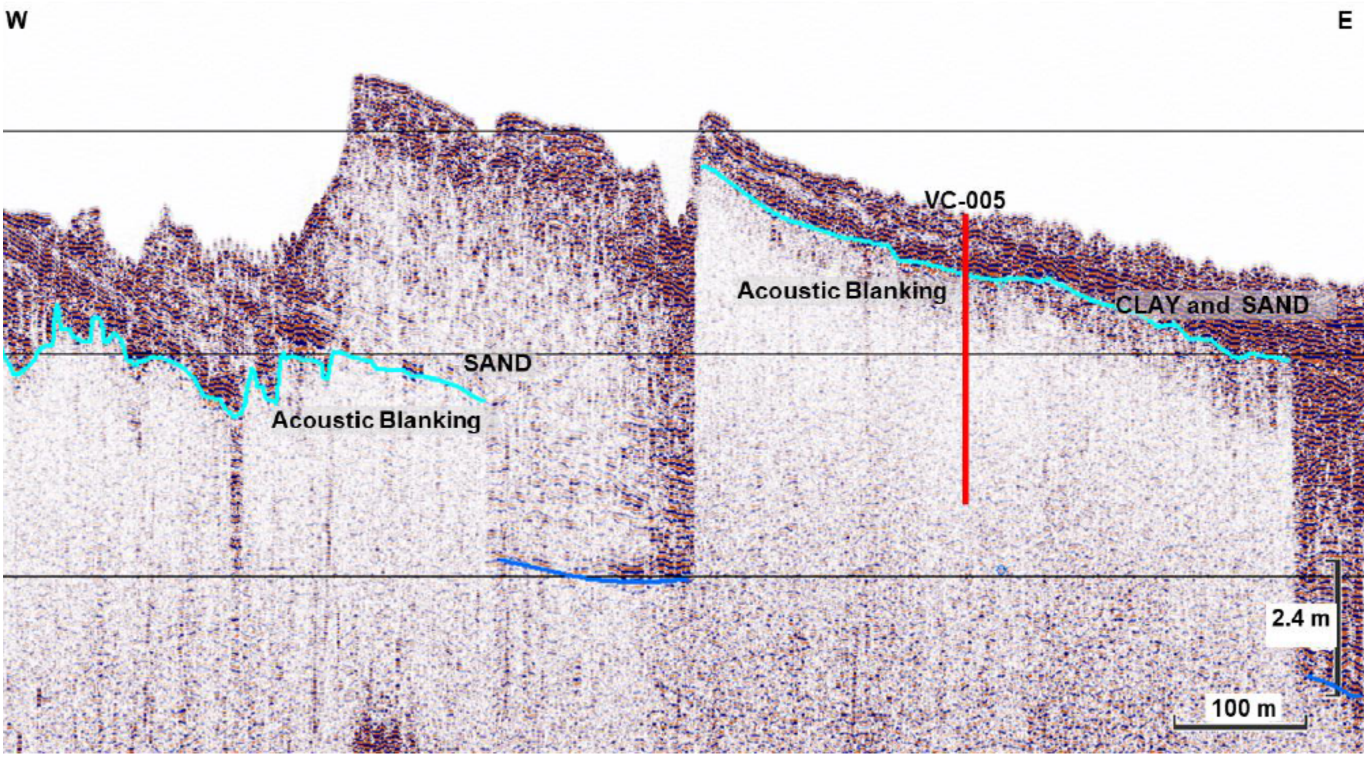


Figure 27: Innomar data extract depicting acoustic blanking

The gases found in shallow marine sediments include carbon dioxide, hydrogen sulphide, ethane and methane (G.D. Floodgate and A.G. Judd, 1992). The biogenic or thermogenic nature of the gases encountered in the survey cannot be deduced due to the constraint imposed by the seismic data (shallow) source (Innomar and Boomer) and the absence of carbon isotopic composition analyses of the VC samples.

However, laboratory tests of sediments from areas with acoustic blanking could be performed to check for the corrosive nature of these sediments.

7.1.8 Dewatering Structures

No dewatering structures have been interpreted from the SBP data; however, the presence of fluid transport pathways cannot be excluded as some seismostratigraphic information have been obscured due to attenuation by gas charged sediments and very coarse sediments. There is no evidence of fluid escape features at the seabed such as pockmarks at seabed from MBES and SSS.

7.1.9 Organic Soils (Peat and Lignite)

PEAT has been detected in the vibrocore VC-S6-005. The PEAT layer had a thickness of 0.42m and found between 1.74m and 2.16m of the core. PEAT can induce undesirable thermal regime (poor cooling) and have a tendency for compressibility under load and possess typically low material strength.

Chemical testing was performed on some selected samples for total organic content and total organic carbon content. Of these samples, the highest recorded total organic and total organic carbon was from VC-S6-005 with measurements of 65.9% and 38.2% respectively.

7.1.10 Flooding

Flooding risk at the landfalls which can affect the TJB or create a path into the HDD need to be considered. Flooding from the sea and from land due to excess run-off and waterways bursting their banks is modelled using the UK government portal: https://flood-map-for-planning.service.gov.uk/confirm-location?easting=634327&northing=163422&nationalGridReference=TR3432763422

The Pegwell Bay conditions are illustrated in the following figures. Note that there are currently no flood defences at the proposed landing point, with the designated feature type being floodable.

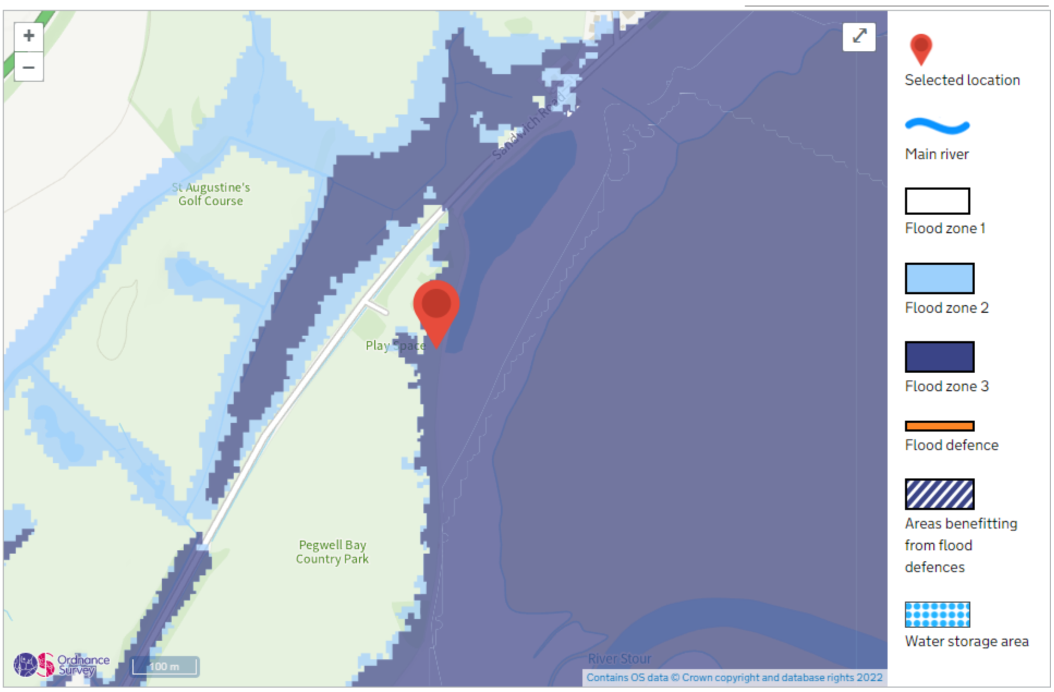


Figure 28: Flood Zones Pegwell Bay Area

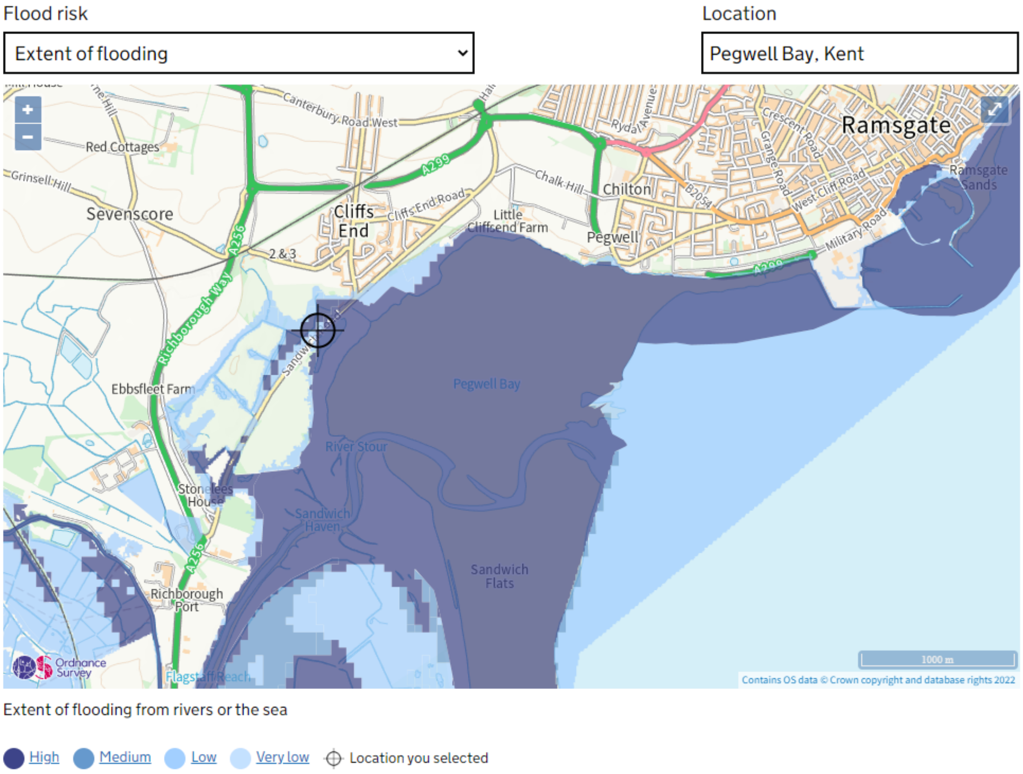


Figure 29: Extent of Flooding from Sea and Land (excluding future environmental change and surge effects)

The mechanisms for the flooding risk from the sea is discussed in the next section.

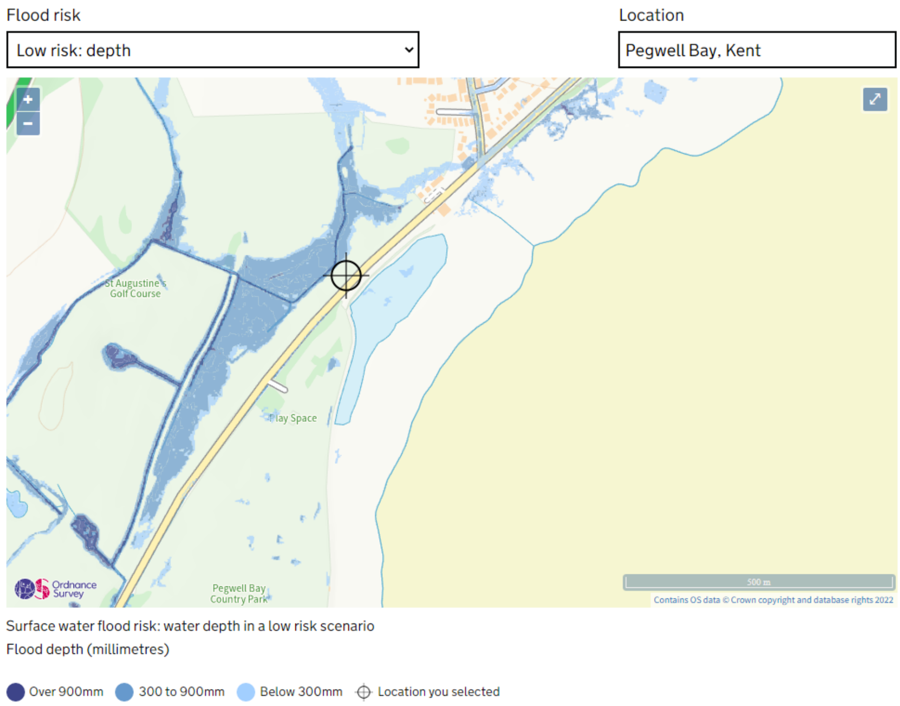


Figure 30: Surface water flood risk: water depth in low-risk scenario

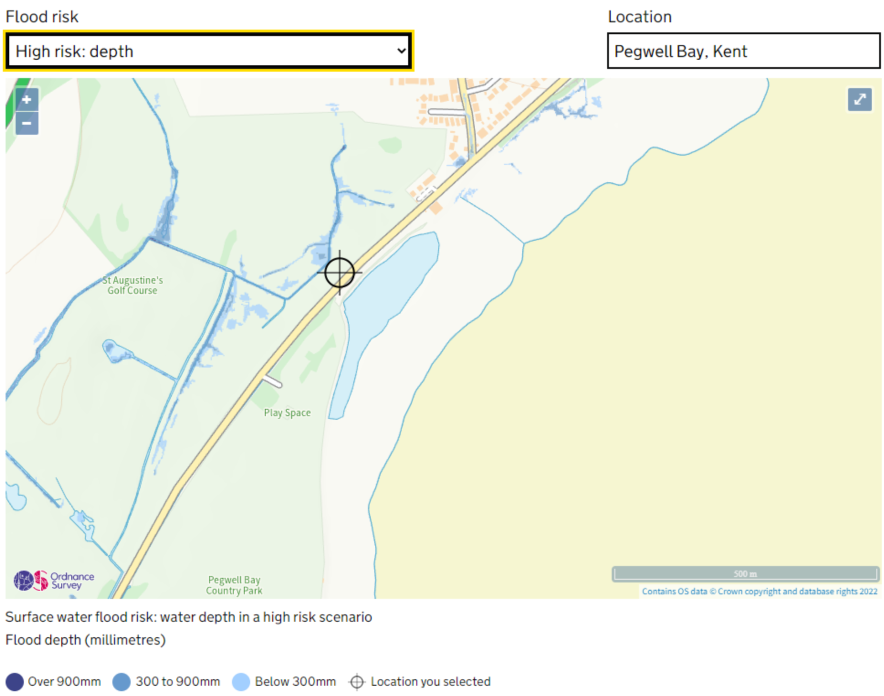


Figure 31: Surface water flood risk: water depth in high-risk scenario

From these maps, it is clear that the greatest flood risk is from inundation from sea to land, but that surface water flooding cannot be discounted as a factor when reviewing the proposed 'shorter' option for the trenchless solution, which may result in the HDD entry point lying within an area with potential for 300 to 900 mm of flood water.

The Aldeburgh conditions are presented in the following figures:

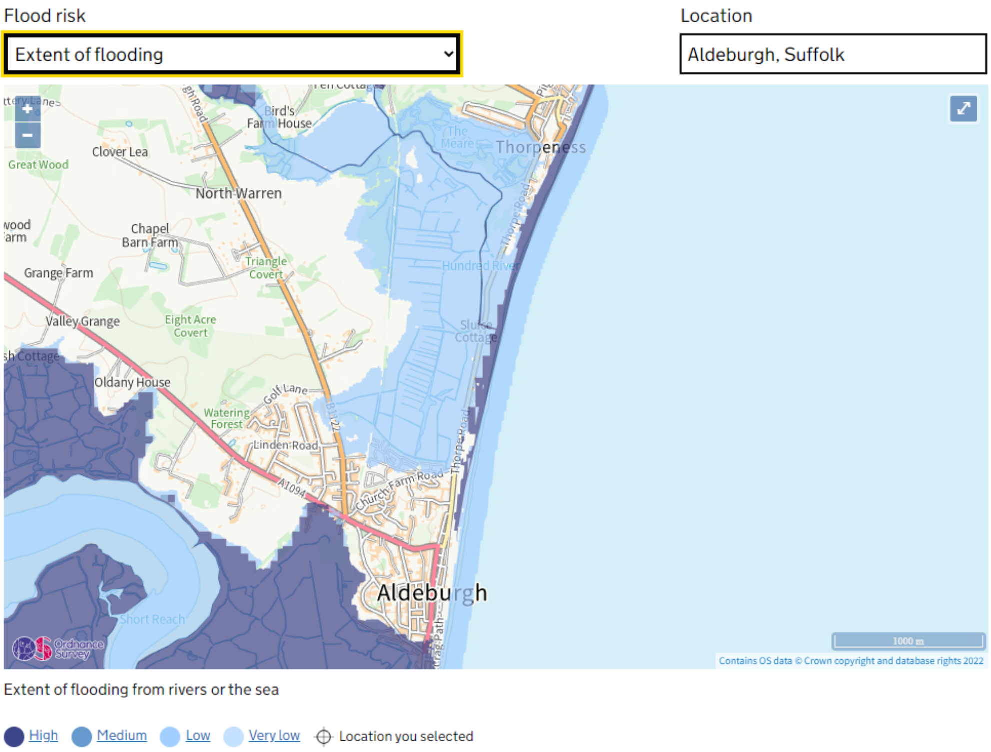


Figure 32: Extent of Flooding from Sea and Land (excluding future environmental change and surge effects)

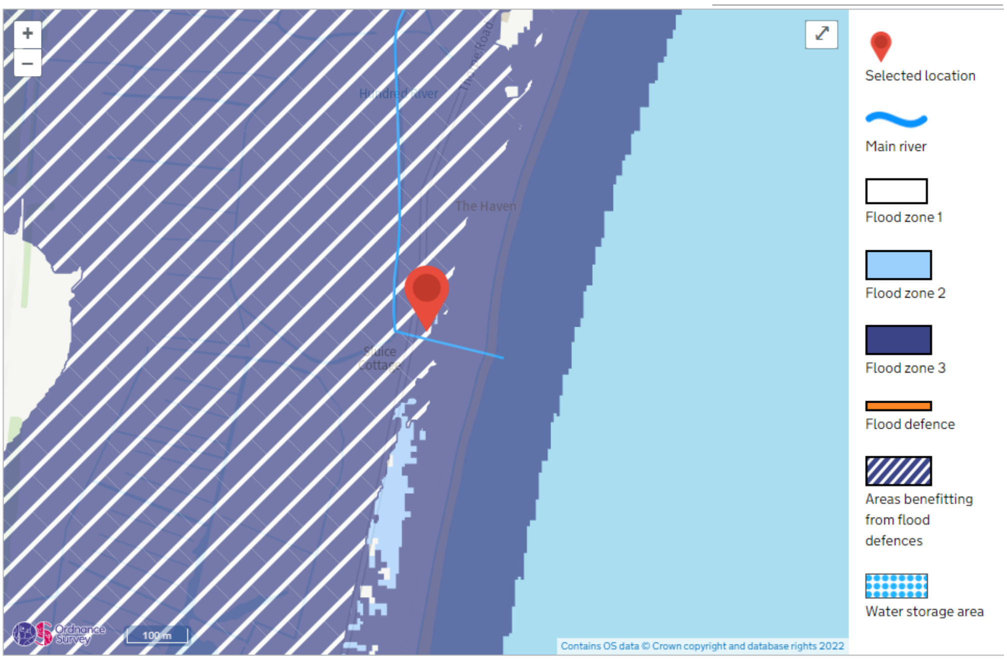


Figure 33: Flood Zones S2 – note that the area benefits from flood defences

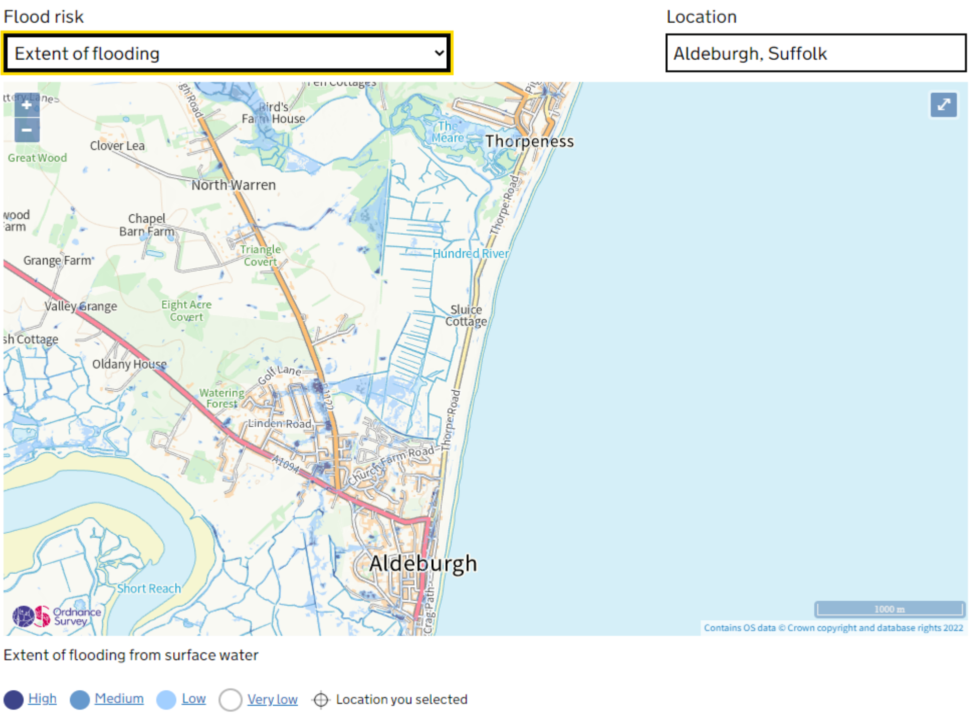


Figure 34: Extent of flooding from surface water

The Aldeburgh landfall is proposed are protected by flood defences with restricted extent of flooding from surface waters. RSPB own the land at the proposed landfall, and actively manage the water levels to optimise the conditions for waterfowl.

