



DOGGER BANK  
CREYKE BECK

November 2011

# Appendix F

## Offshore Cable Corridor Selection Report

Preliminary Environmental Information 1

# Offshore Cable Corridor Selection Report

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## Glossary of Abbreviations

AC	- Alternating Current	ODIS	- Offshore Development Information Statements
CIA	- Cumulative Impact Assessment	OFTO	- Offshore Transmission Network Owner
cSAC	- candidate Special Area of Conservation	PEI	- Preliminary Environmental Information
DC	- Direct Current	pMCZ	- proposed Marine Conservation Zone
DCO	- Development Consent Order	pSAC	- possible Special Area of Conservation
EIA	- Environmental Impact Assessment	RWE	- RWE npower renewables (an RWE Innogy company)
ES	- Environmental Statement	SAC	- Special Area of Conservation
HDD	- Horizontal Directional Drilling	SEA	- Strategic Environmental Assessment
HVAC	- High Voltage Alternating Current	SPA	- Special Protection Area
HVDC	- High Voltage Direct Current	SSE	- Scottish and Southern Energy
GW	- Gigawatts	StEP	- Stakeholder Engagement Plan
IPC	- Infrastructure Planning Commission	TCE	- The Crown Estate
MoD	- Ministry of Defence	WTG	- Wind Turbine Generator
NSIP	- Nationally Significant Infrastructure Project	ZAP	- Zone Appraisal and Planning
NSRAC	- North Sea Regional Advisory Council	ZDE	- Zone Development Envelope
O&M	- Operation and Maintenance	ZoC	- Zone Characterisation

# 1 Introduction

## Background

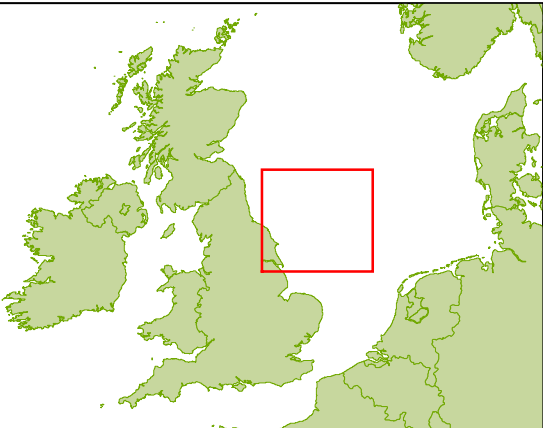
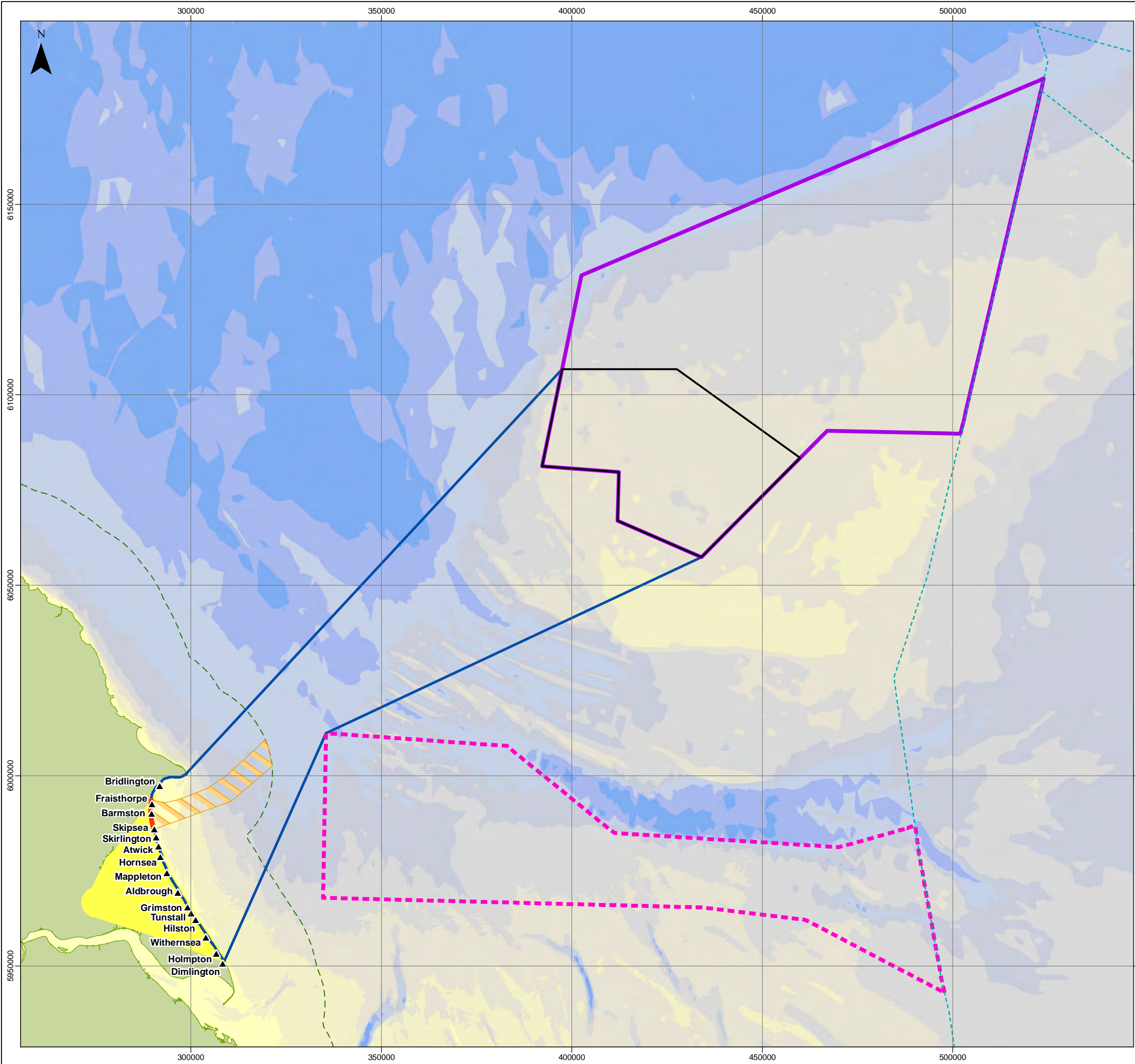
- 1.1 Forewind had previously identified “Dogger Bank Project One”, an offshore wind farm project with a generating capacity of up to 1.4 Gigawatts (GW) which would be connected into the existing Creyke Beck onshore substation near Cottingham in East Riding of Yorkshire. This project was the subject of a formal scoping request to the Infrastructure Planning Commission (IPC) in October 2010. Since then, through discussions with National Grid, Forewind has identified the potential to connect an additional project at that same location. Forewind now proposes that these two projects, each with a generating capacity of up to 1.4 GW (a total potential of 2.8GW) and their associated infrastructure, will be developed together during the pre-application phase. These projects will jointly be called “Dogger Bank Creyke Beck”.
- 1.2 The Dogger Bank Creyke Beck projects will be located in the southwest region of the Dogger Bank Round 3 Offshore Wind Farm Zone. An essential element of this will be an electrical cable exporting electricity from the Offshore Wind Farm to an onshore connection with the national electricity transmission network at the existing Creyke Beck substation near to Cottingham, in the East Riding of Yorkshire.
- 1.3 The identification of the offshore cable corridor for the first projects is necessary at this stage to progress the environmental impact assessment (EIA).
- 1.4 The identification of the location of the landfall point for the export cable is an important element of the site selection and design of the offshore wind farm projects, as it determines the meeting point of the onshore cable corridor and the nearshore cable corridor. The identification of the landfall has been undertaken separately, but in parallel to the identification of the cable corridor.

## Aim of this report

- 1.5 This report explains the process that Forewind has undertaken in order to identify an offshore cable corridor for the Dogger Bank Creyke Beck projects from Tranche A in the southern section of the Dogger Bank Zone to the selected landfall on the Holderness coast.
- 1.6 The final specification of the export cables will be determined during the final design process post consent. The number of cables is therefore not yet known, but could range between two and four pairs.

- 1.7 A 2km-wide offshore cable corridor is considered necessary to accommodate the maximum number of cables and provide flexibility to microsite around any obstacles (such as wrecks) and or features (such as biogenic reef) that require avoidance.
- 1.8 The offshore export cables will have to cross existing cables and pipelines owned by third parties. At these crossing points, it is likely that greater separation distances between the individual Dogger Bank Creyke Beck offshore export cables may be required, than would be needed where there are no crossings.
- 1.9 The identification of the nearshore section of the required export cable corridor has been integrated with the identification of the landfall for the Dogger Bank Creyke Beck projects. This report therefore focuses on the identification of the offshore section of the study area although the more offshore extents of the current nearshore corridor have been refined where appropriate.
- 1.10 The study area for the identification of an export cable corridor for the Dogger Bank Creyke Beck projects comprises the area defined within the Scoping envelope (Forewind Ltd, 2010), from Tranche A to the Holderness Coast (see Figure 1.1).
- 1.11 At the end of the second stage of the identification of the offshore cable corridor, Forewind had refined the landfall selection to a section of the Holderness coast between Skipsea and Fraisthorpe, although exact landfall had not been identified at that point.