7.1.11 Environmental Change and Surge Risk

Eustatic change is currently being driven by the accelerated melting of snow and ice in the high latitudes due to the heating of the atmosphere and the oceans. The projected rise in sea-level has recently been updated to be in order of 0.65m by 2100, based on current rates of increase, which would have significant consequences on both landfalls due to increased wave action, storm damage and erosion.

Storm surges are a change in sea level caused by a storm, which can lead to flooding to low-lying coastal areas. The surge pushes water onshore ahead of a storm, and barometric pressure reductions of c. 1 millibar, result in a rise of sea-level by approximately 1 cm due to lowering of barometric pressure. This is exacerbated by the tidal level when the storm arrives, as the surge can combine with the top of the tidal cycle to augment a high tide flooding event.

The east coast of the UK is affected significantly by storm surges with historical events in 1952 and 2013, and although warning systems are in place from the Met Office and SEPA, the consequences can be deadly.

As the climatic systems change due to Global Warming, the climatic models are indicating a move to wetter conditions and more storm events, with greater frequency. Although these are unlikely to affect all the cable route, those zones which are shallow enough to be affected are likely to experience greater mobility of seabed sediment due to entrainment, and nearshore areas will be vulnerable to increased levels of erosion by wave action. The CBRA needs to ensure that this is considered, especially when looking at the entire life of the asset. Precise quantification of the increased risk is difficult without complex modelling, which is currently underway in the ABPMer study of the Sea Link Landfall Sediment Modelling.

7.2 Anthropogenic Risks

7.2.1 Vessel Traffic and Anchor Strike Risk

AIS data was purchased from Marine Traffic, from 2019 and 2021, to analyse the marine traffic across the route, as well as the trends in traffic emerging from the disruption due to COVID, BREXIT and supply chain issues. The AIS data has been divided into polygons along the route corridor in place of KPs to analyse different areas along the route. The polygons are linked to the Sediment Index and the changes of this along the route, thus linking the geological conditions to the anthropogenic activities, with a minimum area of 100 m and maximum area of 1500 m. Polygons are clipped to the MMT and NEXT survey areas and the AIS areas datasets and are analysed for the following information in each area

- Max. anchor threat line depth
- Trawl scars observed
- Number of fishing vessels
- Max fishing threat line depth
- Number of Vessels (max and median)
- DWT of vessels (max and median)
- Anchor Size (max and median)
- Fluke Length (max)
- Fluke length (by depth)
- Anchor strike period (by depth)
- Recommended DOL to TOC

The polygons and derived anchor strike risk areas from the preferred DF2 route are shown below (pre-Additional Marine Survey campaign).

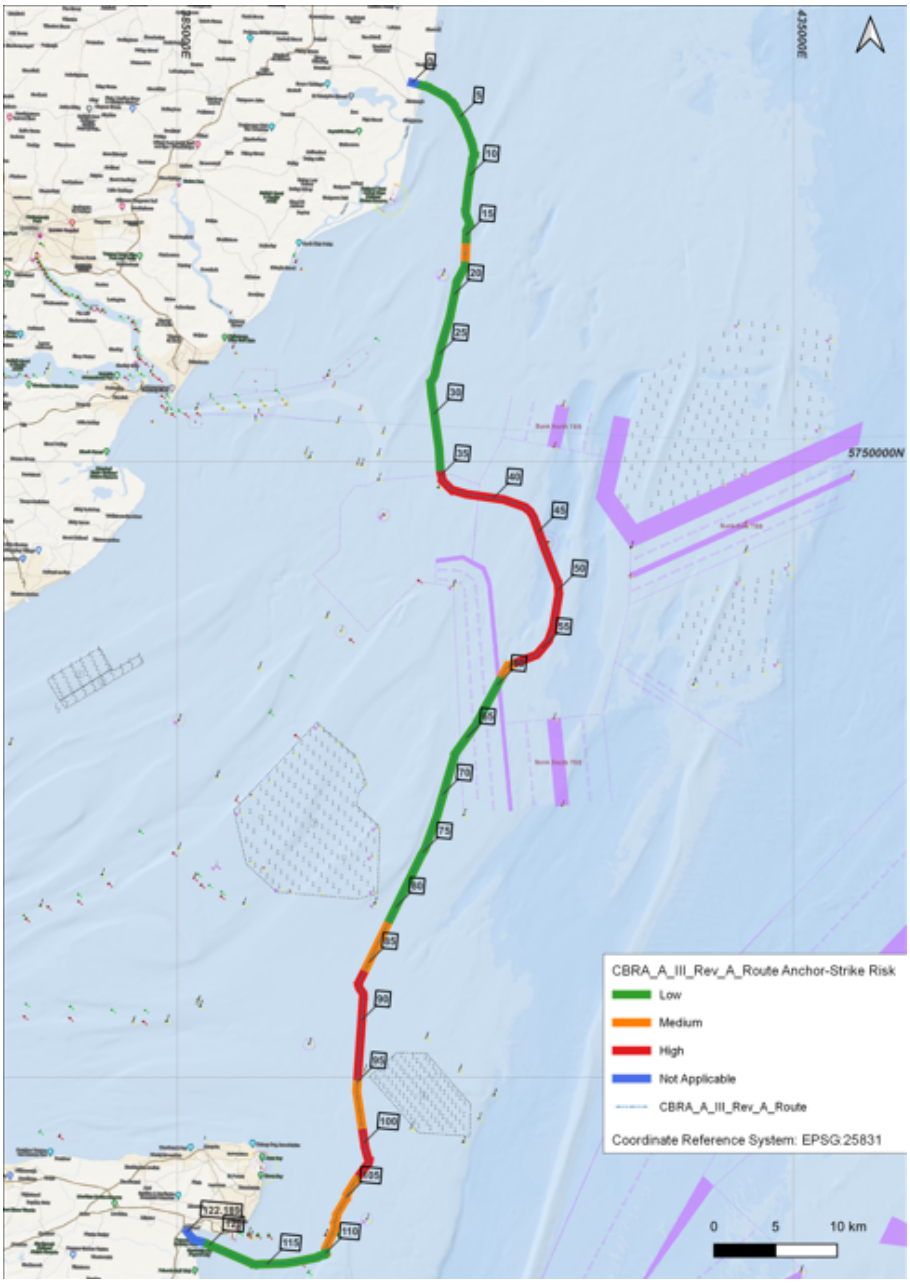


Figure 35: AIS Polygons for DF2 derived Preferred Route and Risk Level (2019 – 2021 data)

The calculations were repeated with data supplied from XODUS, which has been used for the Navigational Risk Assessment applied to the Draft Order Limits, including the expanded areas where the Additional Marine Survey was planned to optimise the route. In addition, the 1:10 000 risk (Insurance basis) was applied to the data and produced the following risk levels along the route:

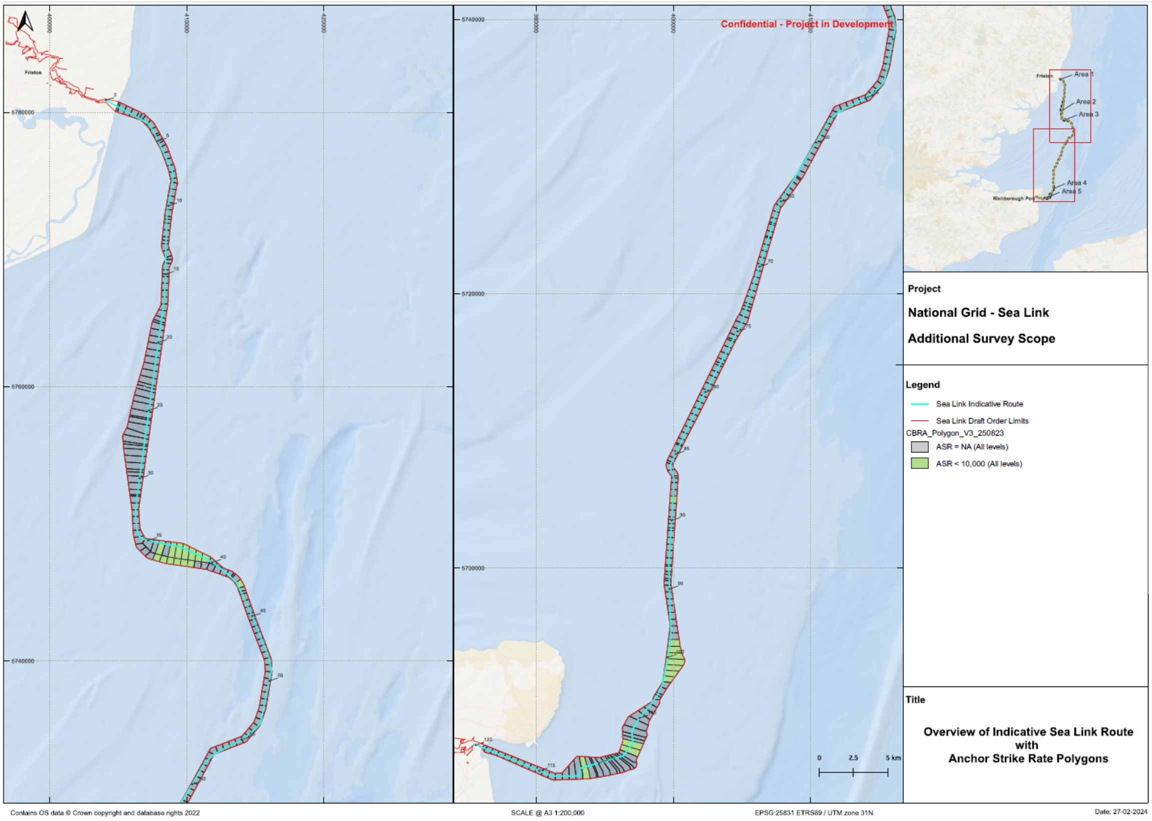


Figure 36: AIS Polygons for Draft Order Limits incorporating the Additional Marine Survey Areas and XODUS AIS dataset with 1:10 000 ASR rate (2022 to 2023 data, supplied XODUS)

Evaluation of the resulting Anchor Strike Rates, compared to the CBRA results derived without the insurance 1:10 000 ASR concluded that this was inconsistent with the level of traffic in this area, and as such, the preference has been to continue with the more conservative risk evaluation. Given that the size and capacity of the vessels, as well as the total volume of traffic is expected to increase during the lifetime of the asset, the risk-averse approach is recommended. No definitive values are available for the increase in traffic; however, the marine stakeholders have all indicated an expectation of growth when extrapolating the trends observed in the last 2 decades. The following figure is the base case for the Depth of Lowering:

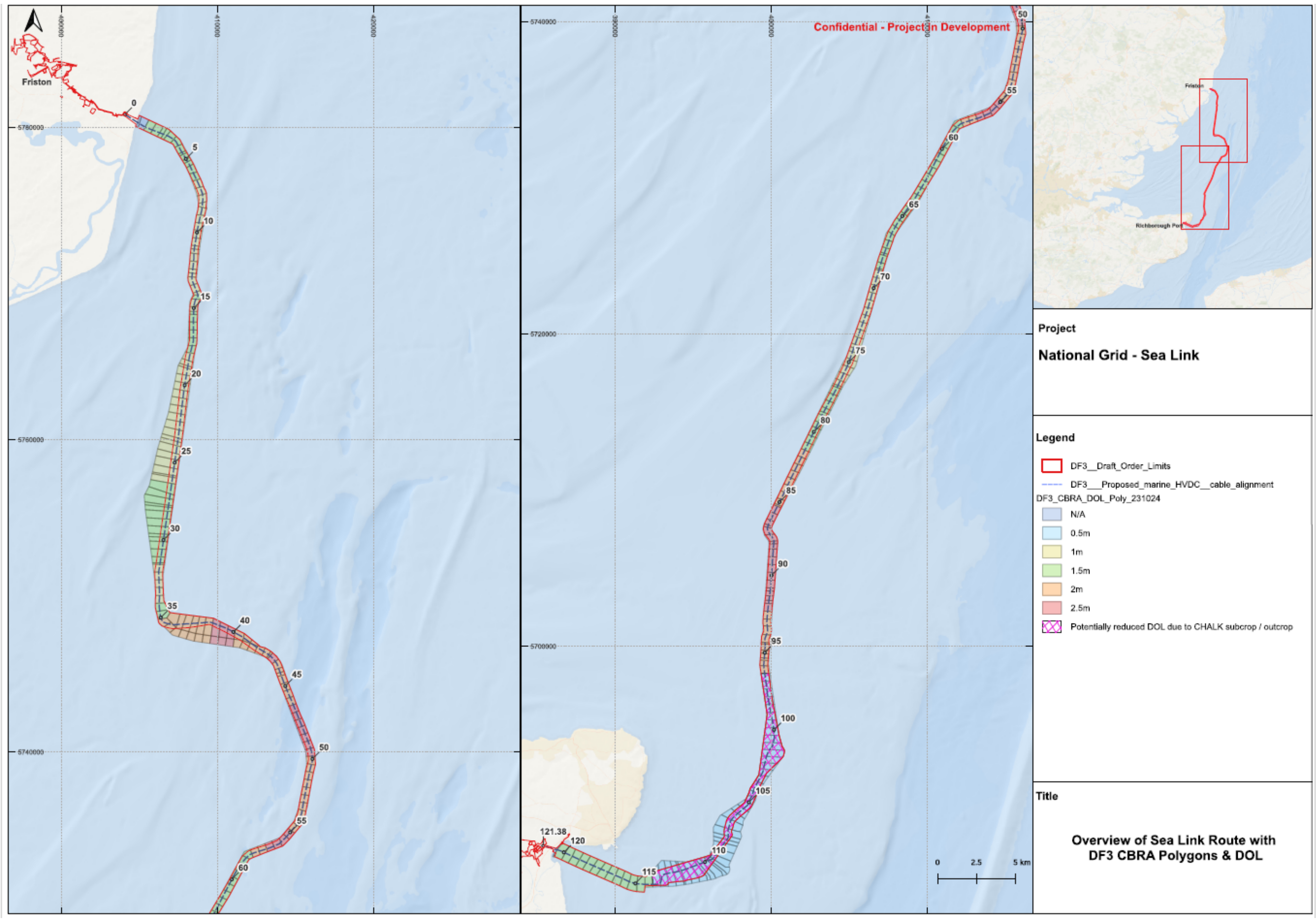


Figure 37: AIS Polygons and Depth of Lowering for the DF3 Route

Traffic volumes and DWT vary along the route but are rarely absent. The largest volumes are indicated in the following regional heat maps and are unsurprisingly concentrated in the shipping channels associated with the approaches to the Thames ports, and for vessels travelling north along the coast of Suffolk, as well as the anchorages. White areas indicated the highest density of shipping (2019) in Figure 38 while dark blue indicate the highest density of shipping (2022-2023) in Figure 39.

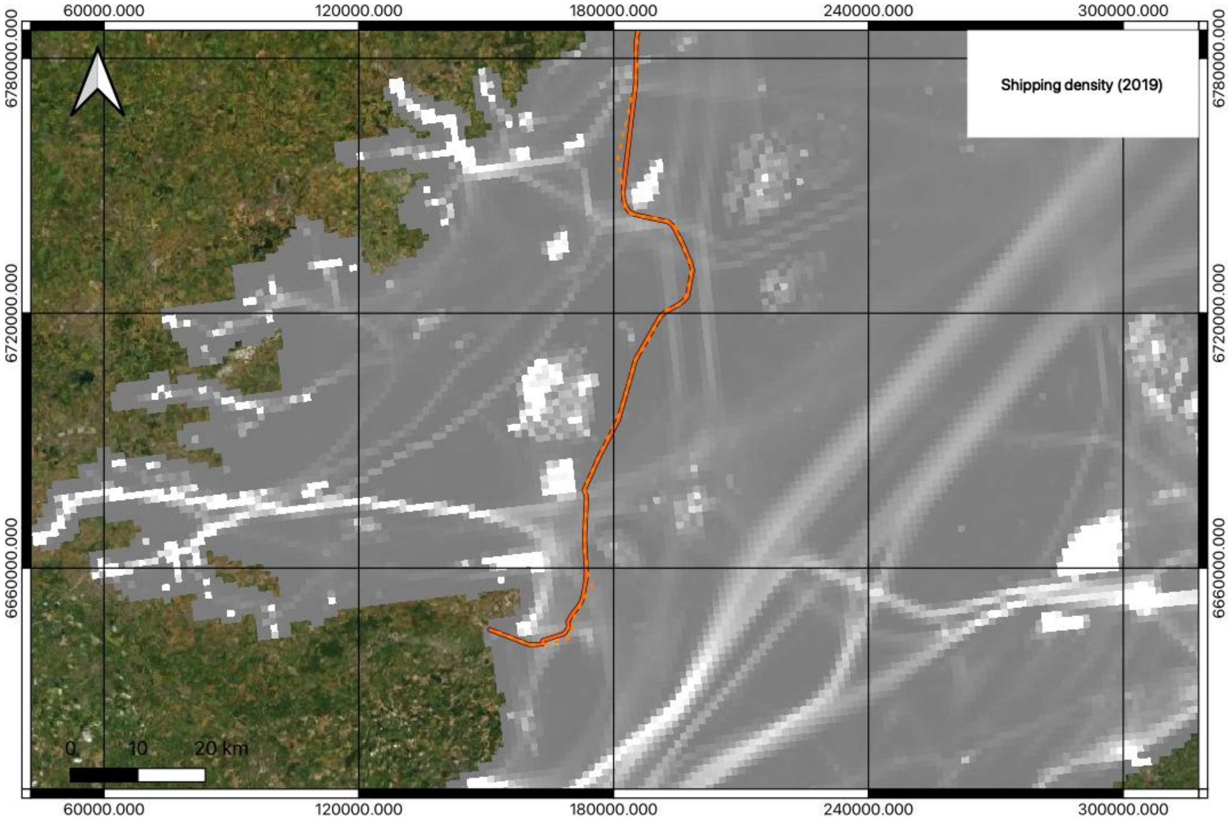


Figure 38: Regional Shipping Density 2019

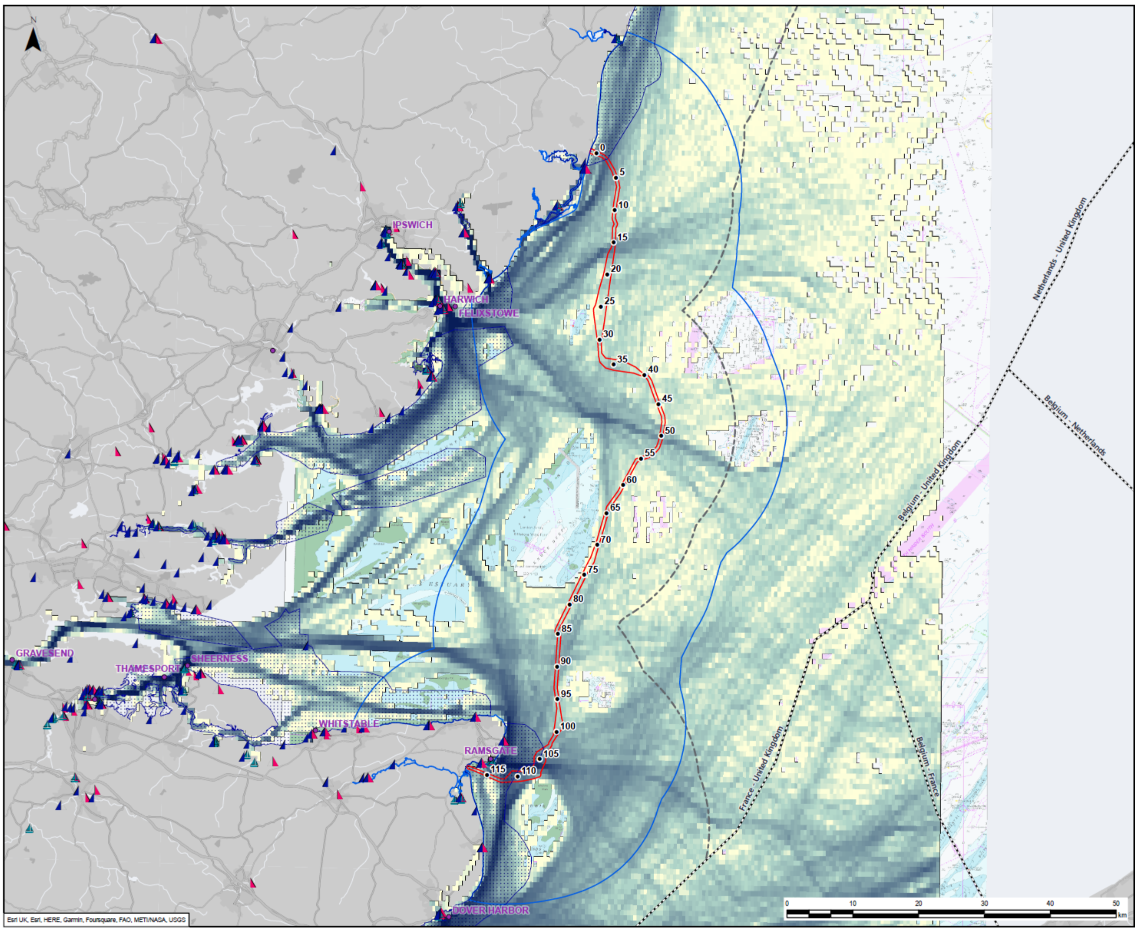


Figure 39: Regional Shipping Density 2022-2023

The vessel traffic is summarised by year and vessel dimensions, as shown in the following table:

Table 16: 2019 and 2021 Vessel Traffic Summary

Vessel Length (m)	2019	Tonnage Range	% Total	2021	Tonnage Range	% Total
<25m	56251	20-285	49.77	30566	31-285	42.14
25m to 50 m	19075	1-887	16.88	4942	1-978	6.81
>50m to 90m	8672	60-5941	7.67	13837	60-5941	19.08
>90m to 120m	10532	320-13204	9.32	8187	320-19100	11.29
>120 to 200 m	11214	1353-63590	9.92	8290	1184-63500	11.43
>200m	7159	4232-228149	6.44	6711	5120-241960	9.25
Total	112894	1- 228149	100	72533	1- 241960	100

The number of vessels is significantly less in 2021 than in 2019, due to the effects of COVID and post-BREXIT supply chain and trading barriers. Vessels of <25m length dominate the traffic, and this is ascribed to fishing, leisure and maintenance traffic (CTVs) to the OWFs. In 2021 the percentage of all classes of larger vessels >50 m length is increasing, with those >200m increasing the most. This is aligned with the trend for larger vessels with greater carrying capacity for cost effective shipment of container, liquid hydrocarbons, and to a lesser extent bulk materials. It also is an indicator of the expectation that these percentages will continue to increase given the expansions currently planned or being constructed at the Tilbury2 and Harwich (Section 7.3).

The vessel traffic details for 2022-2023 distributed by vessel length and vessel DWT is shown in the following table:

Table 17: 2022 - 2023 Vessel Traffic Summary (XODUS AIS Data)

Vessel Length (m)	2022-2023 Tracks	% Total	DWT (tonnes)	2022-2023 Tracks	% Total	Draught (m)	2022-2023 Tracks	% Total
1 to 50m	32163	37.8	1 to 250	31820	37.4	0 to 2.5	14115	16.6
50m to 100 m	14005	16.5	250 to 2500	3270	3.8	2.5 to 5	20994	24.7
100m to 150m	11558	13.6	2500 to 5000	9687	11.4	5 to 10	36543	42.9
150m to 200m	14044	16.5	5000 to 50000	32304	38.0	10 to 15	10909	12.8
Over 200 m	12641	14.9	Over 50000	8025	9.4	Over 15	1897	2.2
Unknown	695	0.8				Unknown	648	0.8
Total	85106	100		85106	100		85106	100

The vessel traffic has seen a considerable increase when compared with 2019 and 2021 figures with the higher length categories and heavier DWT categories (250 tonnes and over) dominated by 'cargo/tanker' vessels. The most common vessel draught category is the 5-10m category (42.9%) with the majority of those vessels being cargo/tanker vessels.

The closest anchorage to the route is located at the Sunk Deepwater Anchorage to the east of the cable route, with Closest Point of Approach (CPA) of 250 m, to the north of the cable route. This anchorage, which is the holding point for large bulk carriers and container vessels entering the ports located along the Thames Estuary, is of great concern for the route due to its proximity and usage as shown in Figure 39.

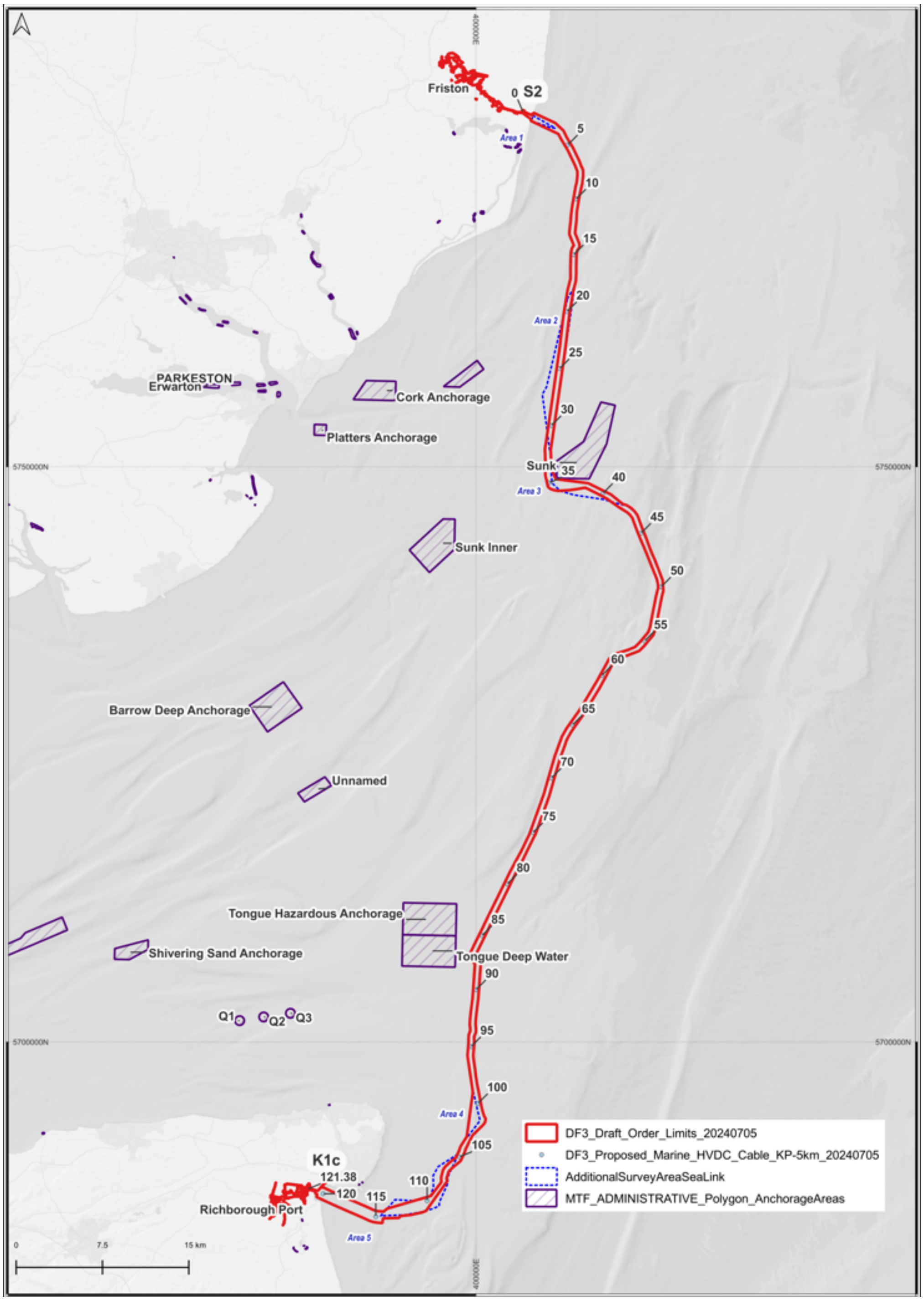


Figure 40: Overview of Anchorage Areas

Further stakeholder engagement with Harwich Haven Authority (HHA) has indicated that traffic to and from the anchorage is strictly controlled for entry and exit to the east of the anchorage into the SUNK VTS, however, this area is the highest risk area on the route. Requests from the HHA to locate the route to the north of the 2021 route to avoid the SUNK pilot station and an area where the passage of large bulk carriers is considered of primary importance. As such Area 3 of the Additional marine Survey was surveyed for a new route.

The additional marine survey results included extensive evidence of increased number of anchor scars in the seabed immediately south of the SUNK Deepwater Anchorage. Several reports of dropped / lost anchors had been made to the relevant authorities and the survey data identified a dropped anchor and chain which could not be identified and had not been report to the SUNK VTS.

Immediately to the south of the anchorage is the pilot station for access to the Harwich Deepwater channel, where the vessels pick-up and drop the pilots for entry and exit from Harwich. The close proximity of these locations to the cable route is a significant hazard to the cable, due to the increased risk of damage by accidental anchor drop, anchoring out with the boundary of the deepwater anchorage or dragging of anchors from vessels blown off station. Deep scarring has been observed on the MBES and SSS data, so this is a probable occurrence.

A second deep water anchorage is located to the west of the cable route, CPA 1.5km, it is the Tongue Deep Water Anchorage and is divided into an area for hazardous cargo (northern half), and non-hazardous cargo (southern half. Again, this anchorage is a risk to the cable, but not as high as the SUNK deepwater anchorage to the northeast. This is also indicated on Figure 38: Regional Shipping Density 2019 (white areas of high traffic density) and Figure 39: Regional Shipping Density 2022-2023 (dark blue areas of high traffic density).

7.2.2 Anchor Types and Anchor Strike risk

Anchor types and penetration in different sediment types are the key factor for assessing the level of risk along the cable routes. The risk study has been carried out based on DWT information contained in the AIS data from Marine Traffic. Using the relationships (contained in the carbon trust methodology) between vessel and anchor weight, it was possible to translate vessel size to anchor fluke length. The fluke length is based on a standard stockless anchor (not High Holding Power). From this, the calculated relationship between a ship’s DWT and her anchors’ fluke length has been derived as shown below:

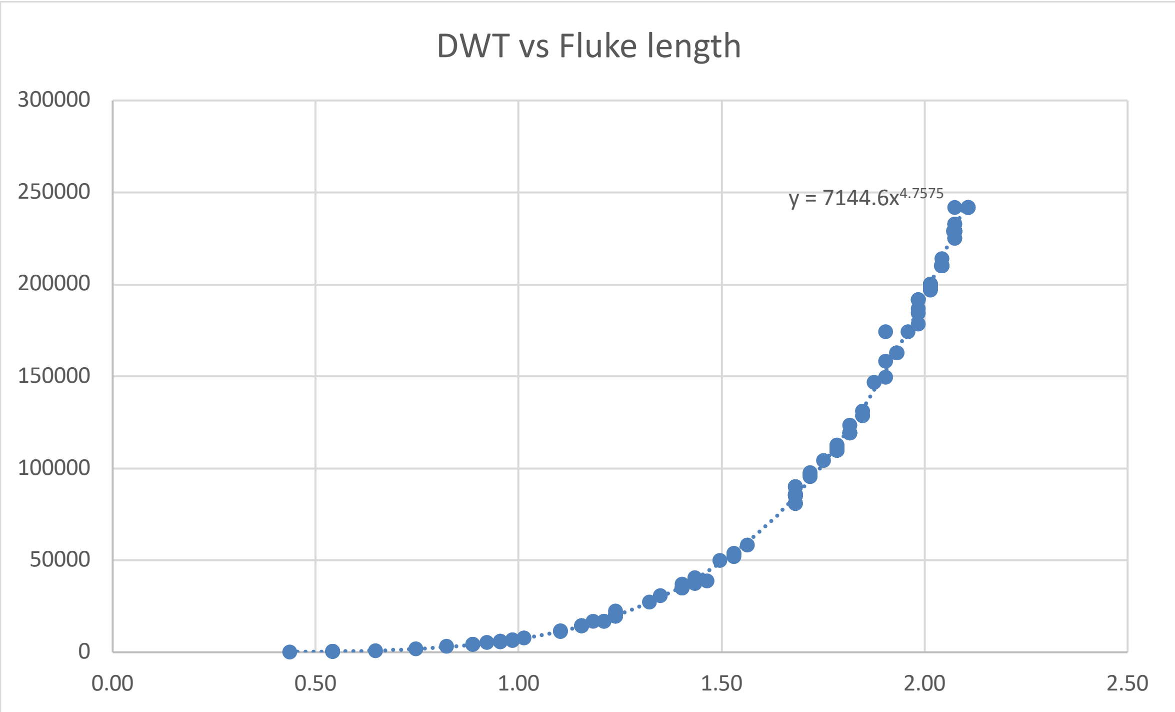


Figure 41 Relationship between DWT and Fluke length

Having established the anchor fluke lengths of the ships in each area a comparison of the fluke length and the geology was undertaken to determine anchor penetration. This is a somewhat contentious calculation with research on *Anchor penetration in different sediments such as* - (PDF) Buried Depth of a Submarine Pipeline Based on Anchor Penetration (researchgate.net) giving somewhat uncertain results.

Other studies have also been undertaken for softer clays to simulate the behaviour of anchors, such as the recent numerical simulations for 3.5t and 8.5t AC14 anchors in soft sediments (clay) with shear strength (s_u) 5kPa, to 20 kPa and extrapolated to stiff clay, s_u 40kPa and 60 kPa have also been undertaken for anchor penetration and dragging in soft sediments [Coupled Eulerian-Langrangian simulation of the penetration and braking behaviour of ship anchors in clay, J Grabe and L. Wu, Geotechnic 39 (2019), Heft 3].

The above simulation illustrates the ‘typical periodic penetration process’ which is observed as the instability of ship anchors when anchoring into soft clay:

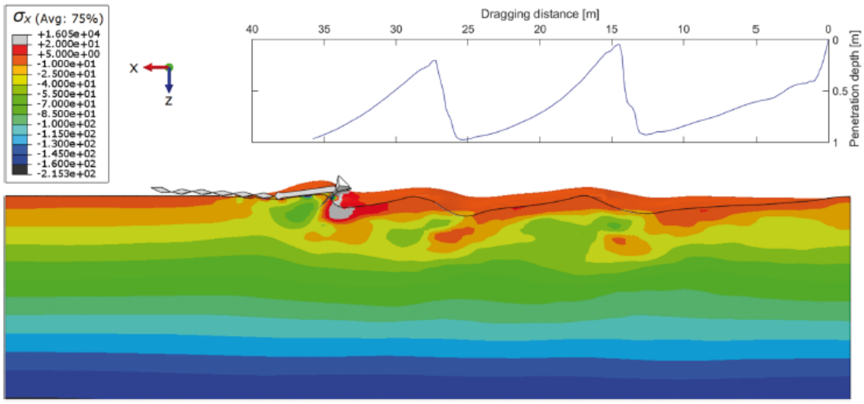


Figure 42: Periodic penetration behaviour in soft clays (horizontal stress colour scale), indicating 'drag and skip' behaviour

To simplify the uncertainties and in line with guidance from the carbon trust it was decided that in "strong" sediments (i.e. London Clay and dense sands, SI classification 2-7) anchor penetration would be assumed to be the same as fluke length. In bedrock (SI classification 1) it was considered that anchors would only penetrate a few cm if at all and thus no penetration was considered. In soft sediments (SI classification 8-9) a max anchor penetration of 3 times fluke length was used. The route has one small area of organic sediment, anchor penetration in this sediment is unknown but was grouped in with the soft sediments as a conservative estimate – this did not in the end affect the DOL results as the size of vessels in this area did not suggest burying the cable as deep as this layer.

Large areas of the Sea Link route comprise a veneer of sand at seabed, underlain by hard (over consolidated) London Clays, with very high shear strengths (150 to 300 kPa), which provides a natural barrier to penetration. However, the large anchors associated with the vessels passing through the SUNK and towards the London ports still pose a threat due to the much greater size than the examples shown. The calculated depths of penetration for a 38Te anchor (suitable for a 200,000DWT vessel) are extrapolated as 2.11m even with London Clay present.

Cable installation projects operating in the Southern North Sea have struggled to achieve a depth of lowering for a cable in excess of 1.5m, even when using mechanical trenching systems (examples – Britned, NEMO etc), and therefore although the recommended DOL in the area will 2m, it is expected that additional protection of the cables may be required to mitigate the risk of anchor-strike damage, by external protection.

Further risk reduction can be achieved by communicating the hazard to marine users; therefore, it is also recommended that the VTS associated with traffic through the SUNK, and into the Harwich deep water channel pro-actively inform the vessels of the presence of the cables. Early circulation of the installed cable as-built locations should be supplied by NGET to the relevant statutory mapping agencies including the UKHO, Port of London Authority and the SUNK Vessel Traffic Separation.

7.2.3 Fishing Activities and Risk

Fishing activities along the route of the cables comprises of smaller inshore crab and lobster potting vessels, with occasional scallop dredging and shrimp netting, to the larger offshore trawling operators from the EU and UK fisheries. During the geophysical survey in 2021, the route was cleared of inshore fishing gear, although the guide vessel regularly reported fishing activity in the offshore parts of the route, and occasional ghost / abandoned gear. Evidence of intense trawling of the latter is also clear from the SSS data records, especially between ~KP 35 to ~KP 68. Note that the fishing AIS data from 2022-23 highlights activity between ~KP 79 to ~ KP 88.

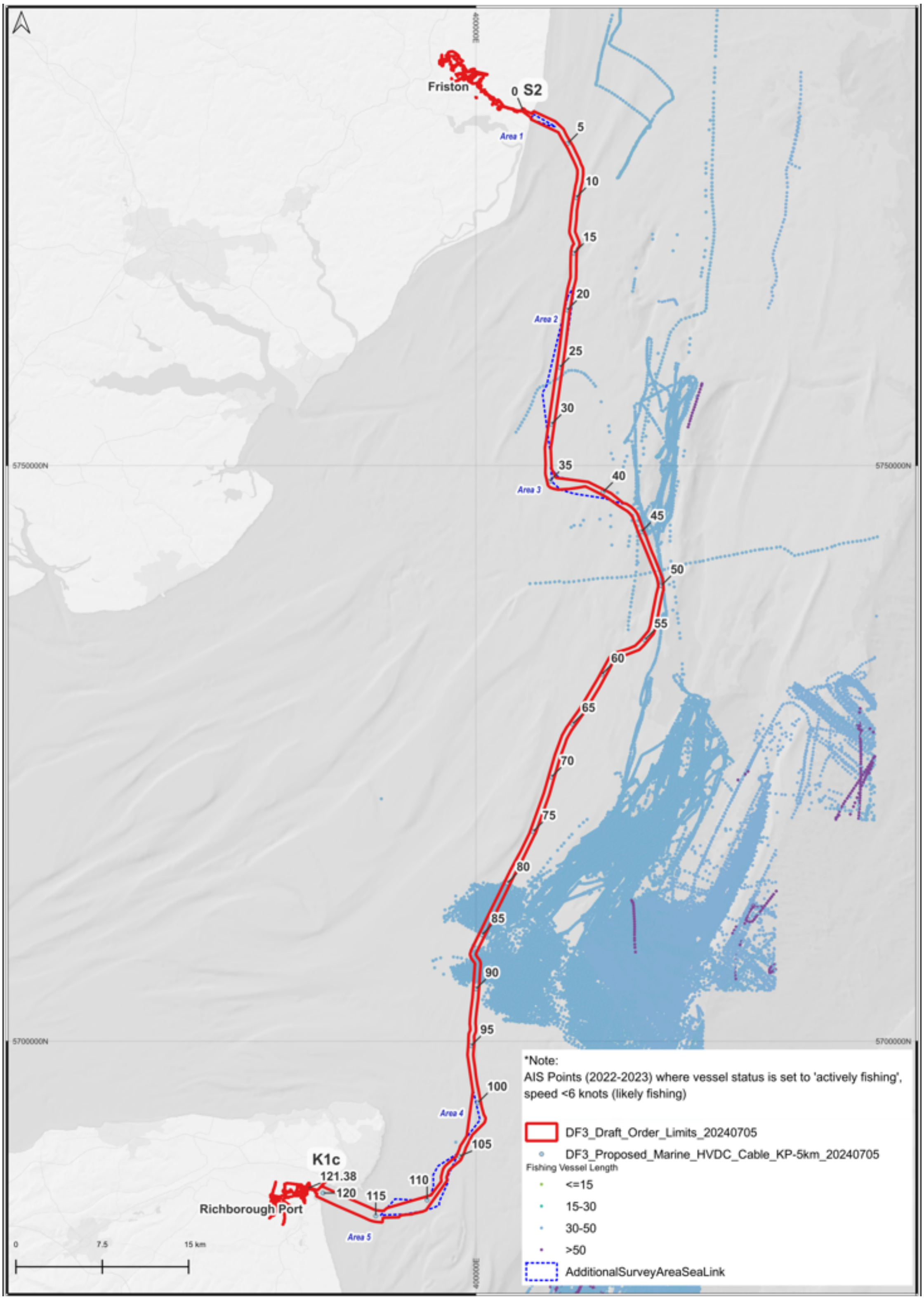


Figure 43: Fishing Activity 2022-2023

Repeated invasive trawling activity, such as beam trawling, can remove decimetres of soft or loose sediments at each trawling event, however, the interval from ~KP 35 to ~KP 68 is underlain by London CLAY, and buried cables will have a lower risk of damage by over-trawling. Many research papers have been produced which conclude that intrusive fishing gear rarely penetrates greater than 0.3m, and the local seabed sediments can reduce this where they are hard or dense. As such the fishing risk component of the recommended DOL is 0.3m. It is noted that from the AIS data the majority of the vessels crossing the route are <25m which would coincide with fishing vessels, as well as pleasure craft and OWF CTVs. Similarly, there are instances of fishing gear damaging cables in the Southern North Sea, although the cables are often exposed on the seabed (prior to protection) or have been de-buried by fishing or mobile sediments.

Over-trawling risk can be reduced during the installation phase by engaging local fisheries to provide the Guard Vessel Services, or via National fishing organisations such as the National Fishing Federation (NFF), or the Scottish Fishing Federation (SFF), which provides a dedicated guard vessel service.

Risk reduction can be assisted by the timely circulation of the installed as-built cable locations by NGET to the relevant statutory UK and EU mapping agencies including the UKHO. Similarly, the information should be circulated concurrently to the fishing organisations along the route and the Kingfisher Kis-Orca Charts.

It is strongly recommended that further studies are undertaken in the future (Section **Error! Reference source not found.**) as it is recognised that this risk is not fully addressed in this CBRA although it is being addressed elsewhere within the project group and can augment the further studies, once completed.