**LEGEND**

- Dogger Bank Round 3 Zone
- Tranche A Boundary
- Initial offshore cable study envelope
- Hornsea Round 3 Zone
- Initial onshore study envelope
- Refined Landfall Search Area
- Indicative Nearshore Cable Corridor Search Envelope Corresponding with the Refined Landfall between Skipsea and Fraisthorpe
- International Boundary
- 12nm Territorial Boundary

**Bathymetry (relative to LAT)**

- Deeper than 70m
- 0m to 70m
- 50m to 60m
- 40m to 50m
- 30m to 40m
- 20m to 30m
- 10m to 20m
- 0m to 10m

Data Source:  
Round 3 © TCE, 2010.  
Bathymetry © SeaZone 2011, © TCarta 2009

PROJECT TITLE ***DOGGER BANK R3 DEVELOPMENT***

DRAWING TITLE

**Figure 1.1**

**Initial Dogger Bank Creyke Beck Offshore Cable Envelope**

VER	DATE	REMARKS	Drawn	Checked	Approved
1	08/11/2011	First Issue	PR	KG-C	GL

DRAWING NUMBER: **M-DES-0024-01**

SCALE	1:1,000,000	PLOT SIZE	A3	DATUM	WGS84	PROJECTION	UTM31N
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## 2 Data

### Data Sources

- 2.1 To aid in the selection process a number of data sources were investigated and considered for use within this report, based on their relevance to the export cable corridor identification process. The full account of the data sets investigated is provided in a separate Technical Note (Offshore Cable Corridor Consent Considerations (Royal Haskoning, 2011). In order to keep this report concise, only those datasets considered of relevance to export cable corridor identification have been detailed here.

Data source	Data type (i.e. GIS/reference paper etc)	Contents
Forewind Ltd (2010)	Scoping Report	Detail on consent parameters and potential impacts from development
ZOC document (EMU, 2010)	Zone Characterisation document	Detail on the physical environment within the study area
RPS report (RPS, 2010)	Technical Report	Sandwave and near surface bedrock extents
GEMS (2010)	Technical Report	Interpretation of bathymetry reconnaissance data
Royal Haskoning (2011)	Offshore cable envelope characterisation	Summary of development constraints in the offshore cable envelope
RPS (2011)	Data Chart	Interpretation of Shallow Seismic Pinger Data
ETA report (ETA, 2011)	Technical Report	Interpretation of GEMS bathymetry and shallow seismic survey data with regard to location of sandwaves

**Table 2.1 Data sources**

Summaries of the reports have been provided below.

## Reports

### RPS Geology Report for Zone Development Envelope (ZDE)

- 2.2 As part of the initial Zonal Characterisation (ZoC) carried out by Forewind, RPS carried out a desk-based review of the physical and geological data within the Zone and the Zone Development Envelope (ZDE). A summary of their findings was reproduced in the first version of the ZoC Report and was used by ETA as an input for their report which is summarised below.
- 2.3 The report reviews the available physical and geological data and from this highlights key potential constraints and considerations for cable route selection. Within the ZDE for the Dogger Bank Zone, the *„most problematic trenching conditions extend from the south-western corner of the Dogger Bank Zone to the coast north of Flamborough Head“* (RPS, 2010). The problem features which could be encountered in this region are described as; *„the largest expanse of active large bedforms, the widest expanse of shallow bedrock, and, rugged rocky coastal sections“*. Between these two areas though there is potential to find areas where the bedrock is covered by a few metres of sandy sediment which may prove suitable for cabling.
- 2.4 Owing to the location of the the onshore grid connection for the Dogger Bank Creyke Beck projects and the location of Tranche A within the Dogger Bank Zone it will be necessary for the offshore export cables to pass through the area identified by RPS (as noted above) as being likely to be the most problematic for cable trenching, particularly if aiming for the shortest route. Consequently, where possible, Forewind has aimed during this process to limit or better understand the potential impacts of the active large bedforms and shallow bedrock and to find potential routes through these. The work that has been carried out to do this and therefore to help cable route selection for the Dogger Bank Creyke Beck projects is discussed further below.

### GEMS Reconnaissance Bathymetry Survey Interpretation

- 2.5 GEMS Survey Ltd. (GEMS) were contracted by Forewind in 2010 to carry out a geophysical survey on the Tranche A area. During the course of this survey campaign a period of poor weather on Dogger Bank was used to run a series of reconnaissance bathymetry and shallow seismic pinger survey lines over a part of the offshore cable envelope. A total of seven survey lines spaced 4km apart were run over the original cable corridor envelope for the Dogger Bank Creyke Beck projects and these are shown in Figure 2.1. These were targeted to try and better define the edges of the sand wave features in the south east and exposed or near surface bedrock. Unlike the survey work within Tranche A, these lines collected only multibeam bathymetry and pinger shallow seismic data. It was considered most useful to use these pieces of equipment as they were both less susceptible to the influence of the poor weather.
- 2.6 After the lines had been run, GEMS provided a survey report detailing the results of the bathymetric survey. The pinger data was not considered within this initial

analysis. The report highlighted a number of seabed features ranging from flat seabed, through gentle seabed undulations, sandwaves of amplitude less than 1m to much larger ridge features. GEMS (2010) noted that in the area of ridge features, sandwaves superimposed on top have given rise in some locations to „*steep slopes in excess of 15°*’. The report then provided charted interpretation of the survey data.

- 2.7 The GEMS report provided interpretation only and did not look to draw any conclusions on the implications of this data or to provide a comparison to charted data.

#### RPS interpretation of GEMS Survey Data

- 2.8 RPS undertook the interpretation of the reconnaissance shallow seismic pinger data that was collected by GEMS on the survey lines discussed above. The output of this interpretation provided a view on sand and quaternary sediment thickness”.
- 2.9 The interpretation of the pinger data correlated well with GEMS” interpretation from the bathymetric data.

#### ETA Analysis of GEMS Survey Data

- 2.10 ETA is a submarine cable specialist commissioned to undertake the analysis of the interpreted GEMS bathymetry and shallow seismic pinger data as discussed above. ETA provided advice to Forewind on the implications of the various seabed conditions identified for cable installation, operation and maintenance. The analysis of the data therefore informed the corridor selection for the offshore export cables for the Dogger Bank Creyke Beck projects.
- 2.11 ETA advised Forewind to avoid the area identified by GEMS as having mobile sandwaves. Further, it was considered that the western survey lines may have insufficient sand depth above the bedrock to achieve appropriate burial depth. ETA advised that the majority of line ML4, the central line of the seven, appeared to provide a sufficient depth of sand for the burial of cables whilst not falling within the area of potentially mobile sandwaves (and hence reducing risk of operational cable exposure or sections of hanging cable).
- 2.12 Quaternary sediments were identified as being thickest in the south west of the survey area and are shown to have a thickness of between 5m to 10m.

#### Royal Haskoning Review of Desk-Based Consenting Considerations

- 2.13 Royal Haskoning undertook a desk-based review of the consenting considerations within the offshore cable study area, in order to highlight any consenting issues which may constrain the location of an export cable corridor within this area (Appendix 1).
- 2.14 The relevant known obtained was mapped in GIS to identify how the potential consenting constraint could influence cable corridor selection, within the offshore extent of the study area. The outputs of this exercise are presented in in greater

detail in Technical Note Offshore Cable Corridor Consent Considerations (Royal Haskoning, 2011).