In the 2022-2023 data, fishing vessels under 15m in length are under-represented. Fishing vessels are present across the corridor but are sparse until approximately between ~KP 79 and ~KP 87. Trawlers are the principal subtype of fishing vessel recorded within the corridor and most of the fishing vessels appear to be coming into/from the port of Ramsgate, while trawlers may be utilising other ports outside the cable corridor.

7.2.4 Leisure Activities

The whole area is used for recreational sailing with the areas near both landfalls particularly busy. Aldeburgh is a busy recreational port and close to the landing is one of the highest risk areas for leisure sailing. Small sailing and sport fishing boats are the predominant traffic within Pegwell Bay.

The 2022-2023 AIS data indicates an increased 'recreational' vessel activity during the summer period with the 'recreational' vessels accounting for 16.4% of vessel traffic during 2022-2023.

7.2.5 Subsea Infrastructure – Cables and Pipelines

There are numerous power and telecoms crossings as summarised in the table below, but no pipeline crossings. Individual agreements will need to be made with the owners of each system to determine the protection of the cable in the vicinity of these crossings. Note that there are no pipeline crossings across the route, or any known planned pipelines.

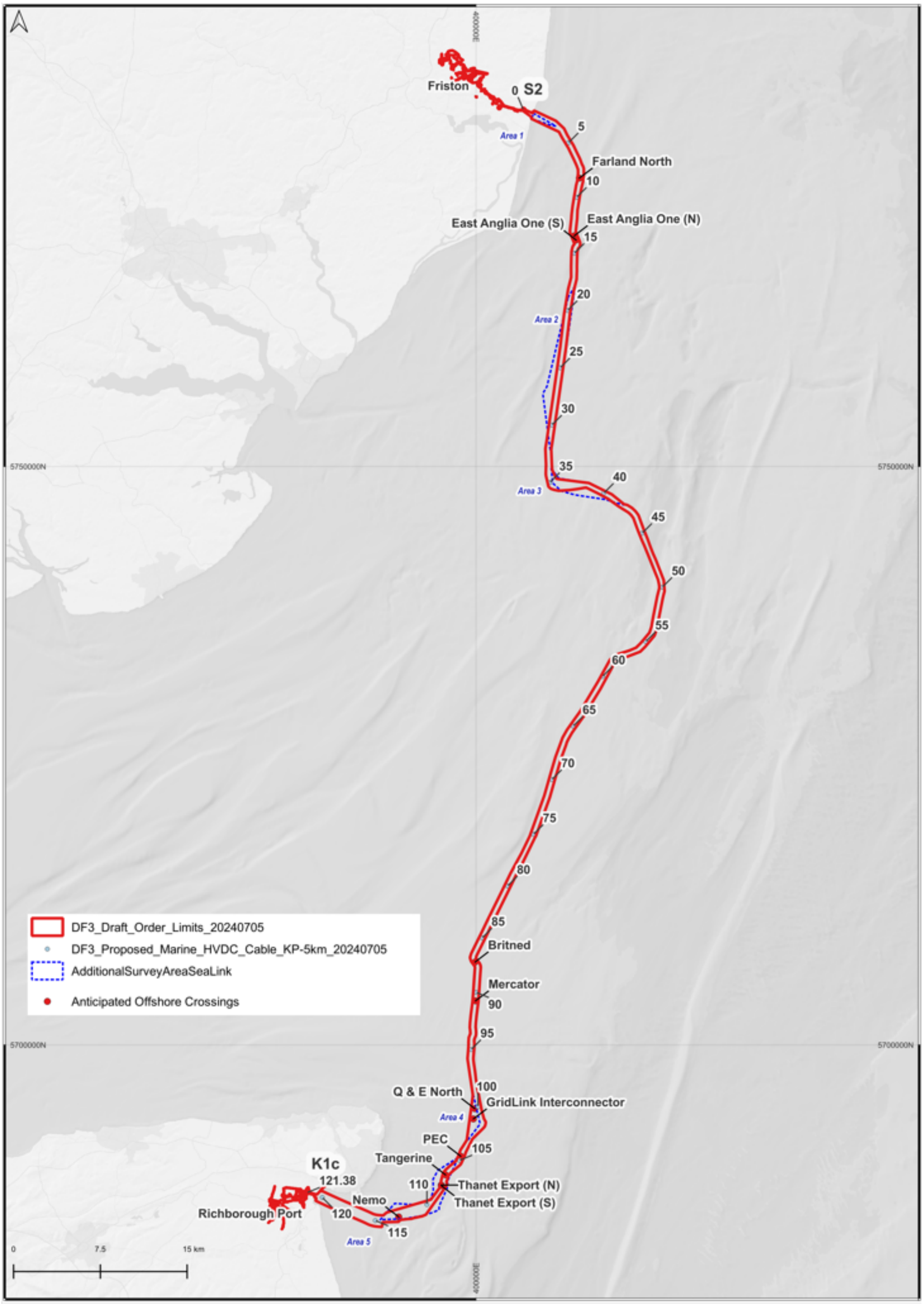


Figure 44: Overview of anticipated crossings

Table 18: In-Service Assets

#	KP (DF3)	Name	Asset Owner	Type	Status
1	8.365	Farland (North)	BT	FO Cable	In service
2	13.373	EA1_N	Scottish Power Renewables	Power	In service
3	13.769	EA1_S	Scottish Power Renewables	Power	In service
4	87.306	Britned	BritNed	Power	In service
5	90.74	Mercator	BT	FO Cable	In service
6	104.591	PEC	Lumen	FO Cable	In service
7	106.747	Tangerine	Lumen	FO Cable	In service
8	107.594	Thanet_N	Balfour Beatty	Power	In service - offshore (northern cable)
9	107.647	Thanet_S	Balfour Beatty	Power	In service - offshore (southern cable)
10	113.106	Nemo_Offshore	Nemo Link	Power	In service – offshore
11	120.86	Nemo_Onshore_1	Nemo Link	Power	In service – onshore cable #1
12	120.861	Nemo_Onshore_2	Nemo Link	Power	In service – onshore cable #2
13	120.885	Thanet Onshore	Balfour Beatty	Power	In service – onshore

Note: Assets 11 to 13 are included as the ducts will pass at depth beneath these in-service power cables

Table 19: Out of Service Assets

No#	KP	Name	Owner	Type	7.2.6 Status
1	3.75	Hermes 1	Global Telesystems	FOC	Out of service
2	5.879	UK-Netherlands 12	BT	FOC	Out of service
3	6.864	UK-Netherlands 5	BT	Coax	Out of service
4	7.701	UK-Netherlands 3	BT	Coax	Out of service
5	69.946	Kentishknock Lightship-Kingsgate(a)	Unknown/BT?	Tele	Out of service
6	70.47	Kentishknock Lightship-Kingsgate(b)	Unknown/BT?	Tele	Out of service

7	87.003	Kentishknock Lightship-Kingsgate(c)	Unknown/BT?	Tele	Out of service
8	94.244	Rembrandt 2	KPN Telecom BV	FOC	Out of service
9	96.165	Hermes 2	Global Telesystems	FOC	Out of service
10	103.528	Dumpton Gap-Middelkerke(a)	Unknown/BT?	Coax	Out of service
11	103.652	UK-Belgium 1	GPO/BT	Coax	Out of service
12	105.044	Dumpton Gap-Middelkerke(b)	Unknown/BT?	Tele	Out of service
13	107.576	Dumpton Gap-N.Goodwin Lightship	Unknown/BT?	Tele	Out of service
14	108.502	Dumpton Gap-Borkum	Deutsche Atlantische Telegraph Company	Tele	Out of service

Note: All OOS assets will be cleared prior to installation, in accordance with ICPC Recommendation 01_ISS_13A

7.2.7 Planned Future Assets

There are future projects which may be approved for power and telecom cables, which are summarised in Section 7.3.

7.2.8 Designated Areas – Environmental

Figure 43 shows there are 3 large scale environmentally protected areas that interact or are in close proximity to the DF3 route. The following figures show the environmental designations in greater detail at the Suffolk and Kent landfalls.

As a direct consequence of the designations, there are significant restrictions to the route which will result in periods where there are Seasonal Restrictions, which can reduce the working window to as little as 7 months of the year. These are under discussion, but the worst case has been assessed where no confirmation of the restrictions has been agreed to date (Statutory Nature Conservation Body and Natural England).

It is expected that further discussions with the Statutory Body and Natural England will better define the restrictions, which may ease depending on activity.

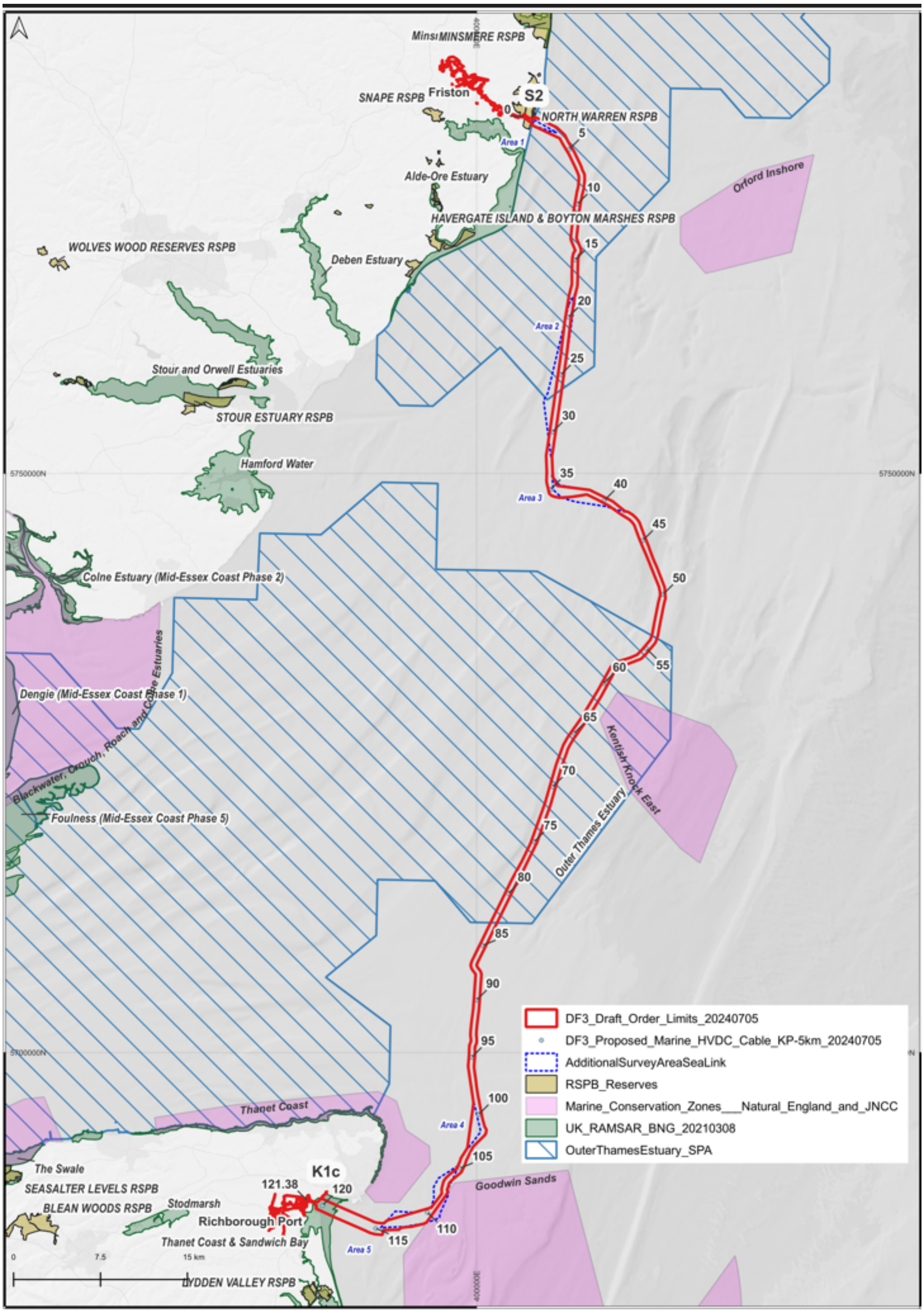


Figure 45: Overview of environmental designations

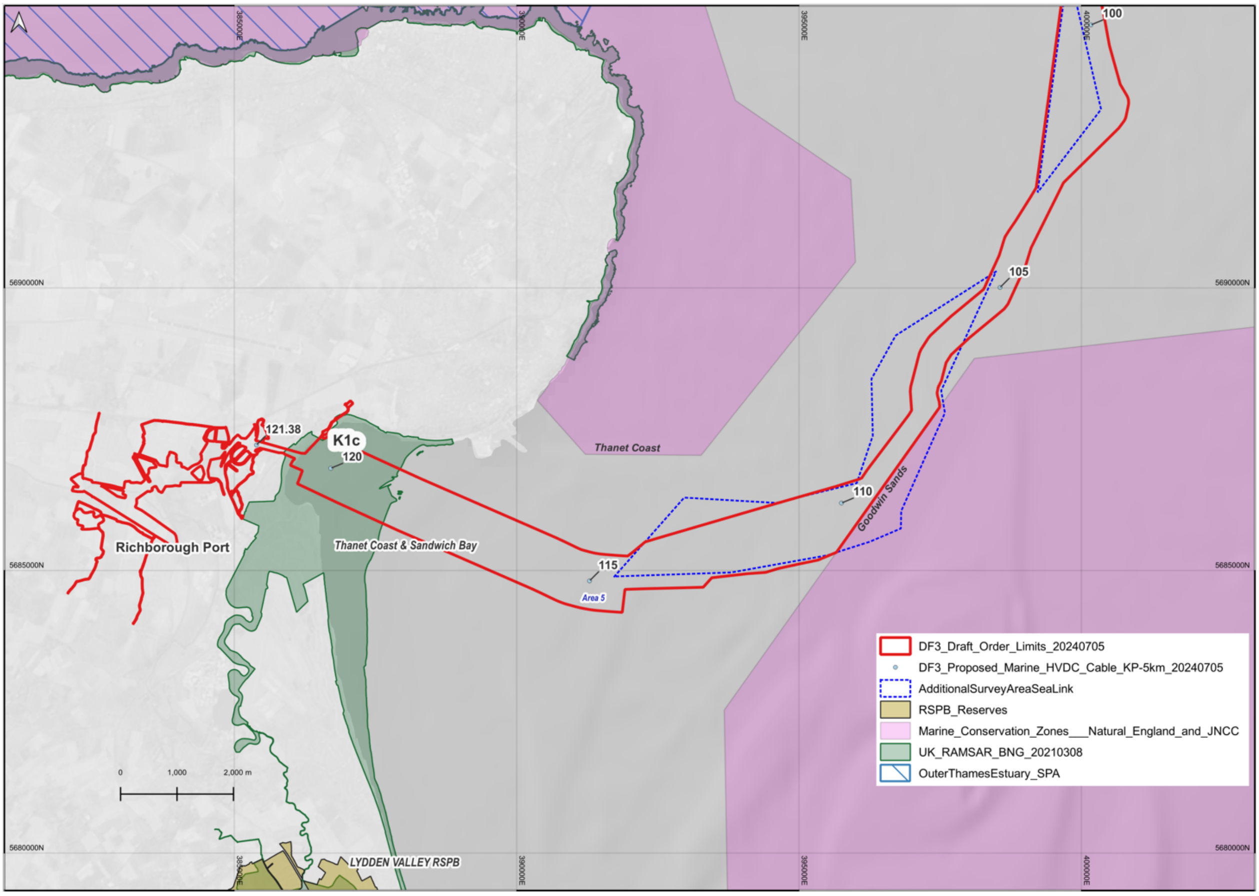


Figure 46: Pegwell Bay environmental designations

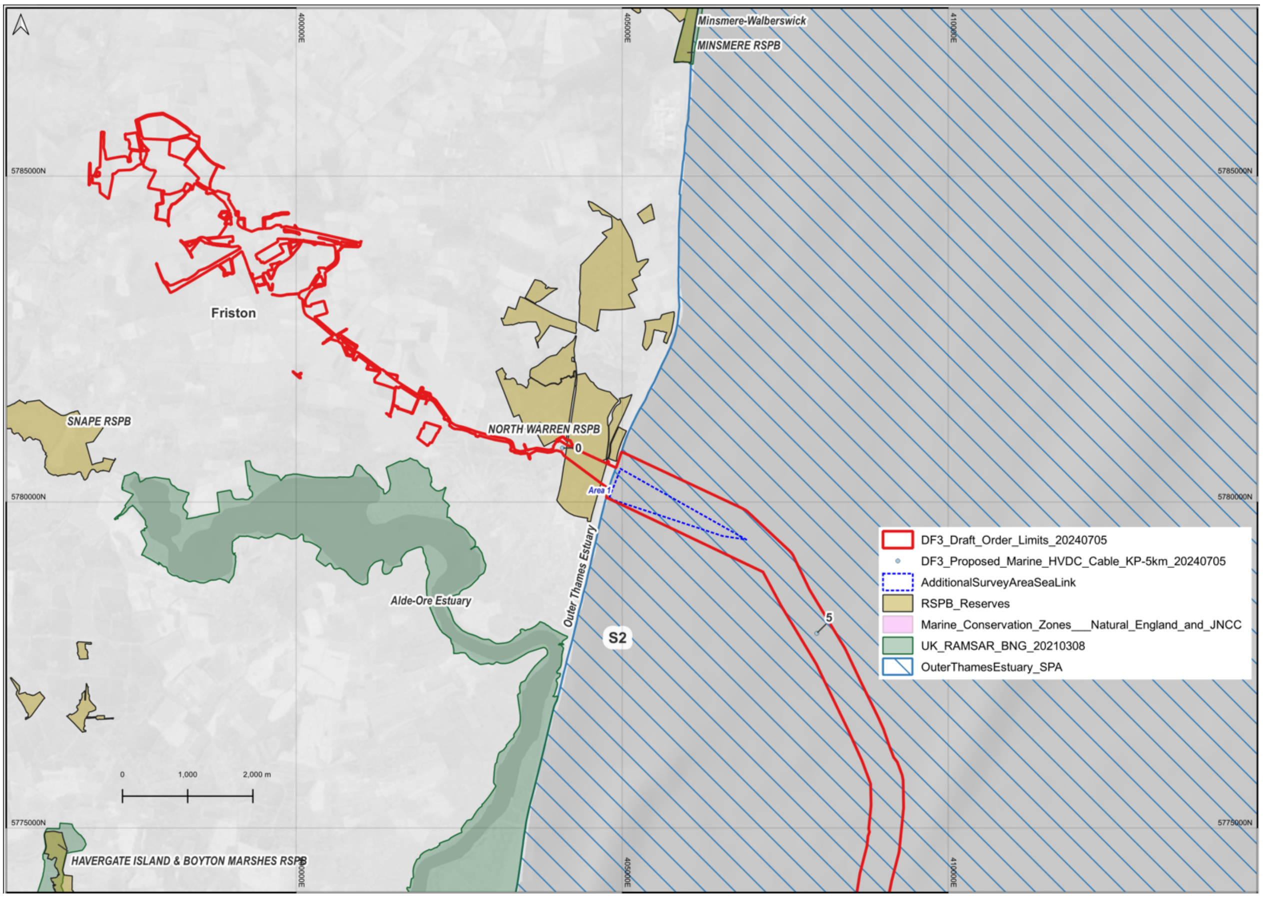


Figure 47: Aldeburgh environmental designations

Table 20: Seasonal Restrictions

Site	Operation	J	F	M	A	M	J	J	A	S	O	N	D	Extent of Seasonal Restriction	Comments
Aldeburgh HDD	Site Preparations													Transition joint bay, Suffolk. PEIR suggests 250m of Sandlings SPA boundary for zone of impact, and therefore area of seasonal restriction.	At the eastern end adjacent to the RSPB reserve and Sandlings SPA the cable excavation/installation works shall avoid February to September as they elevate noise levels in the adjacent protected sites above 60dB. .

	Land Stripping													Transition joint bay, Suffolk. PEIR suggests 250m of Sandlings SPA boundary for zone of impact, and therefore area of seasonal restriction.	
	HDD Ops (land)													N/A	No seasonal restriction expected.
	HDD Ops (marine)													Outer Thames Estuary SPA.	Worst-case scenario would be for a seasonal restriction November-March, in line with standard NE requests for avoidance of impacts to Red Throated Diver. Provisional agreement for reduced restriction for Red Throated Diver has been sought and accepted by NE. This will require agreed transit route for avoidance of sensitive areas- to be confirmed with NE.

Site	**Operation**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**Geographical Extent of Seasonal Restriction**	**Comments**
Pegwell Bay HDD	Site Preparations													N/A	No seasonal restrictions expected
	Land Stripping													N/A	No seasonal restrictions expected
	HDD Ops (land)													N/A	No seasonal restrictions expected

	HDD ops (marine)													Thanet Coast & Sandwich Bay SPA/Ramsar.	Potential that Golden Plover, a feature of the Thanet Coast & Sandwich Bay SPA will be disturbed because of HDD works operating in the intertidal area.