## 3 Key Considerations for Corridor Identification Process

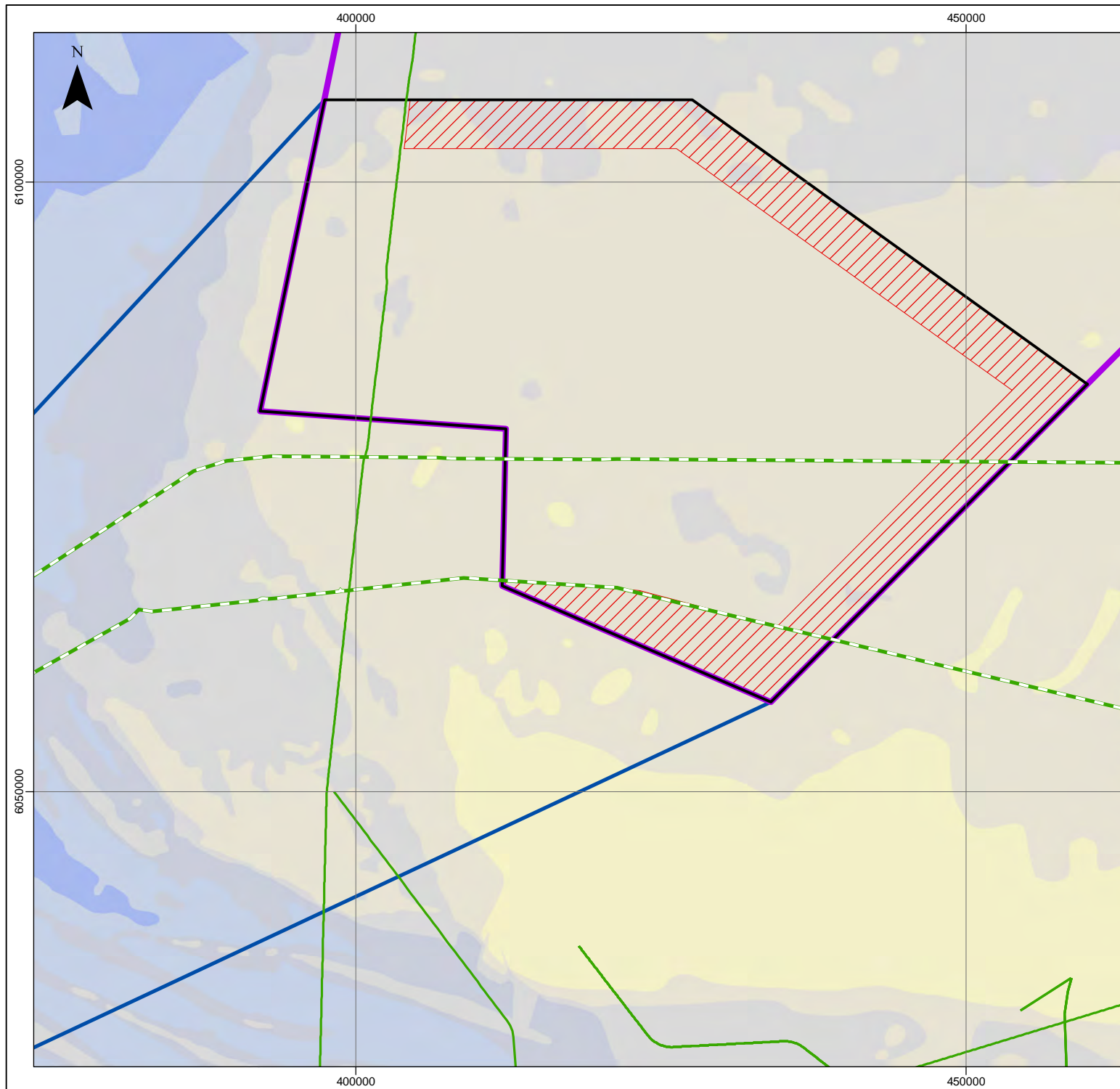
### Identification of Exit Points from Tranche A

- 3.1 Identification of the point of exit from Tranche A within the Zone for the offshore export cable corridor for the Dogger Bank Creyke Beck projects, is made challenging due to lack of certainty on the precise location of the offshore wind farm arrays within the Tranche at this stage in the development of the projects.
- 3.2 In their analysis, RPS concluded that the area immediately to the south and west of the Tranche boundary has been characterised as having large sandbanks and sand waves, some of which are no longer considered to be active, e.g. East Bank Ridges to the west of Dogger Bank. The sandbanks are locally underlain by firm to stiff clay, but mostly stiff to hard glacial clay and possible interbedded sand and stiff to hard clay. These formations have different strengths and densities.
- 3.3 This area was not part of the additional reconnaissance survey, and hence no further information was available further than desk-based information.
- 3.4 In order to determine suitable exit point(s) from the Zone to ensure minimal additional export cable length, without confirmation of the exact position of the Dogger Bank Creyke Beck projects, the following assumptions were made:
  - i. Up to four pairs of cables will be needed to exit from Tranche A for the Dogger Bank Creyke Beck projects.
  - ii. To minimise export cable lengths and optimise array cables within Tranche A, there are unlikely to be converter substations south of the southern-most telecommunications cable within Tranche A or within 4km from the edge of the Tranche on the north and east sides of Tranche A. These areas where it has been assumed the offshore converter stations would not be located are shown in Figure 3.1.
  - iii. It is assumed that two exit points from the Zone, with geophysical surveys completed for a 2km corridor up to the exit points, would be sufficient to reduce the additional export cable length for the Dogger Bank Creyke Beck projects.
  - iv. The determination of the exit points should try to minimise cable crossings if possible.

### Engineering

- 3.5 There are two key considerations for cable corridor route selection for the Dogger Bank Creyke Beck projects from an engineering perspective:





#### LEGEND

- Dogger Bank Round 3 Zone
- Tranche A Boundary
- Initial offshore cable study envelope
- Assumed area without converter substations
- Active Pipelines
- Active Cables

#### Bathymetry (relative to LAT)

- Deeper than 70m
- 60m to 70m
- 50m to 60m
- 40m to 50m
- 30m to 40m
- 20m to 30m
- 10m to 20m
- 0m to 10m



Data Sources:  
R3 Zones © TCE, 2010.  
Bathymetry © SeaZone Solutions Ltd, 2011  
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PROJECT TITLE **DOGGER BANK R3 DEVELOPMENT**  
**Export Cable Survey Route**

DRAWING TITLE  
**Figure 3.1**  
**Exit Point Identification**

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1	08/11/2011	First Issue	PR	KG-C	GL

DRAWING NUMBER: **M-DES-0025-01**

SCALE	1:450,000	PLOT SIZE	A4	DATUM	WGS84	PROJECTION	UTM31N
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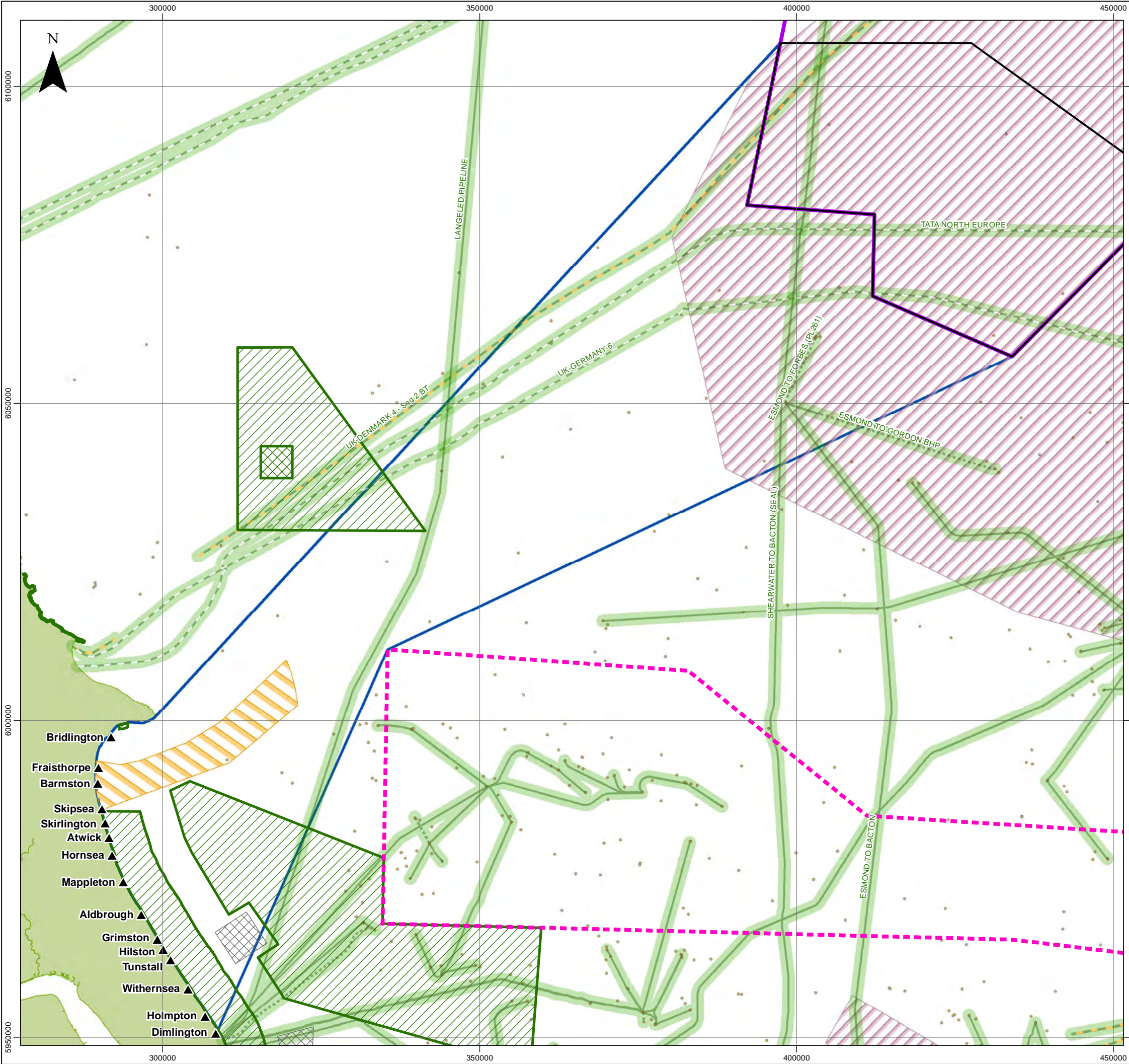
- the ability to bury the cable to an appropriate depth in order to protect it during the operational phase from anchors and trawlers; and
  - the requirement for access to it for maintenance and repairs as necessary.
- 3.6 In particular, when considering cable burial, the sediment conditions and depth are both important.
- 3.7 As explained above, there are some areas of the offshore cable scoping envelope which ETA has advised that cable burial and maintenance at burial depth might not be achieved.
- 3.8 Quaternary sediment has been identified in the south-western section of the offshore cable scoping envelope for the Dogger Bank Creyke Beck projects. The pinger data does not provide an indication of the hardness of the quaternary sediment, and therefore the trenching conditions within this quaternary sediment are currently unknown.