Site	Operation	J	F	M	A	M	J	J	A	S	O	N	D	Geographical Extent of Seasonal Restriction	Comments
Marine	PLGR													N/A	Worst-case scenario would be for a seasonal restriction November-March, in line with standard NE requests for avoidance of impacts to Red Throated Diver. Provisional agreement for reduced restriction for Red Throated Diver has been sought and accepted by NE. This will require agreed transit route for avoidance of sensitive areas- to be confirmed with NE.
	Boulder Clearance													The whole marine route.	Discussions ongoing regarding activities subject to seasonal restrictions for offshore cable installation activities but assumed at this stage to cover all installation activities. Geographic extent proposed to cover whole marine route, due to nature of installation activities, but is a result of the presence of the Outer Thames Estuary SPA.
	Sandwave Pre-Sweeping													The whole marine route	Discussions ongoing regarding activities subject to seasonal restrictions for offshore cable installation activities but assumed at this stage to cover all installation activities. Geographic extent proposed to cover whole marine route, due to nature of installation activities, but is a result of the presence of the Outer Thames Estuary SPA.
	Rock Dumping													The whole marine route	Discussions ongoing regarding activities subject to seasonal restrictions for offshore cable installation activities but assumed at this stage to cover all installation activities. Geographic extent proposed to cover whole marine route,

														due to nature of installation activities, but is a result of the presence of the Outer Thames Estuary SPA. Therefore, some potential for works to take place outside of SPA boundary (and agreed buffer zone) but this has not been agreed at this time.
Cable Lay													The whole marine route	Discussions ongoing regarding activities subject to seasonal restrictions for offshore cable installation activities but assumed at this stage to cover all installation activities. Geographic extent proposed to cover whole marine route, due to nature of installation activities, but is a result of the presence of the Outer Thames Estuary SPA. Therefore, some potential for works to take place outside of SPA boundary (and agreed buffer zone) but this has not been agreed at this time.
Cable Burial													The whole marine route	Discussions ongoing regarding activities subject to seasonal restrictions for offshore cable installation activities but assumed at this stage to cover all installation activities. Geographic extent proposed to cover whole marine route, due to nature of installation activities, but is a result of the presence of the Outer Thames Estuary SPA. Therefore, some potential for works to take place outside of SPA boundary (and agreed buffer zone) but this has not been agreed at this time.
Cable Protect ion													The whole marine route	Discussions ongoing regarding activities subject to seasonal restrictions for offshore cable installation activities but assumed at this stage to cover all installation activities. Geographic extent proposed to cover whole marine route, due to nature of installation activities, but is a result of the presence of the Outer Thames Estuary SPA. Therefore, some potential for works to take place outside of SPA boundary (and agreed buffer zone) but this has not been agreed at this time.
Survey													N/A	Any survey activities that do not require a marine licence will not be subject to seasonal restrictions.

	Cable Joints													The whole marine route	Discussions ongoing regarding activities subject to seasonal restrictions for offshore cable installation activities but assumed at this stage to cover all installation activities. Geographic extent proposed to cover whole marine route, due to nature of installation activities, but is a result of the presence of the Outer Thames Estuary SPA. Therefore, some potential for works to take place outside of SPA boundary (and agreed buffer zone) but this has not been agreed at this time.
	Cable Repair (planned)													The whole marine route	Discussions ongoing regarding activities subject to seasonal restrictions for offshore cable installation activities but assumed at this stage to cover all installation activities. Geographic extent proposed to cover whole marine route, due to nature of installation activities, but is a result of the presence of the Outer Thames Estuary SPA. Therefore, some potential for works to take place outside of SPA boundary (and agreed buffer zone) but this has not been agreed at this time.
	Cable Repair (emergency)													N/A	Emergency repair works fall under a consenting exemption. Therefore, no seasonal restrictions expected

7.2.9 Designated Areas – Extraction and Dumping (including Contaminated Ground)

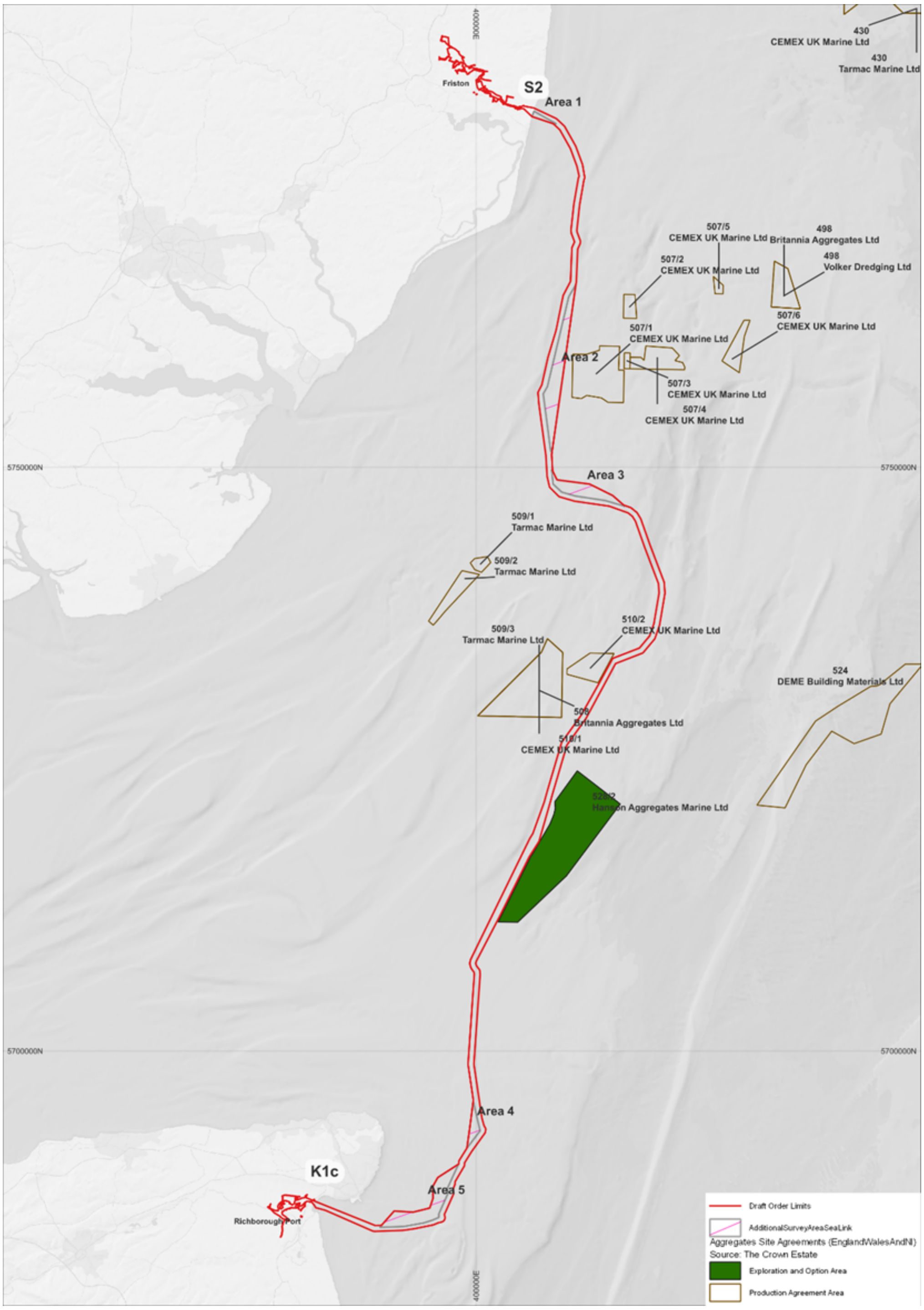


Figure 48: Aggregate extraction areas and red line Boundary

The known extraction areas are shown in Figure 46, whilst there are some proximate areas the operators of these areas have been contacted and required separation distances discussed.

There are no known Offshore UXO dumping sites, however it was common practice to dispose of ammunition at sea without recording the location, therefore there is precedent from other areas that encountering unofficial munitions dumps cannot be discounted.

Known marine dumping grounds are normally indicated on the UKHO charts and dumping of material originating from London and the surrounding area has taken place at sea for centuries. No known active dumping sites for waste (including contaminated material) are located across the cable corridor, although the TCE licence for the geophysical survey indicated that the closed site Warren Spring EXptl Area 2 intersected with the route corridor. Note that the Benthic Survey results did indicate that there are areas where the seabed sediments exhibit metal and PAH contaminant levels which are higher, as shown in the following figures:

ANALYTE	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	Al	Ba	Be	Fe	Mg	P	Sr	V
Method	ICPMSS	ICPMSS	SEDOES	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	SEDOES	SEDOES	SEDOES	SEDOES	SEDOES	SEDOES	SEDOES	SEDOES
Limit of Detection	0.5	0.04	2	0.5	0.5	0.01	0.5	2	10	1	0.1	45	5	45	5	1
NEA 1 Background	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-
NEA 2 Good	15	0.2	60	20	25	0.05	30	90	-	-	-	-	-	-	-	-
NEA 3 Moderate	18	2.5	620	-	150	0.52	42	139	-	-	-	-	-	-	-	-
NEA 4 Poor	71	16	6000	48	1480	0.75	271	750	-	-	-	-	-	-	-	-
NEA 5 Very Poor	580	147	15500	147	2000	1.45	533	6690	-	-	-	-	-	-	-	-
OSPAR, ERL	-	1.2	81	34	47	0.15	-	150	-	-	-	-	-	-	-	-
CEFAS AL2	100	5	400	400	500	3	200	800	-	-	-	-	-	-	-	-
CEFAS AL1	20	0.4	40	40	50	0.3	20	130	-	-	-	-	-	-	-	-
CCME PEL	41.6	4.2	160	108	112	0.7	-	271	-	-	-	-	-	-	-	-
CCME ISQG	7.24	0.7	52.3	18.7	30.2	0.13	-	124	-	-	-	-	-	-	-	-
Dutch RIVM	85	14	380	190	580	10	210	2000	-	-	-	-	-	-	-	-
Units	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
S001	13.5	0.14	41.1	12.0	19.2	0.09	14.3	49.3	35800	196.0	1.0	19500	238.0	454	135.0	59.8
S002	13.7	0.16	51.9	13.2	23.1	0.09	16.9	55.2	44600	263.0	1.1	23100	368.0	573	181.0	69.0
S003	11.8	0.14	41.1	11.5	17.0	0.08	15.1	54.4	37000	228.0	0.9	19500	262.0	405	139.0	59.0
S004	6.8	0.05	11.3	4.5	5.4	0.05	3.7	16.7	9290	138.0	0.3	6790	95.0	141	51.6	15.3
S005	10.1	0.08	38.4	8.8	12.7	0.07	10.2	32.7	26500	211.0	0.8	16400	218.0	397	115.0	48.8
S006	45.4	0.37	22.2	6.4	13.5	0.06	13.9	39.8	14000	110.0	0.9	22300	481.0	18900	738.0	57.5
S008	40.0	0.25	34.7	17.4	10.5	0.07	28.3	48.1	27000	117.0	1.1	27100	338.0	12700	497.0	82.0
S009	13.0	0.10	12.1	5.6	5.9	0.05	6.6	14.4	8250	116.0	0.4	10300	123.0	1350	310.0	22.8
S010	25.2	0.16	22.4	6.9	8.8	0.06	10.8	29.2	14300	140.0	0.6	21600	205.0	5240	459.0	45.2
S011	25.8	0.18	19.7	7.9	8.6	0.07	9.3	32.1	12700	132.0	0.6	19600	219.0	5180	462.0	46.2
S012	8.6	0.06	12.8	5.3	4.8	0.05	3.9	16.0	12800	183.0	0.4	8850	112.0	285	88.3	20.5
S013	26.2	0.06	22.5	7.6	7.3	0.06	10.9	24.2	13000	136.0	0.5	28600	174.0	827	228.0	42.6
S014	21.1	<0.04*	11.7	4.8	7.9	0.03	4.1	20.9	6760	97.6	0.3	13500	247.0	482	234.0	35.1
S015	22.9	0.16	20.2	7.1	9.6	0.04	10.1	26.1	13200	597.0	0.6	16900	292.0	7580	480.0	44.5
S016	9.1	<0.04*	3.9	4.5	3.4	0.03	3.3	14.0	2670	64.8	0.1	5220	106.0	594	439.0	14.2
S017	39.2	0.14	18.3	7.0	7.0	0.04	36.0	30.1	11700	130.0	0.6	20200	200.0	4540	298.0	36.8
S018	20.9	0.08	15.5	6.0	5.3	0.03	9.2	21.1	9190	129.0	0.4	15200	151.0	1810	292.0	35.7
S019	22.9	0.12	10.2	4.6	3.8	0.03	5.8	19.9	5380	97.4	0.3	11600	194.0	2570	314.0	22.8
S020	23.6	0.07	12.1	4.4	7.4	0.05	4.9	23.1	12200	183.0	0.4	14200	197.0	492	220.0	28.9
S021	22.5	0.06	8.9	4.5	5.2	0.05	4.8	23.3	5380	65.9	0.3	14100	163.0	606	252.0	27.7
S022	14.9	0.06	9.9	3.7	4.0	0.05	4.4	17.2	12700	153.0	0.4	9050	119.0	220	98.4	17.5
S023	12.7	0.08	10.2	4.3	3.5	0.05	3.8	14.0	12800	152.0	0.4	9400	120.0	222	89.6	17.6
S024	13.6	0.05	11.5	3.6	3.6	0.04	3.8	13.6	12400	156.0	0.4	9600	132.0	239	121.0	18.6
S025	16.2	0.08	7.2	4.0	4.2	0.04	4.1	15.3	11300	149.0	0.4	9640	142.0	233	162.0	19.2
S026	23.9	0.08	6.4	3.9	4.5	0.06	4.9	17.7	7080	99.9	0.3	12700	252.0	415	417.0	21.9
S027	14.5	0.09	7.3	4.5	4.6	0.06	4.3	23.3	11000	148.0	0.4	8590	138.0	231	186.0	18.4
S029	17.4	0.05	9.8	3.8	3.7	0.05	4.3	14.7	10600	141.0	0.4	9080	122.0	231	129.0	18.7
S030	16.0	0.05	13.3	3.6	3.7	0.03	4.4	51.5	12000	153.0	0.4	10300	142.0	259	120.0	20.1
S032	12.1	0.13	40.8	10.8	15.0	0.07	12.3	83.4	29700	262.0	0.9	18200	324.0	503	144.0	51.9
S033	10.7	0.09	32.8	9.0	12.4	0.06	9.7	112.0	24900	247.0	0.7	15300	277.0	427	125.0	42.6
S034	12.7	0.12	44.0	10.6	16.2	0.06	13.7	74.4	37100	228.0	1.0	20500	359.0	507	147.0	62.2
S035	5.9	<0.04*	5.4	4.2	3.8	0.03	2.4	17.7	5950	106.0	0.2	5000	70.5	118	34.8	9.3
S036	25.9	0.08	25.7	53.8	103.0	0.02	13.6	96.4	9480	113.0	0.8	95601	529.0	519	200.0	50.1
S037	26.9	0.07	8.6	4.9	9.2	<0.01*	4.9	19.5	7210	96.1	0.3	14700	231.0	366	264.0	24.4
Mean	19.0	0.11	10.8	19.5	8.1	7.0	11.1	0.05	9.2	9.9	34.2	24.0	15469	162.9	0.5	17124.1
SD	9.4	0.07	6.9	13.2	8.7	9.5	17.0	0.02	7.2	7.2	25.1	16.8	10631	92.6	0.3	15114.0
Min	5.9	0.05	3.5	3.9	3.6	2.0	3.4	0.02	2.4	2.8	13.6	5.8	2670	64.8	0.1	5000.0
Max	45.4	0.37	32.3	51.9	53.8	51.3	103.0	0.09	36.0	36.4	112.0	83.6	44600	597.0	1.1	95601.0
Median	16.1	0.08	7.5	13.1	5.5	4.5	7.2	0.05	6.2	6.1	23.3	20.4	12300	140.5	0.4	14450.0

*Not included in statistical analyses of Mean, SD, Min, Max and Median

Figure 49: Summary of Metal concentrations (µg/g dry weight) in sediment across the grab sample sites, and threshold values (2021 Samples)

Highlighted cells indicate sites where thresholds exceeded (MMT, 2022), i.e. exceedance of threshold values for Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc.

ANALYTE	NAPHTHALENE	ACENAPHTHYLENE	ACENAPHTHENE	FLUORENE	PHENANTHRENE	DIBENZOTHIOPHENE*	ANTHRACENE	FLUORANTHENE	PYRENE	BENZO[A]ANTHRACENE	CHRYSENE	BENZO[B]FLUORANTHENE	BENZO[K]FLUORANTHENE	BENZO[E]PYRENE*	BENZO[A]PYRENE	PERLENE*	INDENO[123,CD]PYRENE	DIBENZO[A,H]ANTHRACENE	BENZO[GHI]PERYLENE	SUM OF EPA 16 PAHS
Limit of Detection	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
NEA-1-Background	0	0	0	0	0	-	0	0	0	0	0	0	0	-	0	-	0	0	0	0
NEA-2-Good	2	1.6	2.4	6.8	6.8	-	1.2	8	5.2	3.6	4.4	90	90	-	6	-	20	12	18	30
NEA-3-Moderate	27	33	96	150	780	-	4.8	-	84	60	-	-	-	-	183	-	-	27	-	2000
NEA-4-Poor	1754	85	195	694	2500	-	30	400	840	501	280	140	135	-	230	-	63	273	84	6000
NEA-5-Very-Poor	8769	8500	19500	34700	25000	-	295	2000	8400	50100	2800	10600	7400	-	13100	-	2300	2730	1400	20000
OSPAR-ERL	160	-	-	-	240	190	85	600	665	-	384	-	-	-	430	-	240	-	85	-
CEFAS-AL1	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	-
CCME-PEL	391	128	88.9	144	544	-	245	1494	1398	693	846	-	-	-	763	-	-	135	-	-
CCME-ISQG	34.6	5.87	6.71	21.2	86.7	-	46.9	113	153	74.8	108	-	-	-	88.8	-	-	6.22	-	-
Units	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
S001	40.8	4.2	6.8	11.9	79.0	8.4	16.1	106.0	90.9	43.5	56.0	53.3	33.3	55.8	50.5	23.3	53.8	12.7	64.6	723.4
S002	61.7	5.2	8.5	16.4	84.6	9.7	16.4	84.5	80.2	46.4	59.1	63.4	38.2	67.1	56.0	38.6	57.4	12.8	73.9	764.7
S003	6.3	<1	1.3	1.7	7.6	1.1	1.5	6.1	7.0	2.9	4.0	4.6	3.1	5.0	3.1	2.9	3.7	<1	5.8	58.7
S004	2.6	<1	<1	<1	3.7	<1	<1	3.0	3.0	1.5	2.4	2.0	1.3	2.7	1.8	1.3	2.2	<1	3.0	26.3
S005	27.3	3.2	3.8	7.5	43.8	5.1	7.5	38.9	38.3	20.9	31.4	32.5	17.0	37.8	30.1	17.8	33.7	7.2	41.3	384.5
S006	5.4	1.9	<1	1.1	12.2	<1	1.7	29.1	25.7	9.6	15.3	14.8	8.4	14.0	14.6	4.8	14.0	2.4	14.3	170.4
S008	7.5	1.5	1.4	2.1	13.1	2.0	3.5	12.2	11.8	5.6	6.9	5.8	3.9	7.5	4.6	3.7	3.8	1.5	5.5	90.6
S009	4.8	<1	<1	1.2	8.1	<1	2.4	7.8	7.5	3.4	5.1	3.7	2.5	5.4	4.0	2.5	3.0	<1	4.0	57.5
S010	12.8	1.6	1.4	2.7	21.4	2.3	3.9	36.4	34.1	15.4	22.5	23.7	12.7	24.6	18.8	11.0	14.0	3.2	17.8	242.3
S011	13.2	1.7	3.7	4.1	54.3	4.1	13.4	136.0	119.0	60.2	71.0	63.9	34.2	59.8	68.8	25.8	41.7	8.7	44.8	738.6
S012	2.1	<1	<1	<1	3.6	<1	<1	5.6	5.8	2.6	4.1	3.6	3.0	4.7	3.0	2.0	2.2	<1	2.9	38.4
S013	3.3	<1	<1	<1	9.6	<1	2.1	19.5	17.8	8.5	11.0	9.4	7.0	9.9	9.0	5.1	5.8	1.0	7.1	111.1
S014	3.6	<1	<1	1.0	4.8	<1	<1	1.9	1.6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	12.9
S015	3.0	<1	<1	<1	4.5	<1	1.0	8.6	8.0	3.8	5.9	7.2	4.2	7.4	5.3	3.5	4.7	<1	5.5	61.7
S016	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.0
S017	<1	<1	<1	<1	1.2	<1	<1	2.0	2.1	<1	1.4	1.3	<1	1.5	<1	<1	<1	<1	<1	8.0
S018	3.5	<1	<1	<1	6.8	<1	1.3	9.3	9.3	3.9	6.1	7.6	3.7	7.3	4.8	3.1	3.5	<1	4.9	64.6
S019	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.0
S020	<1	<1	<1	<1	1.2	<1	<1	4.0	3.5	1.9	2.7	2.1	1.4	2.1	1.9	1.5	1.2	<1	1.3	21.1
S021	<1	<1	<1	<1	<1	<1	<1	1.5	1.5	<1	<1	1.2	<1	1.2	<1	<1	<1	<1	<1	4.2
S022	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.0
S023	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.0
S024	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.0
S025	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.0
S026	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.0
S027	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.0
S029	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.0
S030	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.0
S032	18.2	1.8	2.4	4.0	32.5	3.5	7.0	52.3	49.5	22.4	34.9	33.8	17.2	34.5	26.9	16.3	19.1	3.9	27.5	353.4
S033	5.6	<1	<1	1.3	10.2	<1	1.7	13.9	13.2	5.7	9.0	9.1	4.2	9.8	6.9	4.8	5.5	1.2	7.6	95.1
S034	38.8	6.7	5.0	9.8	65.1	6.9	12.2	59.2	59.3	29.7	42.3	44.4	18.6	44.7	34.1	21.4	33.8	6.1	44.3	509.4
S035	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.0
S036	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.0
S037	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.0

Figure 50: Summary of PAH concentrations (µg/g dry weight) in sediment across the grab sample sites, and threshold values (2021 Survey)

Highlighted cells indicate sites where thresholds exceeded (MMT, 2022). Note that all PAHs detected exceeded the thresholds, with the exceptions of DiBenzothiphene, Benzo[B]Fluoranthene, Benzo[K]Fluoranthene, Benzo[E]pyrene and Perlene, which is not surprising given the PAH sources from pollution in the area.