## Consenting

- 3.9 The supporting Technical Note (Royal Haskoning, 2011) provides detail on the consenting considerations within the offshore cable scoping envelope that are relevant to the identification of an offshore cable corridor. In summary, it is considered that the following consenting parameters have the potential to influence corridor selection:
- Seabed topography, sediments and features;
  - Nature Conservation Designations;
  - Other Human Activity; and
  - Archaeology (wrecks and archaeological obstructions).
- 3.10 In particular was advised that the Recommended Marine Conservation Zones (rMCZs) and the area that has been interpreted as “near surface bedrock” by RPS, that share a degree of spatial overlap, and lie in the northern part of the western-most extent of the study area, were avoided (Figure 3.2).
- 3.11 The broad recommendations for potential corridors based on the consenting parameters alone are shown in Figure 3.2 and are considered to comprise:
- Option 1:** Exit from the Tranche to the north of TATA North Europe cable with crossing of both this cable and the UK-Germany 6 cable outside of the proposed Special Area of Conservation (pSAC);
- Option 2:** Exit from the Tranche between the TATA North Europe cable and UK-Germany 6 cable, with a crossing of the latter outside of the pSAC;
- Option 3:** Exit from the Tranche between the TATA North Europe cable and UK-Germany 6 cable, with a crossing of the latter inside of the pSAC; and
- Option 4:** Exit from the Tranche to the south of both cables.

- 3.12 All Options presented are considered viable from a consenting perspective. It is, however, considered that Option 1 has the least consenting concerns, with Option 2 considered the next most preferable Option from a consenting perspective.





**LEGEND**

- Dogger Bank Round 3 Zone
- Tranche A Boundary
- Initial offshore cable study envelope
- Hornsea Round 3 Zone
- Indicative Nearshore Cable Corridor Search Envelope Corresponding with the refined landfall between Skipsea and Fraisthorpe
- Reference Area (RA)
- Recommended Marine Conservation Zones
- Dogger Bank cSAC
- Round 2 Offshore Windfarm
- Well - 200m buffer
- Not In Use Pipelines
- Active Pipelines
- Out of Service Cable
- Active Cable
- 1km Buffer either side of Cable or Pipeline

Data Sources:  
R3 Zones © TCE, 2010  
Cables © Kingfisher, 2010  
Oil & Gas © UKDeal, 2010  
Bathymetry, Wrecks & Obstructions © SeaZone Solutions Ltd, 2011 [022010.005]  
Ordnance Survey © Crown copyright and database right, 2011

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Kilometres

PROJECT TITLE ***DOGGER BANK R3 DEVELOPMENT***  
**Export Cable Survey Route**

DRAWING TITLE **Figure 3.2**  
**Export Cable Corridor Consents Constraints and Consent-based Route Suggestions**

VER	DATE	REMARKS	Drawn	Checked	Approved
1	14/11/2011	First Issue	PR	KG-C	GL

DRAWING NUMBER: **M-DES-0033-01**

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## 4 Corridor selection

### Introduction

- 4.1 Having identified the relevant development considerations, Forewind undertook staged process to select a final export cable corridor. This process comprised:
- Step 1 – Identification of Hard constraints
  - Step 2 – Identification of seabed characteristics
  - Step 3 – Identification of exit points from Tranche A
  - Step 4 – Precise cable corridor identification
  - Step 5 – Route Optimisation
- 4.2 These steps are described below.

### Detailed corridor selection

#### STEP ONE: Identification of hard and soft constraints

- 4.3 The identification of hard and soft constraints was the first stage in the identification of an offshore cable corridor. The buffers applied to the constraints below were discussed in the workshop, and based upon the experience and knowledge of the attendees. The buffers are shown in Figure 4.1.

Constraint	Buffer
Telecommunication cables	250m definite no-go for cabling in parallel (not applicable for crossings)
Pipelines	500m definite no-go for cabling in parallel (not applicable for crossings)
Oil and gas wells (plugged and abandoned)	200m buffer during geophysical survey based on Statoil good practice
Wrecks	Owing to the lack of positional accuracy for some of the wrecks within the SeaZone data, a temporary buffer of 500m was applied for the purposes of identifying a route, although this was revisited on a wreck by wreck basis during detailed small scale routing.



**Table 4.1 Establishment of constraint buffers for the purpose of route identification**

**STEP TWO: Identification of seabed characteristics**

- 4.4 The second phase was the identification of areas within the cable corridor scoping envelope that are no-go and less preferred areas for cabling based on existing knowledge of the areas. One of the critical elements that enabled the identification of these areas was the bathymetry and shallow seismic pinger reconnaissance data that was collected on the within the offshore cable scoping envelope. Figure 4.2 shows the sand depths derived from the reconnaissance data.
- 4.5 Four areas of greater constraint within the offshore cable scoping envelope (A-D) are described in Table 4.2. Figure 4.3 show the locations of these four areas.

		Source	Status of zone
Area A	Identified as less favourable for cabling owing to shallow depths of sand above bedrock.	Advised by ETA – based upon analysis of GEMS pinger data interpreted by RPS.	Avoid
Area B	Contains some sand waves and similar bedforms of varying size.	Advised by ETA – based upon analysis of GEMS bathymetry and pinger data interpreted by GEMS and RPS.	Probably preferable to avoid, but could be considered for cabling if needed.
Area C	Contains large sand waves that could be active. Maintenance of cable burial depths would most likely not be possible.	Advised by ETA – based upon analysis of GEMS bathymetry and pinger data interpreted by GEMS and	Avoid

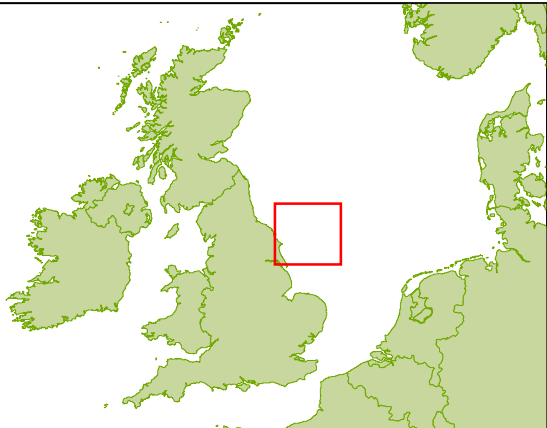
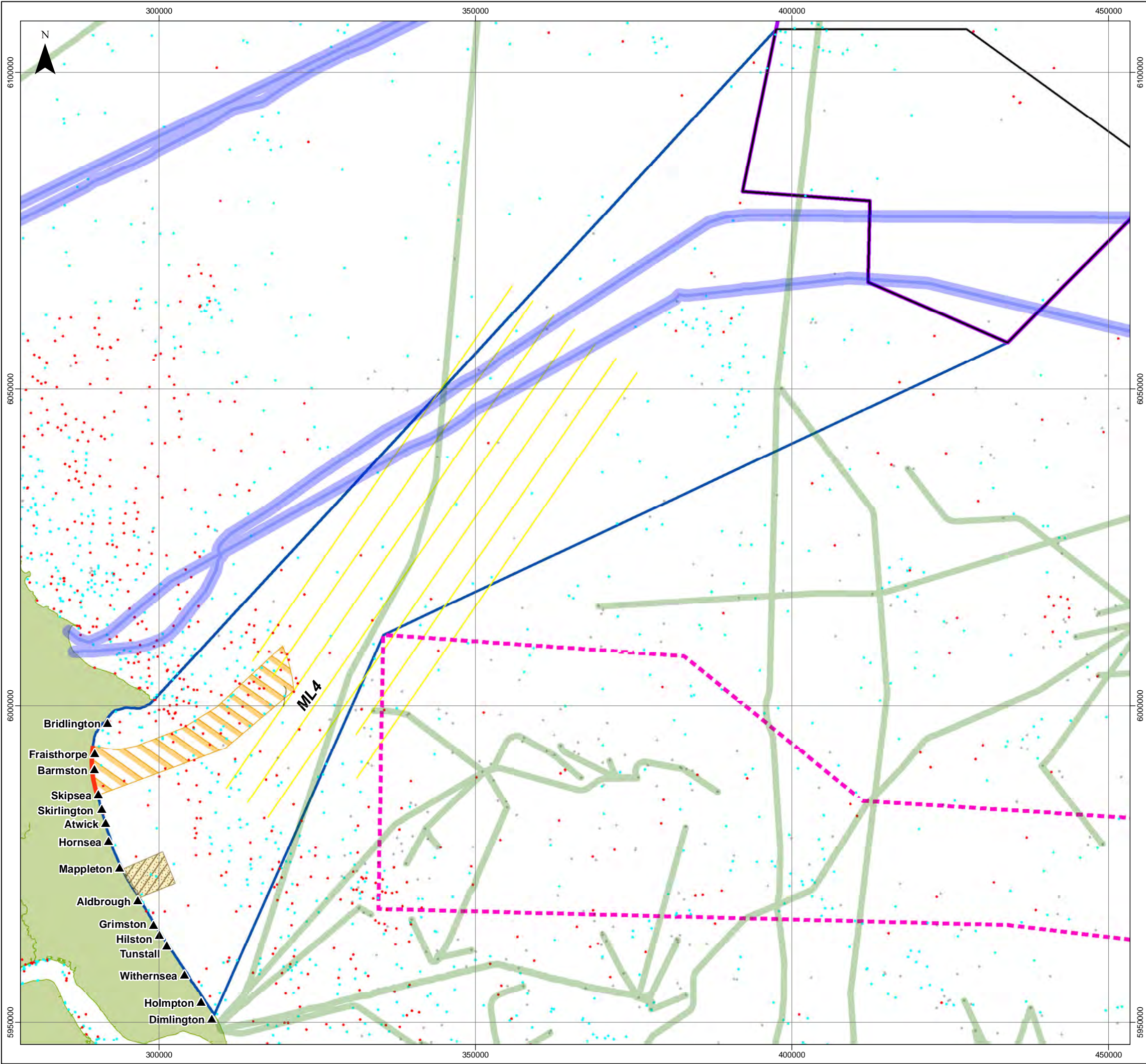
		RPS.	
Area D	Area in the southern part of Tranche A considered an unlikely location for a converter station due to the limited space for turbines in this region hence the lower part of this boundary was ruled out for potential exit points. The area to the south west of this part of the Zone boundary contains a high density of wrecks, is a potential area of aggregates activity and contains a significant amount of active and inactive oil and gas infrastructure. Furthermore, no reconnaissance data has been collected and given its proximity to known sand waves to the south, seabed conditions are considered to represent a risk.	Forewind consideration	Probably preferable to avoid, but could be considered for cabling if needed.

**Table 4.2 Establishment of no-go and less favourable zones within the envelope for purposes of route identification**

**STEP THREE: Identification of Exit Points from Tranche A**

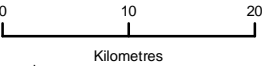
- 4.6 As set out in above, the location of the arrays of wind turbines and the offshore converter stations for the Dogger Bank Creyke Beck projects within Tranche A has not yet been identified.
- 4.7 Following the assumptions for exit point identification set in section 2 above, two exit points have been selected from Tranche A. Firstly one from the vertical edge of Tranche A between the two existing telecommunication cables, and a second to the west of the operational pipeline.
- 4.8 Due to the uncertainties associated with the precise location of the exit points, a cone at the end of the cable corridor that is adjacent to the edge of Tranche A would provide flexibility on converter station and export cable routing. Therefore a small survey cone has been for the most eastern of the two exit points between to two telecommunications cable to allow flexibility and avoid unnecessary additional cabling and this is shown in Figure 4.4.
- 4.9 As a result, two exit points were identified and agreed upon, as shown in Figure 4.4.





- LEGEND**
- Dogger Bank Round 3 Zone
  - Tranche A Boundary
  - Initial offshore cable study envelope
  - Hornsea Round 3 Zone
  - Refined Landfall Search Area
  - Indicative Nearshore Cable Corridor Search Envelope Corresponding with the Refined Landfall between Skipsea and Fraisthorpe
  - GEMS Reconnaissance Survey Lines
  - Foul Ground
  - 500m Active Pipeline Buffer
  - 250m Active Cable Buffer
  - 1km Active Cable Buffer
  - 200m radius around Wrecks where position known
  - 200m radius around Wrecks where position estimated
  - 200m radius around Wells

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Cables © KISCA, 2010.  
Oil & Gas Wells and Pipelines © UKDeal 2010



PROJECT TITLE **DOGGER BANK R3 DEVELOPMENT**  
**Export Cable Survey Route**

DRAWING TITLE  
**Figure 4.1**  
**Constraint Buffers and Route Defining Constraints**

VER	DATE	REMARKS	Drawn	Checked	Approved
1	08/11/2011	First Issue	PR	KG-C	GL

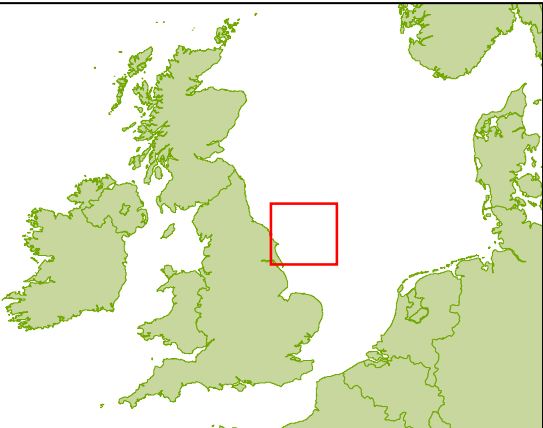
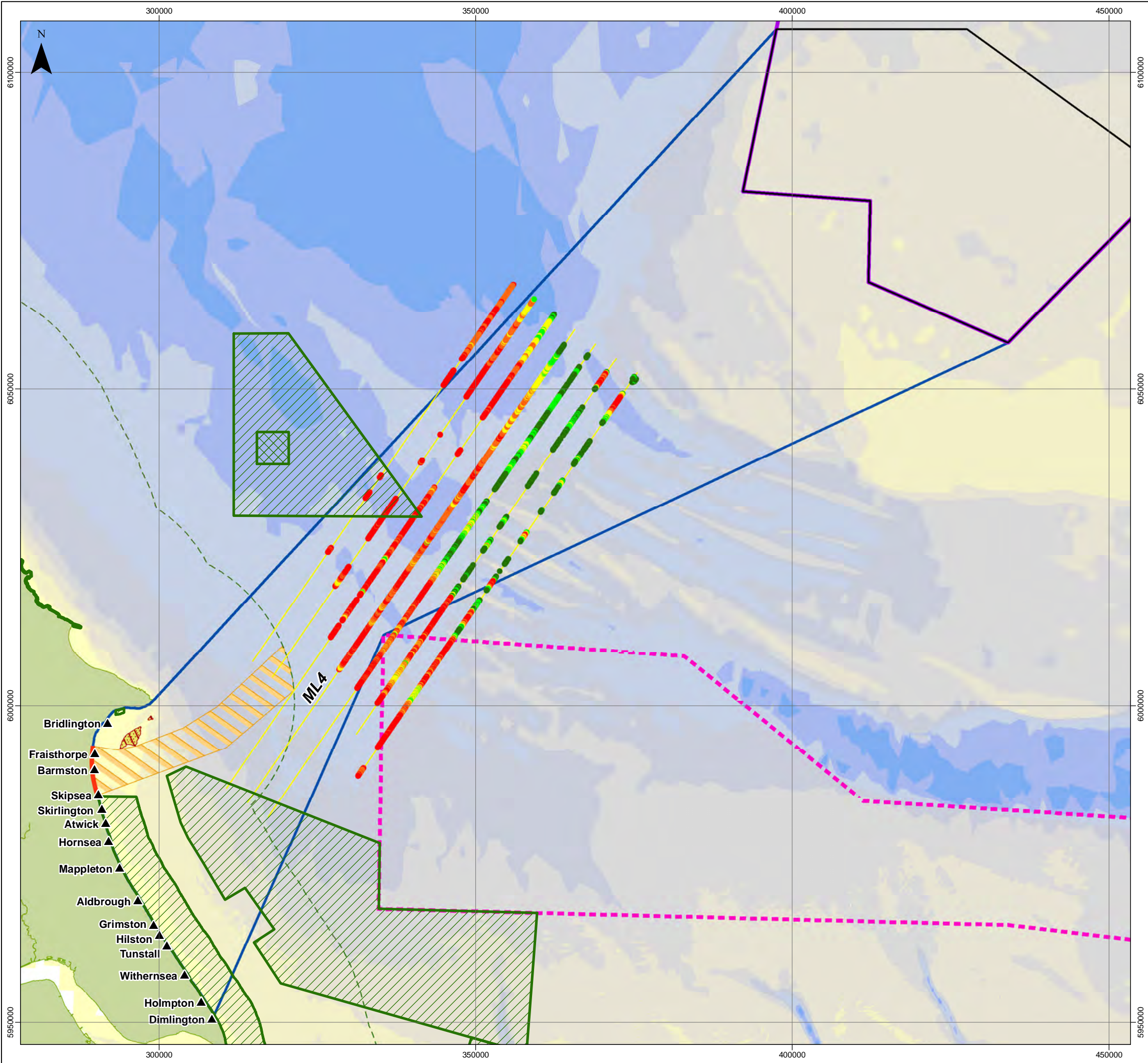
DRAWING NUMBER: **M-DES-0028-01**