Additional results will be obtained from the sampling required to groundtruth the Additional Marine Survey interpretation (2024) and the MMO pre-sweeping samples which will focus on Trace metals, PAH and PSA. These results will be included in a future revision.

7.2.10 Designated Areas – Military Areas

There are no designated military areas on the route, although the cable route traverses the edges of two (2) mine countermeasure areas, X5119, X5119/JUTTER which are still in operation (RPS DTS, 2022).

An historic military artifact thought to be a part of the pipe system of the WW2 'Defence Against Invasion' underground tanks for storing a mixture of fuel and oil with a pipe system running across the southern portion of Pegwell Bay and into the Stour River, is thought to have been located in the Saltmarsh near the lagoon at Pegwell Bay, from the magnetometer data set.

7.2.11 UXO

RPS has completed a UXO desk study (Report Ref: EES1339 – Desk Study for Potential UXO Contamination – Sea Link Cable Route) to provide an assessment of the risks posed by UXO to the Sea Link cable route in order to identify a suitable methodology for the mitigation of any identified risks to an acceptable level in accordance with the ALARP principle.

Based on the conclusions of the research and the risk assessment undertaken, RPS has found there to be a Moderate risk from encountering UXO on site. The risk is primarily due to the presence of aerial bombs, sea mines, torpedoes and depth charges. RPS take in to account the category of UXO both when assessing the probability of the item functioning and the consequence of such an event. This leads to the varying risk levels between munitions with the same installation methodology. The cable route has been split into 14 zones (A-N), dependent on the risk presented and the planned installation activities.

Figure 51: RPS UXO Risk Zones

UXO		A	B	C	D	E	F	G	H	I	J	K	L	M	N
Overall Risk Level															
		Risk Zones													
Small Arms Ammunition		Low	Neg	Neg	Neg	Neg	Neg	Neg	Neg	Neg	Neg	Neg	Neg	Low	Low
Land Service Ammunition		Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
≤155 mm Projectiles		Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Mod
>155 mm Projectiles		Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Aerially Dropped Bombs	Allied Origin	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod
	Axis Origin	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod
Sea Mines	Allied Origin (Contact Mine)	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod
	Allied Origin (Ground Mine)	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod
	Axis Origin (Contact Mine)	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod
	Axis Origin (Ground Mine)	Low	Mod*	Mod**	Low	Mod*	Low	Mod**	Low	Mod**	Low	Mod*	Mod*	Low	Low
Land Mines		Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Torpedoes		Low	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Low	Low
Depth Charges		Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Low	Low
Conventional Dumped Munitions		Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Dumped Chemical Munitions		Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Missiles/Rockets		Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low

Figure 52: Overall Risk Levels

In the softer sediments, it is possible for munitions to be covered by shifting sediments on the seabed and subsequently become buried. This is dependent on the mass, dimensions/shape of the item and the sediments upon which it came to rest as well as the currents affecting the area, however the maximum burial depth due to scour is approximately equal to the diameter of the munition. Burial is not possible in areas where bedrock is exposed. Given the water depths throughout the site, it is considered likely that burial via natural processes (i.e. mobile seabed) will be the main form of burial rather than burial as a direct result of penetration upon impact. Mobile sediment bedforms are expected across the site which will potentially increase burial.

The Safelane onshore evaluation of landfalls highlights both areas as higher risk from the MLWS to the TJB areas. This is due to historic database reviews, as well as analysis of the aerial photographs. The RSPB reserve was used as an ordnance safe disposal, resulting in historic craters which have been naturalised.

The Pegwell Bay risk levels for the landfall also reflect the high volumes of UXOs found and reiterates the practice of jettisoning bomb loads and fuel from aircraft returning to the bomber base at Marston Airfield.

7.2.12 EMF

An EMF assessment has been carried out by National Grid (Ref: EEN/466/NOTE2022 - Sea Link EMF Assessment April 2022) looking at various configurations (bundled, single cables separated by 200m, bundled with a separate metallic return separated by 200m and two bundled pairs separated by 200m) which reached the following conclusions:

- HVDC cables will produce magnetic fields which inherently comply with ICNIRP occupational and public static exposure limits. Distances of 0.8m from the cable centre for the separated cable designs and of 0.45m for bundled cable designs, should be maintained in areas onshore where indirect effects of the cables could be observed, such as pacemaker interference.
- The induced electric fields from all cable designs are localised, with the bundled cables increasing the field above background at up to around 8m from the seabed, and up to around 20m for the separated cable design. A bundled design has been chosen which minimises the effects of EMF.
- Sea Link received feedback from the MMO on the 2023 Preliminary Environmental Information Report (PEIR) requesting that the target DOL is 1.5m along the entire marine route, on the grounds of limiting impacts from EMF. This was driven by the EN-3 National Policy Statement, which stated '*Some research has shown that where cables are buried at depths greater than 1.5m below the sea bed impacts are likely to be negligible*' Since receiving this feedback, the EN-3 National Policy Statement underpinning this request has been revised with this requirement removed, as such this minimum DOL requirement may not be applicable. The CBRA has assumed a target minimum DOL requirement of 1.0m where geological conditions permit and 0.5m in competent bedrock.

7.2.13 Archaeological Areas

Wessex Archaeology have undertaken an assessment of the original surveyed route from 2021, as defined by the extent of the SSS data, and any limitations due to the extent of the Archaeological Exclusion Zones (100m radius around identified items of interest). Analysis of the SSS, SBP MBES and magnetometer data has been combined to produce a gazetteer of targets within the corridor, which have been categorised as follows:

Table 21: Archaeological Discrimination Criteria

Overview classification	Discrimination	Criteria	Data type
Archaeological	P1	Feature of probable archaeological interest, either because of its palaeogeography or likelihood for producing paleoenvironmental material	SBP, MBES
Archaeological	P2	Feature of possible archaeological interest	SBP, MBES
Archaeological	A1	Anthropogenic origin of archaeological interest	MBES, SSS, Mag.
Archaeological	A2_h	Anomaly of likely anthropogenic origin but of unknown date; may be of archaeological interest or a modern feature	MBES, SSS, Mag.
Archaeological	A2_l	Anomaly of possible anthropogenic origin but interpretation is uncertain; may be anthropogenic or a natural feature	MBES, SSS, Mag.
Archaeological	A3	Historic record of possible archaeological interest with no corresponding geophysical anomaly	MBES, SSS, Mag.

Thirty-five (35) paleogeographic features have been identified which range from gas blanking of geophysical data records in the vicinity to the VC which recovered peat, to channel and cut and fill deposits thought to contain material of paleoenvironmental interest.

Eight hundred and thirty-seven (837) seabed features have been identified from the data analysis and search of historical and modern wreck databases from the UKHO and NMHR. Only those wrecks of archaeological potential are included in the listings, but modern wreck positions have been supplied for information; 406038 mE, 5784901 mN and 399653 mE, 5700985 mN (ETRS89 UTM31N). Twenty-Nine (29) targets have been interpreted as wrecks or are recorded within the UKHO wreck register, as indicated in Table 22.

The seabed features range from magnetic anomalies with no visible correlation in the geophysical and MBES data, to intact wrecks and associated debris fields, with individual items of debris, debris fields and localised areas of seabed disturbance as most potential anthropogenic artifacts of interest. Further details can be found in full in the Wessex Archaeology gazetteer. Note that there are records of at least 3 WWII wrecked aircraft in Pegwell Bay, but these are not described by Wessex, but have been identified by RPS in the UXO DTS.

The archaeological work is currently being revised by Wessex after analysis of the data acquired in 2023 and 2024.

Table 22: Wrecks within the cable route corridor, or with 100m radius AEZ which extends into the cable route corridor

ID	Wreck	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
7002	Wreck	406023	5784883	A1	10.8	8.4	0.4	-	An unrecorded wreck. The condition of the wreck suggests it is unlikely to be modern.	SSS	-
7060	Recorded wreck	408288	5783064	A3	-	-	-	-	An unknown, recorded wreck in the UKHO database. The position is situated outside of the study area, however an AEZ will bring it within the corridor.	-	UKHO 87913
7065	Magnetic	409944	5780707	A1	-	-	-	3113	Possibly associated with the position of a UKHO and NMHR recorded wreck "HMS Dane",	Mag.	UKHO 10317, NMHR 912877
7073	Recorded wreck	409983	5778623	A3	-	-	-	-	The position of UKHO recorded wreck "Ingstad", the ship struck a mine laid by UC-7 on	-	UKHO 10306, NMHR 912870

									10/12/1915. Also recorded by NMHR as the possible position of the "Ingstad". Remains have been identified at this position previously.		
7116	Wreck	407157	5779594	A1	15.5	8.4	0.7	-	Associated with a UKHO record for an unknown wreck	SSS, MBES	UKHO 87090
7120	Wreck	407875	5778194	A1	22.2	9.9	0.4	111	An unrecorded wreck Interpreted as an unknown wreck, not recorded in the UKHO or NMHR records.	SSS, MBES, Mag.	-
7173	Wreck	408301	5772170	A1	36.8	15.2	0.6	34	Associated with a UKHO and NMHR record for HMS Tervani, a trawler ship	SSS, Mag.	UKHO 10249, NMHR 912686
7176	Wreck	408288	5772083	A1	41.4	10.2	0.4	-	Associated with a UKHO record for an unknown wreck.	SSS	UKHO 86578
7217	Recorded wreck	407920	5767697	A3	-	-	-	-	The position of an unknown, recorded wreck in the UKHO data	-	UKHO 80055
7231	Recorded wreck	408207	5764777	A3	-	-	-	-	The position of an unknown, recorded wreck in the UKHO data.	-	UKHO 92098

7232	Wreck	406866	5761733	A1	44.5	14.5	3.4	3415	Associated with an unknown, recorded wreck in the UKHO and NMHR datasets	SSS, MBES, Mag.	UKHO 14743, NMHR 879873
7241	Recorded wreck	406658	5759338	A3	-	-	-	-	The position of a suspected, unknown, recorded wreck in the UKHO database., first identified in 2019. Described as being	-	UKHO 92145
7259	Recorded wreck	405529	5753497	A3	-	-	-	-	The position of a recorded wreck in the UKHO and NMHR database, Mexico, a tanker vessel.	-	UKHO 14616, NMHR 912623
7269	Wreck	406448	5750777	A1	43.5	20.7	3.2	5114	Associated with a UKHO and NMHR record for UC-11 (Possibly), a UI-type WWI minelaying submarine	SSS, MBES, Mag.	UKHO 14599, NMHR 908160
7284	Recorded wreck	407938	5747882	A3	-	-	-	-	The position of an unknown, recorded wreck in the UKHO and NMHR records.	-	UKHO 14570, NMHR 802570
7346	Wreck	412020	5733762	A1	97.0	25.2	11.1	1659	Recorded in the UKHO and NMHR dataset as the possible wreck of the Salerno, a two-boiler	SSS, MBES, Mag.	UKHO 14419, NMHR 802191

									general cargo steamer that stuck a mine.		
7348	Wreck	411708	5733710	A1	27.6	10.7	3.6	-	Recorded in the UKHO dataset as an unnamed dangerous wreck lying upright and in good condition. May also be associated with an NMHR record situated 17 m north-west as the possible wreck of the Volscian.	SSS	UKHO 14418, NMHR 802188
7414	Wreck	399938	5701754	A1	116.6	36.6	6.8	27020	Recorded by the UKHO and NMHR as Saidieh, a 3303 gross ton steam	SSS, MBES, Mag.	UKHO 13968, NMHR 904723
7426	Wreck	399876	5700385	A1	51.6	11.9	3.4	10094	Recorded by the UKHO and NMHR as an unknown wreck	SSS, MBES, Mag.	UKHO 13958, NMHR 831796
7472	Wreck	400613	5693545	A1	52.5	38.7	1.6	5443	. Recorded in the UKHO and NMHR database as Selma (Possibly)	SSS, MBES, Mag.	UKHO 14944, NMHR 904908
7490	Recorded wreck	398419	5691708	A3	-	-	-	-	The position of a recorded wreck in the UKHO and NMHR records for Frons Olivae.	-	UKHO 13876, NMHR 904905
7494	Wreck	398780	5690035	A1	51.3	42.2	1.0	8421	Associated with a recorded wreck in the UKHO dataset, Klar.	SSS, MBES, Mag.	UKHO 15175

7495	Recorded wreck	398693	5689906	A3	-	-	-	-	A recorded wreck now amended to Dead in the UKHO and NMHR databases for Yvonne	-	UKHO 13861, NMHR 904901
7500	Recorded wreck	399517	5691466	A3	-	-	-	-	The position of a recorded obstruction in the UKHO record and an unknown wreck in the NMHR records.	-	-
7558	Wreck	396356	5685266	A1	106.1	49.5	3.1	3614	Associated with UKHO and NMHR records for the Bravore.	SSS, MBES, Mag.	UKHO 13837, NMHR 904884
7617	Debris field	394428	5685138	A2_h	27.3	7.5	0.9	-	Associated with a UKHO record for an obstruction found by MBES survey in 2019 measuring 14.7 x 3.5 m. Interpreted as a possible debris field.	SSS	UKHO 91236
7641	Debris field	393821	5684780	A2_h	10.6	5.5	0.9	-	Associated with a UKHO recorded obstruction described as an object with some structure that might indicate it is man-made. Interpreted as a possible non-ferrous debris field	SSS, MBES	UKHO 91238
7647	Magnetic	393042	5685011	A1	-	-	-	91	Corresponds with a recorded obstruction in the UKHO records,	Mag.	UKHO 91206

									described as possibly being a degraded or broken apart wreck or other [debris].		
7721	Wreck	389778	5685519	A1	8.5	4.7	0.4	9085	This feature is associated with a UKHO record for an unknown wreck possibly a barge.	SSS, MBES, Mag.	UKHO 85569

Extracted from Wessex Archaeology gazetteer.

7.3 Future Planned Developments

The cable route is planned to be operational in 2030. Currently there are known developments planned for telecom (FO data) cables, proposed export HVAC cables from OWFs, and HVDC Interconnectors which cross the route as shown below:

Table 23: Future Planned Cable Developments which will cross the Sea Link Corridor

#	KP (DF3)	Name	Asset Owner	Note	Type
1	11.354	EA3_N_Corr	Scottish Power Renewables	Planned Corridor (northern limit)	Power
2	14.482	EA3_S_Corr	Scottish Power Renewables	Planned Corridor (southern Limit)	Power
3	50.181	FiveEstuaries_N_Corr	RWE	Planned Corridor (northern limit)	Power
4	50.672	NeuConnectRPLRev6	Neuconnect	Planned Route	Power
5	52.012	NorthFalls_N_Corr	SSE/RWE	Planned Corridor (northern limit)	Power
6	52.719	FiveEstuaries_S_Corr	RWE	Planned Corridor (southern Limit)	Power
7	53.032	NorthFalls_S_Corr	SSE/RWE	Planned Corridor (southern Limit)	Power
8	88.646	Nautilus_Opt1	NGV	Planned	Power
9	100.151	Q&E North	Consortium	Installation planned Q1/Q2 2025	FO Cable
10	101.27	Grid Link	Icon	Planned	Power
11	Unknown	Cronos Interconnector	Cronos Energy Ltd	Early phase	Power
12	Unknown	Tarchon Interconnector	Tarchon Energy Ltd	Early Phase	Power

Large infrastructure projects are also planned with the Port of London stating that around £1Bn is expected to be invested in the ports located along the Thames and Thames Estuary, which indicates a huge development in the region over the next 5 years and a significant increase in traffic which will cross the Sea Link cable to the east of the Thames estuary, [London | UK Ports (uk-ports.org)] Not only the volume, but also the size of the container vessels is expected to increase, as is indicated by dredging development projects such as that currently being undertaken at Harwich.

Forth Ports have developed Tilbury, with the expansions planned at Tilbury2, (DCO planning approved 2019), specifically for a new RO/RO deepwater cargo ferry and construction and aggregate facility at the new CMAT terminal. The proposed increase in cargo is projected to be 32 million tonnes / year with vessels of tonnage of the order >200,000 DWT (mega-container ships). Proposed Arrangement of TILBURY2 – TILBURY2

The Port of Ramsgate has received UK government funding to reinstate ferry traffic to continental Europe, although there is no expectation that the ferry size will increase, compared to current vessels (R. Brown, Harbour master and vessel co-ordinator, meeting comm 12.06.22.)

Harwich Haven applied to the MMO in October 2019 for consent to deepen the port and approach channel to –16.0m (plus tide) in response to the need to accommodate mega-sized container vessels (Harwich Haven Authority announces major improvement project for Harwich Harbour - Harwich Haven Authority). Progress has been reported via Channel Deepening Project Blog - Harwich Haven Authority with operations starting in October 2021 and local stakeholders sharing some of the port development plans, via local information sites such as the Harwich International Port Development | Harwich & Dovercourt Sailing Club (hdsc.org.uk)).

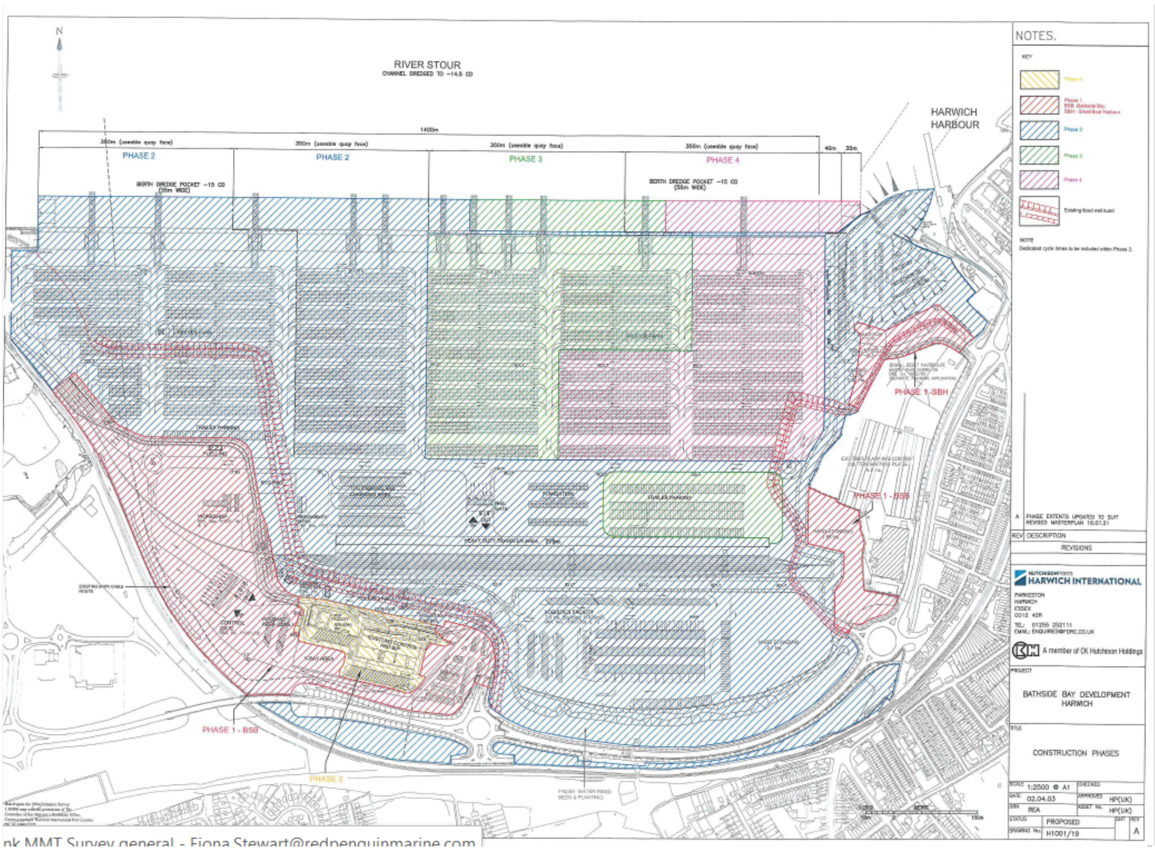


Figure 53: Harwich International Port Development

(Harwich International Port Development | Harwich & Dovercourt Sailing Club (hdsc.org.uk)).

8 ADDITIONAL REQUIREMENTS AND FUTURE REVISIONS DURING THE DCO PROCESS

8.1 Overview

The CBRA has addressed the issues affecting the cable recommended DOL which are available during the Phase 2 part of the project leading to the DCO application. There are areas which could benefit from further examination to better assess and quantify the risks, thus allowing further refinement of the derivation of the recommended DOL. Note that some of these studies fall out with the basic requirements for the Carbon Trust guidelines but are important when dealing with this hybrid approach.