SCALE 1:600,000 PLOT SIZE A3 DATUM WGS84 PROJECTION UTM31N

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**LEGEND**

- Dogger Bank Round 3 Zone
- Tranche A Boundary
- Offshore Cable Scoping Envelope
- Hornsea Round 3 Zone
- 12nm Territorial Boundary
- Refined Landfall Search Area
- Indicative Nearshore Cable Corridor Search Envelope Corresponding with the refined landfall between Skipsea and Fraisthorpe
- GEMS Reconnaissance Survey Lines
- Smithic Sandbank

**Bathymetry (relative to LAT)**

- Deeper than 70m
- 60m to 70m
- 50m to 60m
- 40m to 50m
- 30m to 40m
- 20m to 30m
- 10m to 20m
- 0m to 10m

**RA & rMCZ areas**

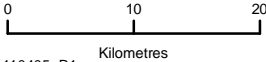
- Reference Area
- Recommended Marine Conservation Zones

**Sand Thickness (m below seabed)**

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10

(RPS Energy 2011)

Data Sources:  
R3 Zones © TCE, 2010.  
Sandbanks © SeaZone Solutions Limited, 2011 [022010.005]  
MCZ areas from NetGain  
Sand Thickness from RPS Energy drawing: Thickness\_Surfaces\_dd\_110405\_R1  
Bathymetry © SeaZone Solutions Ltd, 2011. [022010.005]



**PROJECT TITLE** *DOGGER BANK R3 DEVELOPMENT*  
**Export Cable Survey Route**

**DRAWING TITLE**  
**Figure 4.2**  
**Routing Considerations**

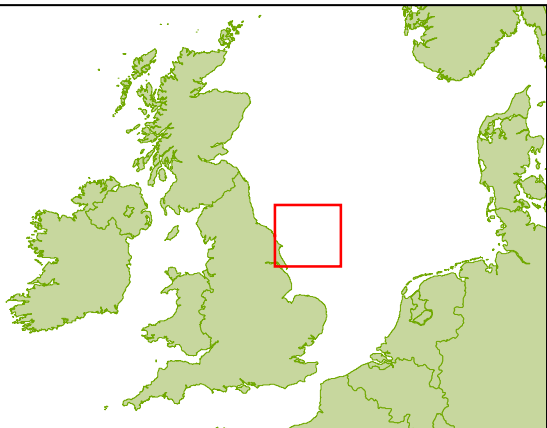
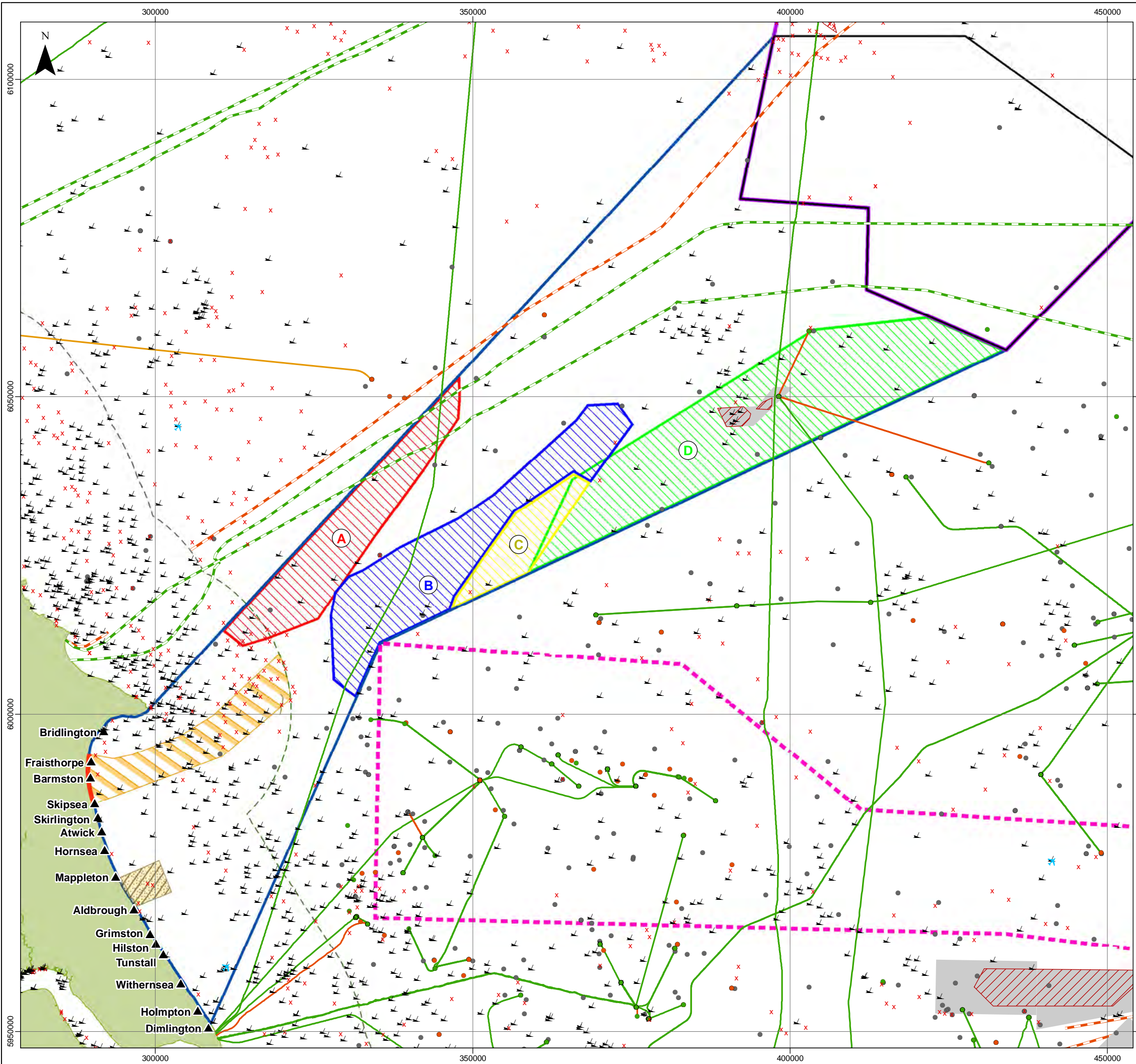
VER	DATE	REMARKS	Drawn	Checked	Approved
1	15/11/2011	First Issue	PR	KG-C	GL

**DRAWING NUMBER:** **M-DES-0026-01**

SCALE	1:600,000	PLOT SIZE	A3	DATUM	WGS84	PROJECTION	UTM31N
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**LEGEND**

- Dogger Bank Round 3 Zone
- Tranche A Boundary
- Initial offshore cable study envelope
- Hornsea Round 3 Zone
- Refined Landfall Search Area
- Indicative Nearshore Cable Corridor Search Envelope Corresponding with the Refined Landfall between Skipsea and Fraisthorpe
- 12nm Territorial Boundary

**Less Favourable Cable Routing Areas**

- A
- B
- C
- D

**Aggregate Areas**

- Application Area
- Prospecting Area

**Pipelines**

- Active
- Not In Use
- Under Construction

**Wrecks & Obstructions**

- Aircraft Wreck
- Obstruction
- Wreck
- Foul Ground

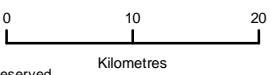
**Cables**

- Active
- Out of Service

**Oil & Gas Wells**

- Active
- Suspended
- Abandoned
- Status Unknown

Data Sources:  
R3 Zones © TCE, 2010.  
Aggregate Areas © TCE, 2010  
Obstructions © SeaZoneSolutions Limited, 2011 [022010.005]  
Wreck data from UKHO © British Crown Copyright, 2011. All rights reserved  
Cables © KISCA, 2010.  
Oil & Gas Wells and Pipelines © UKDeal 2010



PROJECT TITLE **DOGGER BANK R3 DEVELOPMENT**  
**Export Cable Survey Route**

DRAWING TITLE **Figure 4.3**  
**Key Cable Routing Considerations**

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1	10/11/2011	First Issue	PR	KG-C	GL

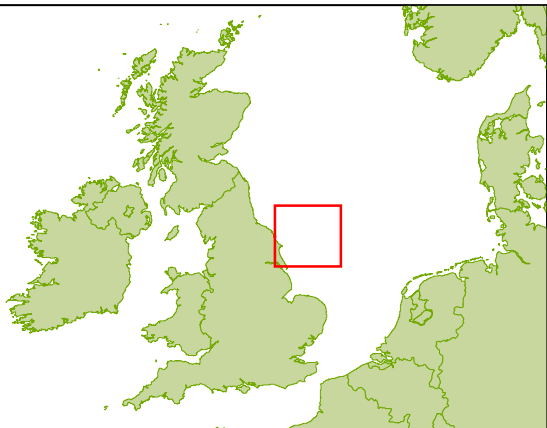
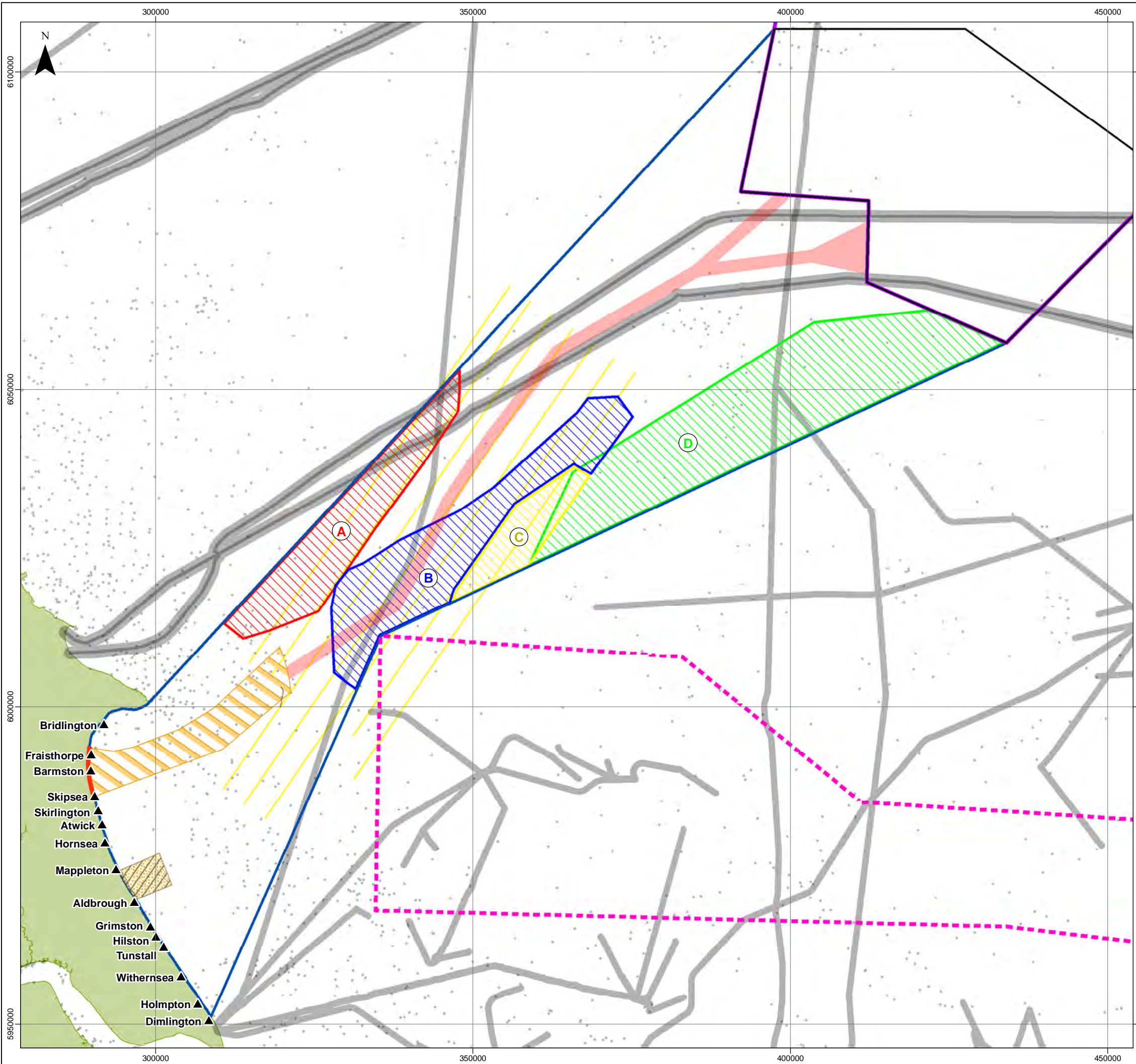
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SCALE	1:600,000	PLOT SIZE	A3	DATUM	WGS84	PROJECTION	UTM31N
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**LEGEND**

- Dogger Bank Round 3 Zone
- Tranche A Boundary
- Initial offshore cable study envelope
- Hornsea Round 3 Zone
- Refined Landfall Search Area
- Indicative Nearshore Cable Corridor Search Envelope Corresponding with the Refined Landfall between Skipsea and Fraisthorpe
- GEMS Reconnaissance Survey Lines
- Offshore Cable Corridor for Geophysical Survey

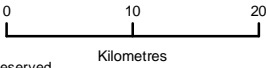
**Less Favourable Cable Routing Areas**

- A
- B
- C
- D

Areas shown as grey represent:

- 500m either side of active pipelines
- 250m and 1km either side of active cables
- 200m radius around wrecks
- 200m radius around wells

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Obstructions © SeaZoneSolutions Limited, 2011 [022010.005]  
Wreck data from UKHO © British Crown Copyright, 2011. All rights reserved  
Cables © KISCA, 2010.  
Oil & Gas Wells and Pipelines © UKDeal 2010



PROJECT TITLE **DOGGER BANK R3 DEVELOPMENT**  
**Export Cable Survey Route**

DRAWING TITLE **Figure 4.4**  
**Offshore Cable Corridor In Relation To Constraints**