8.2 Detailed Hydrodynamic Modelling in Nearshore / Non-trenched (HDD) Exit Locations

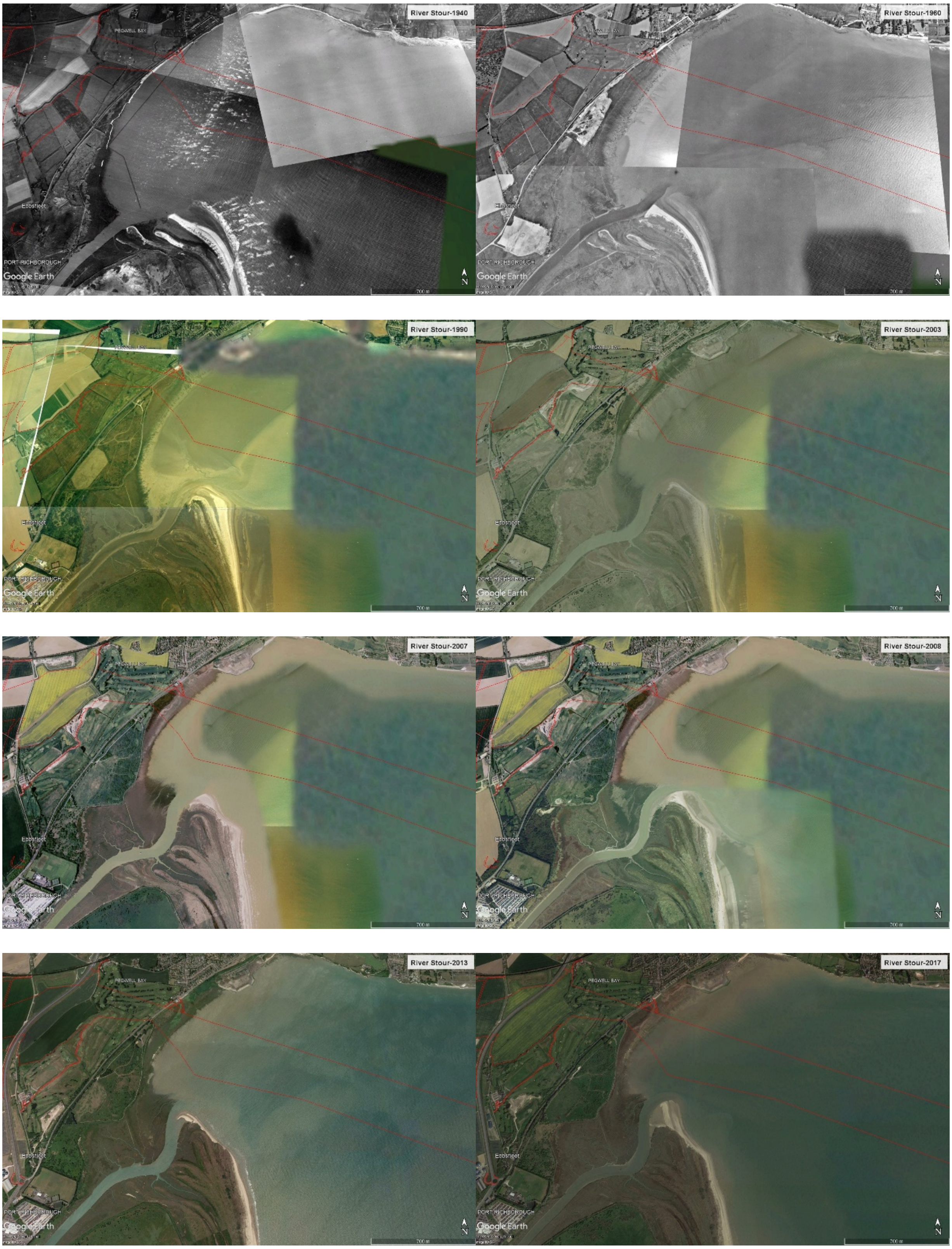
Although the Suffolk coastline has been studied extensively for hydrodynamic behaviour, it would be beneficial to undertake a detailed study at the S2 landfall, particularly with regard to the local effects of the sluice to the north of the landfall, particularly on local scour. Local water management by the RSPB reserve which feeds into the water course may create irregular variation on water volumes draining to the nearshore. In addition, the length of the non-trenched solution will be engineered later in the project and the exit location will require the detailed study.

Similarly, within Pegwell Bay, there is a need to undertake an additional hydrodynamic study to ensure that the longterm development of the river Stour channel as it exits into Pegwell Bay, and the associated spit developing to the south of route is fully understood. This information will be required for the detailed engineering of the non-trenched solution and the burial requirements on the approaches to the exit point, where the river channel meanders through the mud flats.

A study has been undertaken by ABPMer, but the reports have yet to be finalised and hence have not been included in this report . This study also addresses the changes in the River Stour migrations through time.

There is a likelihood of a strong interaction between the fluvial discharge and coastal tide that could result in an estuarine shear front. In this zone, large velocity flow gradients, suspended sediment concentration, salinity and temperature can be found. The shear front could restrict the dispersal of fluvial sediment leading to increased deposition near the mouth of the river.

The following public domain satellite images of the river Stour depict the changes of its depositional zone at Pegwell Bay from 1940 to 2022. The draft order limits (SeaLink_MM_DF2_Projectwide_RLB_20230414) has been overlain on the images for spatial clarity.


River Stour-1940
River Stour-1960
River Stour-1990
River Stour-2003
River Stour-2007
River Stour-2008
River Stour-2013
River Stour-2017
Google Earth

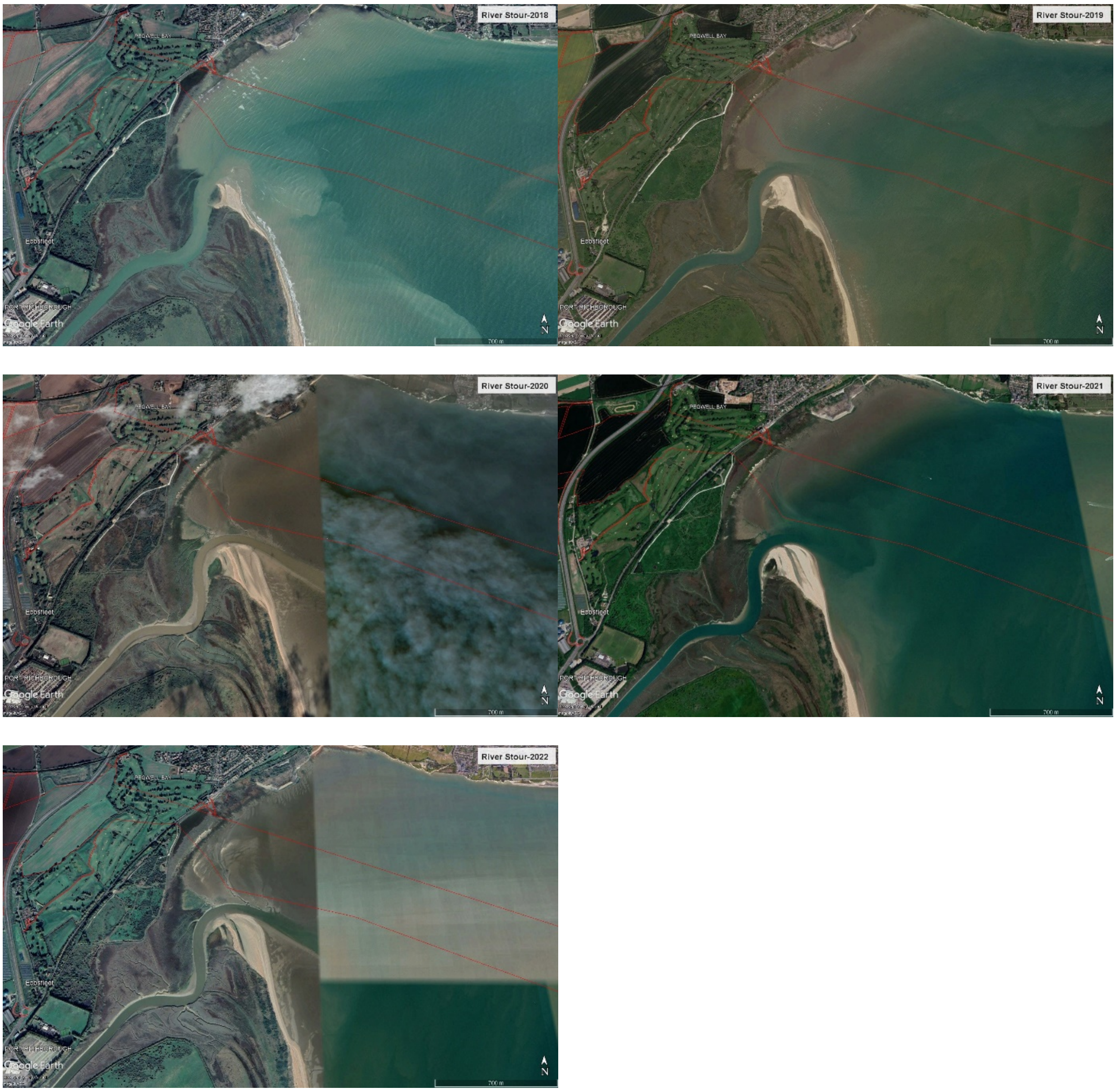


Figure 54: Evolution of the Stour River Mouth

8.3 Future Vessel Traffic Study to cover Life of Asset

The highest risk to the cables is marine traffic and accidental anchor incidents in the areas of high traffic. The highest risk area is in the vicinity of the SUNK deepwater anchorage and the SUNK VTS, augmented by the deepwater channel to Harwich. The volume of traffic and size of vessels is expected to increase during the lifetime of the asset, especially with the main ports in the PLA and Harwich Haven areas having submitted significant port expansion plans, as well as the need to deepen some of the shipping channels.

It is highlighted that currently there is not a quantitative overview of the impact on traffic volumes and the number of vessels in excess of 200 000 DWT which will cross the cable in its lifetime, or an overview of plans to expand the deepwater anchorages and holding areas for the increase in vessel traffic and the increase in draft of the larger vessels.

Alternately the Stakeholders in the area may already have such a study and need to be consulted to request access.

8.4 MMO Required Depth of Lowering Direction

As part of the Stage 1 phase of the Sea Link cable route development, the Depth of Lowering for burial where risk was low was aligned to the 1.0 m common practice applied to the Southern North Sea, UKCS.

Sea Link received feedback from the MMO on the 2023 Preliminary Environmental Information Report (PEIR) requesting that the target DOL is 1.5m along the entire marine route, on the grounds of limiting impacts from EMF. This was driven by the EN-3 National Policy Statement, which stated 'Some research has shown that where cables are buried at depths greater than 1.5m below the sea bed impacts are likely to be negligible' Since receiving this feedback, the EN-3 National Policy Statement underpinning this request has been revised with this requirement removed, as such this minimum DOL requirement may not be applicable. The CBRA has assumed a target minimum DOL requirement of 1.0m where geological conditions permit and 0.5m in competent bedrock.

8.5 Routing south of the SUNK Deepwater Anchorage and in close proximity to the SUNK pilot Station and Traffic Separation System (TSS)

A further area of uncertainty, which will need to be resolved prior to submission of the DCO application or will raise questions during the DCO examination relates to the route around the periphery of SUNK. This area is part of the highest risk area along the cable corridor, due to the close proximity to the SUNK deepwater anchorage to the north, and the SUNK pilot station to the south, which is just over 1nM distance from the DF3 RPL. A further restriction from Trinity House with regard to the CPA to buoys of 200m minimum further restricts the route, with the major route restriction discussed with HHA, reducing the southern sweep of the corridor south of an axis between the Storm Buoy and the W1 buoy. As is indicated by the NRA, this is a very constricted and heavily trafficked area, with optimisation limited due to the vessels passing through the area, which are in excess of 150 000DWT.

A further request from HHA and PLA has been added to the physical restrictions, which is to avoid SIMOPs with the construction phases of the Five Estuary and North Falls export cables, and associated works. The requests and outcomes to the requested restrictions will be addressed as the project moves to the finalisation of DF4 in co-operation with all concerned Stakeholders.

9 RECOMMENDED DOL

9.1 Overview

The AIS data has been analysed in order to produce the shipping risk for the route, in particularly looking at the shipping volumes, DWT and anchor sizes, to calculate the risks of accidental anchor strikes and anchor drag.

In order to undertake the analysis with reference to the changes in geological and geotechnical conditions along the route, representative polygons have been created coincident with the SI indices along the route. Although this creates a very detailed division of the route it is highly suited for applying to the BAS which follows on from the derivation of the recommended DOL, and production of the CBRA.

9.2 Calculated vs. Observed anchor behaviour and iterative evaluation of the DOL

The calculated DOL has been compared to the industry's experience via projects undertaken infield to assess anchor penetration compared to calculated penetration values such as the Carbon Trust process, and to the observed installation experience of other cable projects installed in the area, e.g. NEMO, Britned, and the in-service OWF export cables.

TenneT Offshore GmBH have undertaken studies within the German Bight of the North Sea, which concluded from survey results of the trials that for an 11.5T Hall Anchor, the maximum penetration across 3 sediment types (relative loose, fine SANDS, relatively dense SAND and a thin sand veneer overlying overconsolidated stiff CLAY), was less than 1m, both for a dropped anchor, and for dragged anchor (maximum pull load 800kN). The results were reported at the BISsub14 conference, June 2014, and went further to extrapolate that a 29T anchor could give a penetration of 1.6m.

This iterative assessment of the calculated vs. observed anchor penetration studies indicates that the recommended DOL may be reduced or unachievable without additional protection in areas, especially those which have exposed, or thin veneer over London Clay. London Clay has proved to be difficult to trench, either due to the use of inappropriate systems (jetting systems), or systems which have proven to achieve depth, but at slower rates than proposed. Where the highest risks have been identified, the recommended DOL remains the same as the calculated DOL due to uncertainty over planned developments in ships traffic over the lifetime of the cable.

The following table shows the list of the KP intervals and differential between the Recommended DOL, note that these range from 0.5 (top of cable) to 2.5 m (top of cable), depending on the Hazards present in the area.

Table 24: Table of Recommended DOL extracted from the CBRA table

Start KP	End KP	Section Distance (km)	DOL to Top of Product (relative to undisturbed seabed, or NMRL whichever is the lower	Further Detail
0.000	1.524	1.524	N/A	Landfall at Aldeburgh, Suffolk, including trenchless technique requirements.
1.524	6.518	4.994	1.50	
6.518	14.094	7.576	1.00	
14.094	14.410	0.316	1.50	
14.410	15.215	0.805	1.00	
15.215	17.915	2.700	1.50	
17.915	26.342	8.427	1.00	
26.342	31.587	5.245	1.50	
31.587	34.075	2.488	1.00	
34.075	35.089	1.014	1.50	
35.089	38.550	3.461	2.00	
38.550	40.103	1.553	2.50	
40.103	42.806	2.703	2.00	
42.806	43.301	0.495	2.50	
43.301	46.302	3.001	2.00	
46.302	49.828	3.526	2.50	
49.828	54.871	5.043	2.00	
54.871	56.887	2.016	2.50	
56.887	57.887	1.000	2.00	
57.887	68.706	10.819	1.50	
68.706	76.644	7.938	1.00	
76.644	81.301	4.657	1.50	
81.301	85.304	4.003	2.00	
85.304	92.313	7.009	2.50	
92.313	96.343	4.030	2.00	
96.343	113.883	17.540	0.50	Pre-sweep and bedrock across this location
113.883	120.469	6.586	1.50	
120.469	121.380	0.911	N/A	Trenchless technique to avoid sensitive habitats at Pegwell Bay landfall.

Base case is 1.0m DOL to TOC in sediment, 0.5m DOL to TOP in rock outcrop.

Where competent bedrock, (Coralline Crag, Chalk and flint beds) subcrops or outcrops the seabed, or there is a thin veneer (<0.2m), the DOL to TOP is reduced to 0.5m and the preferred method of protection is by mechanical trenching. Note that where there is an undulating bedrock surface, with variable cover depth between 0.5 m to 1.0 m, a pre-sweep followed by 0.5m DOL has been assumed.

The maximum recommended depth of lowering has been calculated as 2.5 m within the areas of highest risk in the vicinity of the SUNK deepwater anchorage and the shipping channels associated with the SUNK Vessel Traffic System (VTS) and the southeastern approaches to the Outer Thames Estuary adjacent to the North Foreland.

Shapefiles have been compiled for the Recommended DOL zones and different risk classes. These are presented in Appendix 10.4

10 APPENDICES

10.1 Table of Stakeholders

Stakeholder	Asset Name	Contacts (as at 01/08/2024)
SZC - Sizewell C	N/A	REDACTED
EDF - Sizewell B	N/A	REDACTED
Hanson Aggregates Marine Ltd	N/A	REDACTED
Tarmac Marine Ltd	N/A	REDACTED
Cemex Marine Ltd	N/A	REDACTED
Britannia Aggregates Ltd	N/A	REDACTED
Port of London Authority	N/A	REDACTED
Harwich Haven Authority	N/A	REDACTED
Port of Felixstowe	N/A	REDACTED
Port of Ramsgate	N/A	REDACTED
Port of Lowestoft	N/A	REDACTED
MCA VTS	N/A	REDACTED
Trinity House	N/A	REDACTED
MMO Coastal Office / Licensing Team / Conservation Team	N/A	REDACTED
The Crown Estate	N/A	REDACTED
UKHO	N/A	REDACTED
Eastern IFCA	N/A	REDACTED
Kent and Essex IFCA	N/A	REDACTED
NFFO	N/A	REDACTED
Balfour Beatty	Thanet Export Cable - North	REDACTED

Balfour Beatty	Thanet Export Cable - South	REDACTED
Balfour Beatty	Thanet Onshore cables	REDACTED
BritNed	BRITNED	REDACTED
BT	Farland North	REDACTED
BT	Mercator	REDACTED
BT	UK Netherlands 8 - Telecommunications (Rupert)	REDACTED
BT	UK Netherlands 11 - Telecommunications (part removal)	REDACTED
BT	UK-Belgium 3 (partial removal?)	REDACTED
BT	UK-Belgium 5 (partial removal)	REDACTED
BT	UK-Netherlands 12	REDACTED
BT/GPO	UK-Belgium 1	REDACTED
BT/GPO	Dumpton Gap - La Panne No2 Historic	REDACTED
GridLink	GridLink Interconnector Ltd	REDACTED
London Array	London Array	REDACTED
Lumen (Colt)	PAN EUROPEAN CROSSING (PEC)	REDACTED
Lumen (Colt)	Tangerine	REDACTED
Nemo Link	Nemo Link	REDACTED
Nemo Link	Nemo Link Onshore cables	REDACTED
NeuConnect	NeuConnect	REDACTED
OceaniQ	OceaniQ Q&E North	REDACTED
RWE	Five Estuaries Proposed Export Route	REDACTED
RWE / SSE	North Falls Proposed Export Route	REDACTED
Scottish Power Renewables	East Anglia One Export Cable (N)	REDACTED
Scottish Power Renewables	East Anglia One Export Cable (S)	REDACTED
Scottish Power Renewables	East Anglia Three Transmission Asset Wind Export	REDACTED
Vattenfall Networks Limited	Thanet OWF	REDACTED
Cronos Energy Ltd	Cronos Energy Ltd (North Kent)	REDACTED
National Grid Ventures	LionLink	REDACTED

Sandwich Port and Haven Commissioners	Sandwich Port and navigational channel	REDACTED

10.2 Route Position Lists – Surveyed and Preferred DF3 RPL

<u>Primary Surveyed Route - Sizewell</u>

MMT: SEAL_RPL_Sizewell_Option_Rev03_210629

KP	Easting	Northing	Length (m)	ID	Route
0.000	405742.31	5784712.8	420.31	Sizewell Landing	SEAL_Sizewell_Rev03
0.420	406155.06	5784633.4	1078.73	AC1	SEAL_Sizewell_Rev03
1.499	407228.21	5784742.9	2329.88	AC2	SEAL_Sizewell_Rev03
3.829	409463.01	5784084.1	449.47	AC3	SEAL_Sizewell_Rev03
4.278	409542.38	5783641.7	2425.44	AC4	SEAL_Sizewell_Rev03
6.704	409970.69	5781254.4	1380.21	AC5	SEAL_Sizewell_Rev03
8.084	410543.66	5779998.7	500.57	AC6	SEAL_Sizewell_Rev03
8.585	410670.66	5779514.5	594.94	AC7	SEAL_Sizewell_Rev03
9.180	410535.72	5778935.1	1974.77	AC8	SEAL_Sizewell_Rev03
11.154	409818.19	5777095.3	96.74	AC9	SEAL_Sizewell_Rev03
11.251	409786.77	5777003.8	1043.62	AC10	SEAL_Sizewell_Rev03
12.295	409447.82	5776016.8	1077.36	AC11	SEAL_Sizewell_Rev03
13.372	409136.89	5774985.2	299.71	AC12	SEAL_Sizewell_Rev03
13.672	409024.44	5774707.4	2193.60	AC13	SEAL_Sizewell_Rev03
15.865	408647.36	5772546.5	2266.89	AC14	SEAL_Sizewell_Rev03
18.132	408400.45	5770293.1	213.03	AC15	SEAL_Sizewell_Rev03
18.345	408435.21	5770082.9	646.94	AC16	SEAL_Sizewell_Rev03
18.992	408665.04	5769478.2	145.59	AC17	SEAL_Sizewell_Rev03
19.138	408712.66	5769340.6	129.73	AC18	SEAL_Sizewell_Rev03

KP	Easting	Northing	Length (m)	ID	Route
19.268	408686.20	5769213.6	487.02	AC19	SEAL_Sizewell_Rev03
19.755	408481.59	5768771.6	491.75	AC20	SEAL_Sizewell_Rev03
20.246	408458.36	5768280.4	2411.92	AC21	SEAL_Sizewell_Rev03
22.658	408358.08	5765870.6	1384.49	AC22	SEAL_Sizewell_Rev03
24.043	407716.66	5764643.6	3014.24	AC23	SEAL_Sizewell_Rev03
27.057	407114.54	5761690.2	2417.04	AC24	SEAL_Sizewell_Rev03
29.474	406420.01	5759375.1	2451.63	AC25	SEAL_Sizewell_Rev03
31.926	405882.10	5756983.2	687.71	AC26	SEAL_Sizewell_Rev03
32.613	405566.72	5756372.0	927.43	AC27	SEAL_Sizewell_Rev03
33.541	405645.28	5755447.9	4429.10	AC28	SEAL_Sizewell_Rev03
37.970	406243.39	5751059.4	1802.28	AC29	SEAL_Sizewell_Rev03
39.772	406349.23	5749260.2	851.81	AC30	SEAL_Sizewell_Rev03
40.624	406540.07	5748430.1	1017.76	AC31	SEAL_Sizewell_Rev03
41.642	407259.74	5747710.4	1299.64	AC32	SEAL_Sizewell_Rev03
42.941	408508.57	5747350.6	3010.66	AC33	SEAL_Sizewell_Rev03
45.952	411488.59	5746922.1	1785.48	AC34	SEAL_Sizewell_Rev03
47.738	413171.34	5746325.27	578.17	AC35	SEAL_Sizewell_Rev03
48.316	413622.19	5745963.32	558.69	AC36	SEAL_Sizewell_Rev03
48.874	413914.29	5745487.06	2393.22	AC37	SEAL_Sizewell_Rev03
51.268	414714.36	5743231.54	3349.77	AC38	SEAL_Sizewell_Rev03
54.617	415906.34	5740101.02	872.20	AC39	SEAL_Sizewell_Rev03
55.490	415968.49	5739231.03	2713.64	AC40	SEAL_Sizewell_Rev03
58.203	415514.75	5736555.60	539.27	AC41	SEAL_Sizewell_Rev03

KP	Easting	Northing	Length (m)	ID	Route
58.742	415337.57	5736046.26	640.47	AC42	SEAL_Sizewell_Rev03
59.383	415127.15	5735441.34	1473.24	AC43	SEAL_Sizewell_Rev03
60.856	414178.69	5734314.02	2546.16	AC44	SEAL_Sizewell_Rev03
63.402	411804.35	5733394.54	5455.21	AC45	SEAL_Sizewell_Rev03
68.858	409209.79	5728595.83	2792.09	AC46	SEAL_Sizewell_Rev03
71.650	407576.90	5726331.00	4290.53	AC47	SEAL_Sizewell_Rev03
75.940	406359.81	5722216.72	988.56	AC48	SEAL_Sizewell_Rev03
76.929	406095.23	5721264.22	2912.64	AC49	SEAL_Sizewell_Rev03
79.841	405103.04	5718525.78	528.68	AC50	SEAL_Sizewell_Rev03
80.370	404825.23	5718075.98	298.81	AC51	SEAL_Sizewell_Rev03
80.669	404693.84	5717807.61	6908.21	AC52	SEAL_Sizewell_Rev03
87.577	401656.14	5711603.12	4277.66	AC53	SEAL_Sizewell_Rev03
91.855	399775.15	5707761.21	261.82	AC54	SEAL_Sizewell_Rev03
92.117	399711.65	5707507.21	296.57	AC55	SEAL_Sizewell_Rev03
92.413	399791.02	5707221.46	267.11	AC56	SEAL_Sizewell_Rev03
92.680	399946.04	5707003.94	214.89	AC57	SEAL_Sizewell_Rev03
92.895	400078.33	5706834.60	291.81	AC58	SEAL_Sizewell_Rev03
93.187	400099.50	5706543.56	6319.19	AC59	SEAL_Sizewell_Rev03
99.506	399656.88	5700239.89	1376.29	AC60	SEAL_Sizewell_Rev03
100.882	399562.83	5698866.82	4677.26	AC61	SEAL_Sizewell_Rev03
105.560	400248.69	5694240.12	764.83	AC62	SEAL_Sizewell_Rev03
106.324	400453.82	5693503.31	256.13	AC63	SEAL_Sizewell_Rev03
106.581	400584.50	5693283.03	195.89	AC64	SEAL_Sizewell_Rev03

KP	Easting	Northing	Length (m)	ID	Route
106.777	400544.82	5693091.20	144.52	AC65	SEAL_Sizewell_Rev03
106.921	400458.17	5692975.53	1776.87	AC66	SEAL_Sizewell_Rev03
108.698	399416.89	5691535.75	1215.97	AC67	SEAL_Sizewell_Rev03
109.914	398772.05	5690504.85	258.31	AC68	SEAL_Sizewell_Rev03
110.172	398758.82	5690246.88	1606.29	AC69	SEAL_Sizewell_Rev03
111.778	397942.58	5688863.44	240.47	AC70	SEAL_Sizewell_Rev03
112.019	397939.41	5688622.99	521.67	AC71	SEAL_Sizewell_Rev03
112.541	397748.71	5688137.42	298.79	AC72	SEAL_Sizewell_Rev03
112.839	397836.03	5687851.67	1917.41	AC73	SEAL_Sizewell_Rev03
114.757	397053.58	5686101.18	94.05	AC74	SEAL_Sizewell_Rev03
114.851	397026.72	5686011.05	292.82	AC75	SEAL_Sizewell_Rev03
115.144	397088.73	5685724.87	77.48	AC76	SEAL_Sizewell_Rev03
115.221	397064.16	5685651.39	78.92	AC77	SEAL_Sizewell_Rev03
115.300	397006.10	5685597.94	341.34	AC78	SEAL_Sizewell_Rev03
115.641	396674.24	5685518.08	453.58	AC79	SEAL_Sizewell_Rev03
116.095	396254.94	5685345.10	46.39	AC80	SEAL_Sizewell_Rev03
116.141	396209.91	5685333.95	1564.72	AC81	SEAL_Sizewell_Rev03
117.706	394675.72	5685026.37	824.04	AC82	SEAL_Sizewell_Rev03
118.530	393860.50	5684906.10	222.05	AC83	SEAL_Sizewell_Rev03
118.752	393639.61	5684883.43	67.08	AC84	SEAL_Sizewell_Rev03
118.819	393572.57	5684881.15	2250.19	AC85	SEAL_Sizewell_Rev03
121.069	391323.77	5684801.79	65.03	AC86	SEAL_Sizewell_Rev03
121.134	391258.90	5684806.33	68.41	AC87	SEAL_Sizewell_Rev03

KP	Easting	Northing	Length (m)	ID	Route
121.203	391192.44	5684822.55	97.12	AC88	SEAL_Sizewell_Rev03
121.300	391103.51	5684861.58	4315.30	AC89	SEAL_Sizewell_Rev03
125.615	387147.81	5686586.19	804.34	AC90	SEAL_Sizewell_Rev03
126.420	386372.03	5686798.59	324.64	AC91	SEAL_Sizewell_Rev03
126.744	386140.00	5687025.65	553.46	AC92	SEAL_Sizewell_Rev03
127.298	385798.28	5687461.01	0.00	Pegwell Bay Landing	SEAL_Sizewell_Rev03

ETRS 89 UTM 31N

Aldeburgh Spur Surveyed Route

MMT: SEAL_RPL_Aldebrough_Option_Rev01_210729

KP	Easting	Northing	Length (m)	ID	Route
0.000	409024.44	5774707.47	235.10	Intersection Point	SEAL_Aldeburgh_Rev01
0.235	409112.65	5774925.39	982.92	AC1	SEAL_Aldeburgh_Rev01
1.218	408895.91	5775884.12	1633.24	AC2	SEAL_Aldeburgh_Rev01
2.851	408327.72	5777415.34	1893.19	AC3	SEAL_Aldeburgh_Rev01
4.744	407399.33	5779065.27	879.63	AC4	SEAL_Aldeburgh_Rev01
5.624	406756.69	5779665.91	1660.12	AC5	SEAL_Aldeburgh_Rev01
7.284	405289.31	5780442.31	1279.11	AC6	SEAL_Aldeburgh_Rev01
8.563	404053.7	5780773.04	0.00	Aldeburgh Landing	SEAL_Aldeburgh_Rev01

(ETRS 89 UTM 31N)

Aldeburgh to Pegwell Bay Route (DF2)

KP	WGS 84 (UTM 31N)		ETRS 89 UTM 31N	
	X	Y	X	Y
0.00	404091.3761	5780877.798	404091.376	5780877.8
3.61	407259.6477	5779142.006	407259.648	5779142.01
4.60	407731.6734	5778279.182	407731.673	5778279.18
7.60	408991.262	5775556.417	408991.262	5775556.42
8.25	408940.4004	5774908.305	408940.4	5774908.31
8.57	408915.544	5774587.681	408915.544	5774587.68
10.57	408542.2242	5772622.831	408542.224	5772622.83
13.25	408474.0548	5769946.165	408474.055	5769946.17
13.74	408461.427	5769450.336	408461.427	5769450.34
16.57	408389.4851	5766625.546	408389.485	5766625.55
31.56	406344.9998	5751770.064	406345	5751770.06
32.56	406259.9316	5750777.781	406259.932	5750777.78
33.56	406318.6528	5749779.506	406318.653	5749779.51
34.53	406592.2631	5748846.52	406592.263	5748846.52
35.53	407098.807	5747984.306	407098.807	5747984.31
36.46	407924.0458	5747554.651	407924.046	5747554.65
37.46	408897.6379	5747326.354	408897.638	5747326.35
41.46	412792.006	5746413.165	412792.006	5746413.17
42.41	413485.9712	5745761.241	413485.971	5745761.24
45.41	414843.1694	5743087.82	414843.169	5743087.82
48.41	415957.819	5740302.58	415957.819	5740302.58
49.38	416176.106	5739360.528	416176.106	5739360.53
53.38	415368.9863	5735442.802	415368.986	5735442.8

54.35	414679.8348	5734763.972	414679.835	5734763.97
55.34	413863.5967	5734192.046	413863.597	5734192.05
57.47	411977.0457	5733198.946	411977.046	5733198.95
58.32	411350.4213	5732634.363	411350.421	5732634.36
65.32	407754.8813	5726628.354	407754.881	5726628.35
66.31	407404.9965	5725700.576	407404.997	5725700.58
67.31	407141.9819	5724735.783	407141.982	5724735.78
74.73	404961.9994	5717645.888	404961.999	5717645.89
81.27	401828.1562	5711904.318	401828.156	5711904.32
86.25	399729.3117	5707388.974	399729.312	5707388.97
86.57	399839.0435	5707087.373	399839.044	5707087.37
87.20	400056.2593	5706490.35	400056.259	5706490.35
93.20	399673.5904	5700502.562	399673.59	5700502.56
94.20	399680.3702	5699503.474	399680.37	5699503.47
98.20	399808.331	5695505.52	399808.331	5695505.52
99.20	399770.7391	5694511.44	399770.739	5694511.44
100.0	399620.519	5693718.188	399620.519	5693718.19
102.20	399212.5418	5691563.826	399212.542	5691563.83
103.17	398816.47	5690678.352	398816.47	5690678.35
103.56	398569.3708	5690371.996	398569.371	5690372
105.17	397560.8475	5689121.619	397560.847	5689121.62
105.59	397342.502	5688764.225	397342.502	5688764.23
106.30	396968.8282	5688152.586	396968.828	5688152.59
106.57	396990.2213	5687882.355	396990.221	5687882.36
106.63	396994.4443	5687829.011	396994.444	5687829.01
107.20	397036.6374	5687256.398	397036.637	5687256.4

108.34	396368.6805	5686329.324	396368.68	5686329.32
111.65	393192.7435	5685395.901	393192.744	5685395.9
111.93	393179.3408	5685122.586	393179.341	5685122.59
112.18	393166.6126	5684866.794	393166.613	5684866.79
113.18	392167.2449	5684831.534	392167.245	5684831.53
114.18	391171.7845	5684831.561	391171.784	5684831.56
119.18	386545.325	5686727.64	386545.325	5686727.64
120.40	385413.0508	5687177.141	385413.051	5687177.14

Aldeburgh to Pegwell Bay Route (DF3)

KP	ETRS 89 UTM 31N	
	X	Y
0.00	404082.675	5780830.211
0.50	404505.272	5780562.980
1.00	404927.868	5780295.749
1.50	405350.464	5780028.517
2.00	405815.033	5779844.852
2.50	406281.726	5779665.414
3.00	406748.419	5779485.976
3.50	407183.375	5779242.551
4.00	407482.594	5778853.329
4.50	407725.000	5778416.165
5.00	407983.401	5777988.112
5.50	408234.202	5777555.979
6.00	408448.446	5777104.207
6.50	408668.006	5776654.992
7.00	408875.022	5776199.891
7.50	409055.015	5775733.574
8.00	409055.359	5775234.624
8.50	409005.083	5774737.158
9.00	408889.413	5774251.324
9.50	408787.636	5773761.792
10.00	408692.513	5773271.051
10.50	408614.341	5772777.205
11.00	408531.926	5772284.044
11.50	408498.917	5771785.702
12.00	408467.546	5771286.926
12.50	408411.685	5770790.057
13.00	408368.570	5770292.814
13.50	408536.394	5769825.045
14.00	408724.656	5769361.842
14.50	408586.011	5768921.268
15.00	408492.243	5768432.868
15.50	408474.799	5767933.184
16.00	408463.398	5767433.314
16.50	408462.398	5766933.347
17.00	408464.483	5766433.351
17.50	408368.900	5765945.298
18.00	408246.400	5765460.537
18.50	408152.250	5764969.863
19.00	408070.792	5764476.543
19.50	407989.333	5763983.224
20.00	407907.875	5763489.904
20.50	407835.656	5762995.278

21.00	407777.199	5762498.707
21.50	407718.743	5762002.136
22.00	407660.286	5761505.565
22.50	407601.830	5761008.994
23.00	407543.373	5760512.422
23.50	407478.557	5760016.680
24.00	407407.753	5759521.719
24.50	407336.949	5759026.758
25.00	407266.146	5758531.796
25.50	407195.342	5758036.835
26.00	407124.539	5757541.873
26.50	407053.735	5757046.912
27.00	406982.931	5756551.950
27.50	406911.836	5756057.031
28.00	406839.616	5755562.274
28.50	406767.396	5755067.517
29.00	406695.176	5754572.761
29.50	406622.957	5754078.004
30.00	406550.737	5753583.247
30.50	406478.517	5753088.490
31.00	406406.297	5752593.733
31.50	406333.089	5752099.129
32.00	406253.245	5751605.545
32.50	406256.740	5751107.012
33.00	406277.610	5750607.448
33.50	406294.772	5750107.861
34.00	406280.012	5749608.079
34.50	406301.549	5749109.789
35.00	406372.364	5748615.199
35.50	406678.023	5748265.630
36.00	407163.905	5748151.070
36.50	407662.782	5748184.563
37.00	408161.659	5748218.057
37.50	408660.536	5748251.551
38.00	409159.120	5748288.636
38.50	409655.257	5748286.456
39.00	410121.490	5748106.229
39.50	410586.756	5747923.125
40.00	411028.493	5747689.365
40.50	411468.531	5747451.948
41.00	411881.197	5747170.609
41.50	412287.226	5746878.836
42.00	412703.202	5746602.044
42.50	413127.441	5746337.429
43.00	413518.517	5746029.848
43.50	413821.944	5745635.653

44.00	413994.091	5745166.222
44.50	414166.238	5744696.791
45.00	414348.588	5744231.289
45.50	414535.697	5743767.618
46.00	414741.042	5743311.781
46.50	414931.669	5742849.578
47.00	415120.815	5742386.734
47.50	415307.902	5741923.056
48.00	415494.795	5741459.298
48.50	415680.660	5740995.128
49.00	415866.435	5740530.921
49.50	416013.970	5740054.811
50.00	416089.162	5739561.243
50.50	415987.287	5739073.698
51.00	415872.464	5738587.198
51.50	415775.541	5738096.682
52.00	415678.617	5737606.166
52.50	415581.694	5737115.650
53.00	415488.835	5736624.362
53.50	415403.459	5736131.706
54.00	415252.638	5735655.638
54.50	414981.732	5735244.274
55.00	414660.354	5734861.239
55.50	414331.765	5734484.867
56.00	413975.233	5734134.318
56.50	413517.999	5733933.249
57.00	413047.765	5733765.297
57.50	412570.400	5733616.561
58.00	412101.716	5733443.880
58.50	411737.094	5733102.848
59.00	411411.873	5732725.527
59.50	411166.264	5732290.008
60.00	410926.080	5731851.557
60.50	410696.118	5731407.577
61.00	410466.157	5730963.598
61.50	410236.195	5730519.619
62.00	410006.233	5730075.639
62.50	409765.632	5729637.606
63.00	409507.954	5729209.118
63.50	409249.481	5728781.109
64.00	408966.401	5728369.364
64.50	408675.854	5727962.453
65.00	408387.418	5727554.036
65.50	408098.982	5727145.619
66.00	407849.262	5726712.602
66.50	407632.982	5726263.638

67.00	407460.711	5725794.253
67.50	407288.440	5725324.867
68.00	407116.170	5724855.481
68.50	406972.490	5724376.650
69.00	406831.220	5723897.022
69.50	406689.950	5723417.394
70.00	406550.350	5722937.283
70.50	406413.367	5722456.413
71.00	406276.383	5721975.544
71.50	406139.400	5721494.674
72.00	405971.097	5721023.878
72.50	405802.069	5720553.315
73.00	405633.041	5720082.752
73.50	405464.014	5719612.189
74.00	405294.986	5719141.625
74.50	405125.958	5718671.062
75.00	404956.930	5718200.499
75.50	404765.907	5717739.198
76.00	404547.430	5717289.456
76.50	404328.953	5716839.714
77.00	404108.013	5716391.244
77.50	403867.763	5715952.747
78.00	403627.513	5715514.249
78.50	403390.584	5715073.949
79.00	403157.491	5714631.678
79.50	402938.300	5714182.284
80.00	402719.108	5713732.890
80.50	402499.917	5713283.495
81.00	402279.324	5712834.789
81.50	402058.037	5712386.423
82.00	401836.751	5711938.056
82.50	401615.465	5711489.690
83.00	401394.179	5711041.324
83.50	401173.965	5710592.436
84.00	400957.857	5710141.550
84.50	400741.437	5709690.818
85.00	400519.696	5709242.676
85.50	400297.955	5708794.534
86.00	400076.214	5708346.393
86.50	399857.435	5707896.799
87.00	399767.682	5707425.121
87.50	400033.927	5707007.386
88.00	400143.784	5706538.350
88.50	400106.820	5706039.718
89.00	400073.060	5705540.862
89.50	400040.177	5705041.944

90.00	400005.018	5704543.185
90.50	399968.569	5704044.515
91.00	399922.816	5703546.788
91.50	399858.505	5703050.941
92.00	399794.311	5702555.081
92.50	399744.261	5702057.592
93.00	399710.854	5701558.845
93.50	399754.556	5701061.964
94.00	399621.776	5700588.739
94.50	399600.418	5700095.883
95.00	399572.453	5699596.903
95.50	399534.262	5699098.369
96.00	399527.924	5698600.178
96.50	399593.734	5698104.580
97.00	399666.557	5697609.938
97.50	399723.580	5697113.224
98.00	399798.380	5696618.938
98.50	399883.890	5696126.314
99.00	399983.178	5695636.366
99.50	400074.349	5695144.756
100.00	400166.569	5694653.961
100.50	400186.395	5694154.354
101.00	400080.138	5693666.990
101.50	399798.680	5693262.960
102.00	399645.087	5692787.437
102.50	399526.953	5692301.593
103.00	399384.020	5691826.122
103.50	399161.272	5691378.480
104.00	398938.525	5690930.838
104.50	398765.949	5690463.069
105.00	398557.712	5690008.495
105.50	398245.860	5689633.083
106.00	397860.186	5689314.876
106.50	397495.023	5688973.749
107.00	397303.156	5688518.833
107.50	397229.033	5688030.061
108.00	397116.195	5687569.588
108.50	396814.534	5687170.840
109.00	396512.622	5686772.281
109.50	396217.364	5686373.232
110.00	395750.358	5686194.611
110.50	395283.352	5686015.991
111.00	394816.346	5685837.370
111.50	394344.878	5685671.866
112.00	393860.548	5685549.080
112.50	393368.277	5685461.913

113.00	392968.920	5685218.274
113.50	392781.223	5684791.671
114.00	392285.833	5684756.237
114.50	391786.179	5684766.283
115.00	391289.131	5684817.444
115.50	390815.088	5684971.048
116.00	390361.770	5685181.861
116.50	389903.437	5685381.688
117.00	389445.104	5685581.516
117.50	388986.772	5685781.344
118.00	388528.439	5685981.172
118.50	388070.273	5686181.374
119.00	387615.514	5686389.206
119.50	387160.755	5686597.037
120.00	386708.283	5686809.783
120.50	386241.374	5686984.960
121.00	385762.349	5687127.807
121.38	385392.198	5687220.789

(ETRS 89 UTM31N)

Link: DF3 Alignment

10.3 CBRA Spreadsheet –DF3 Route Aldeburgh –Pegwell Bay

Link: Sea Link Stage 2 - Cable Burial Risk Assessment DF3 CBRA Table_Rev 02(F) (1).xlsx

10.4 Shapefiles

Folder	Type	Description
Anchor Strike Risk DOL to TOC	.shp	Anchor Strike Risk by chainage and Depth of Lowering to Top of Cable.

*Link to Red Penguin Sharepoint site.

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