VER	DATE	REMARKS	Drawn	Checked	Approved
1	14/11/2011	First Issue	PR	KG-C	GL

DRAWING NUMBER: **M-DES-0034-01**

SCALE	1:600,000	PLOT SIZE	A3	DATUM	WGS84	PROJECTION	UTM31N
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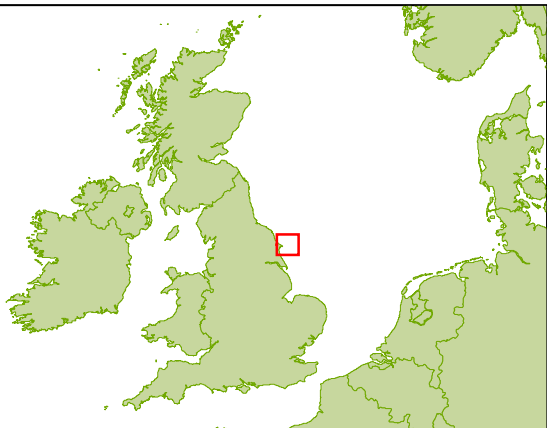
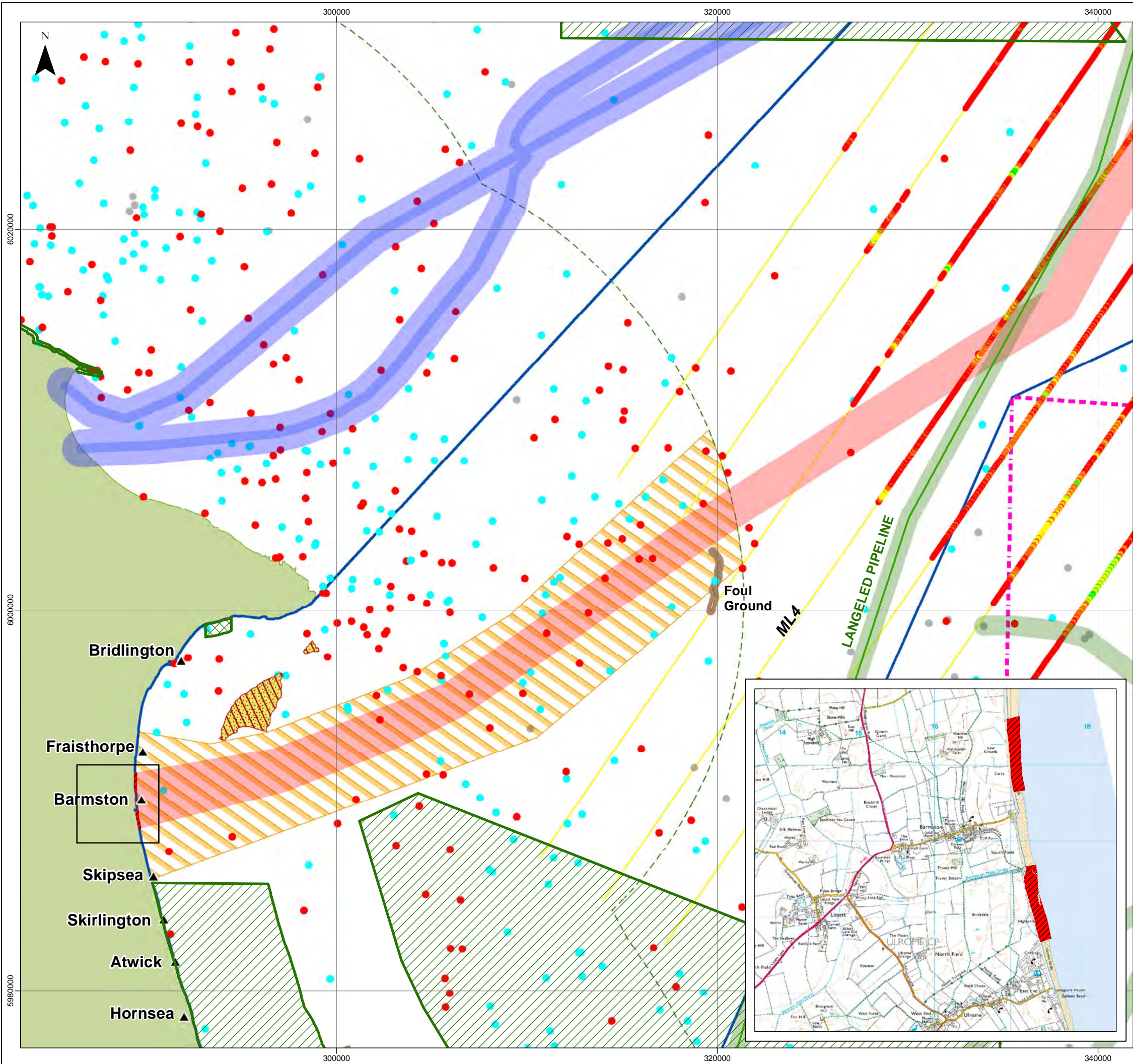
**STEP FOUR: Precise cable corridor identification**

- 4.10 Following analysis of existing data, a decision was made to avoid the cluster of wrecks immediately to the south of the southern telecommunications cable (where it angles towards the shore) shown in Figure 4.3, owing to the higher risk of identifying currently unknown wrecks in the area and the higher risk of identifying local features which could have caused the shipwrecks and hence may represent a constraint.
- 4.11 Given the risks within Area D (set out in Table 4.2 above and mapped in Figure 4.3), and the concentration of wrecks in the area north east of the extent of the reconnaissance data, the workshop opted for a cable corridor between the two existing telecommunications cables (Figure 4.4).
- 4.12 ETA recommended following the line of ML4, the middle survey line from GEMS" reconnaissance survey (see Figure 5.2). This was selected as the sand coverage appears to be thick enough to allow appropriate burial depths within sand, but is away from the mobile sand waves. Furthermore, the Langeled pipeline partially follows this route. Following the lines with known sand thickness and the route of an existing pipeline minimises risk of finding unfavourable conditions in any geophysical survey.
- 4.13 Towards the southern end of the corridor, near to the north-western corner of the Hornsea offshore wind farm zone, it angles across the Langeled pipeline in order to cross the pipeline at an angle of between 30° and 90°.
- 4.14 At the point on line ML4 where the data shows that the sand coverage appears to stop, the corridor meets the indicative nearshore cable corridor search envelope that corresponds with the refined landfall between Skipsea and Fraisthorpe that has been identified as part of the landfall selection exercise.

**STEP 5: Route Optimisation**

- 4.15 Route optimisation was undertaken following detailed interrogation of the wrecks data establish certainty around locations of the wrecks in close proximity to the route.
- 4.16 In addition, Forewind"s landfall selection exercise narrowed down the landfall selection to two specific stretches of the Holderness coast, to the north and south of the village of Barmston. These are shown in detail in Figure 4.5.
- 4.17 Figure 4.5 shows a zoomed in section of the nearshore route. As noted previously, the recommendation at the workshop was to follow reconnaissance line ML4 as far as possible due to the sand thickness and hence comparative ease of cabling. However, in order to avoid the foul ground (see Figure 4.5) and seeking the most direct route to the landfall, the corridor leaves the ML4 survey line immediately after crossing the Langeled pipeline.
- 4.18 The final routing into the two refined landfall locations are takes account of the Smithic Sandbank and the known and estimated locations of wrecks.





**LEGEND**

- Initial offshore cable study envelope
- Hornsea Round 3 Zone
- Refined Landfall Areas
- Offshore Cable Corridor for Geophysical Survey
- Indicative Nearshore Cable Corridor Search Envelope Corresponding with the Refined Landfall between Skipsea and Fraisthorpe
- GEMS Reconnaissance Survey Lines
- 12nm Territorial Boundary
- Foul Ground (with 200m buffer applied for clarity)
- Smithic Sandbank
- 500m Active Pipeline Buffer
- 250m Active Cable Buffer
- 1km Active Cable Buffer
- Reference Area (RA)
- Recommended Marine Conservation Zones
- 200m radius around Wrecks where position known
- 200m radius around Wrecks where position estimated
- 200m radius around Wells

**Sand Thickness (m below seabed) (RPS Energy 2011)**

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10

Data Sources:  
R3 Zones © TCE, 2010.  
Obstructions © SeaZoneSolutions Limited, 2011 [022010.005]  
Wreck data from UKHO © British Crown Copyright, 2011. All rights reserved  
Cables © KISCA, 2010.  
Oil & Gas Wells and Pipelines © UKDeal 2010  
Sandbanks © SeaZoneSolutions Limited, 2011 [022010.005]  
Ordnance Survey 1:25k data © Crown copyright, All rights reserved. 2011 Licence number 0100031673

PROJECT TITLE **DOGGER BANK R3 DEVELOPMENT**  
**Export Cable Survey Route**

DRAWING TITLE **Figure 4.5**  
**Nearshore Cable Corridor Routing**

VER	DATE	REMARKS	Drawn	Checked	Approved
1	10/11/2011	First Issue	PR	KG-C	GL

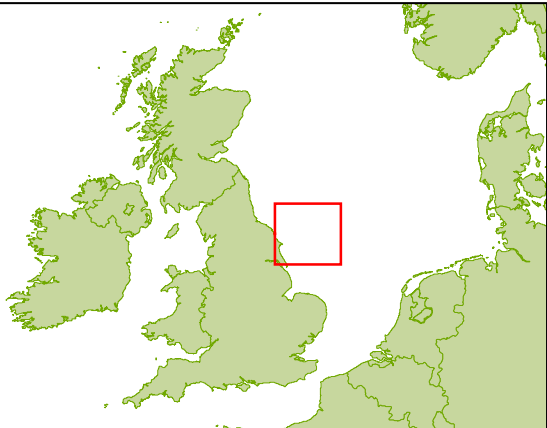
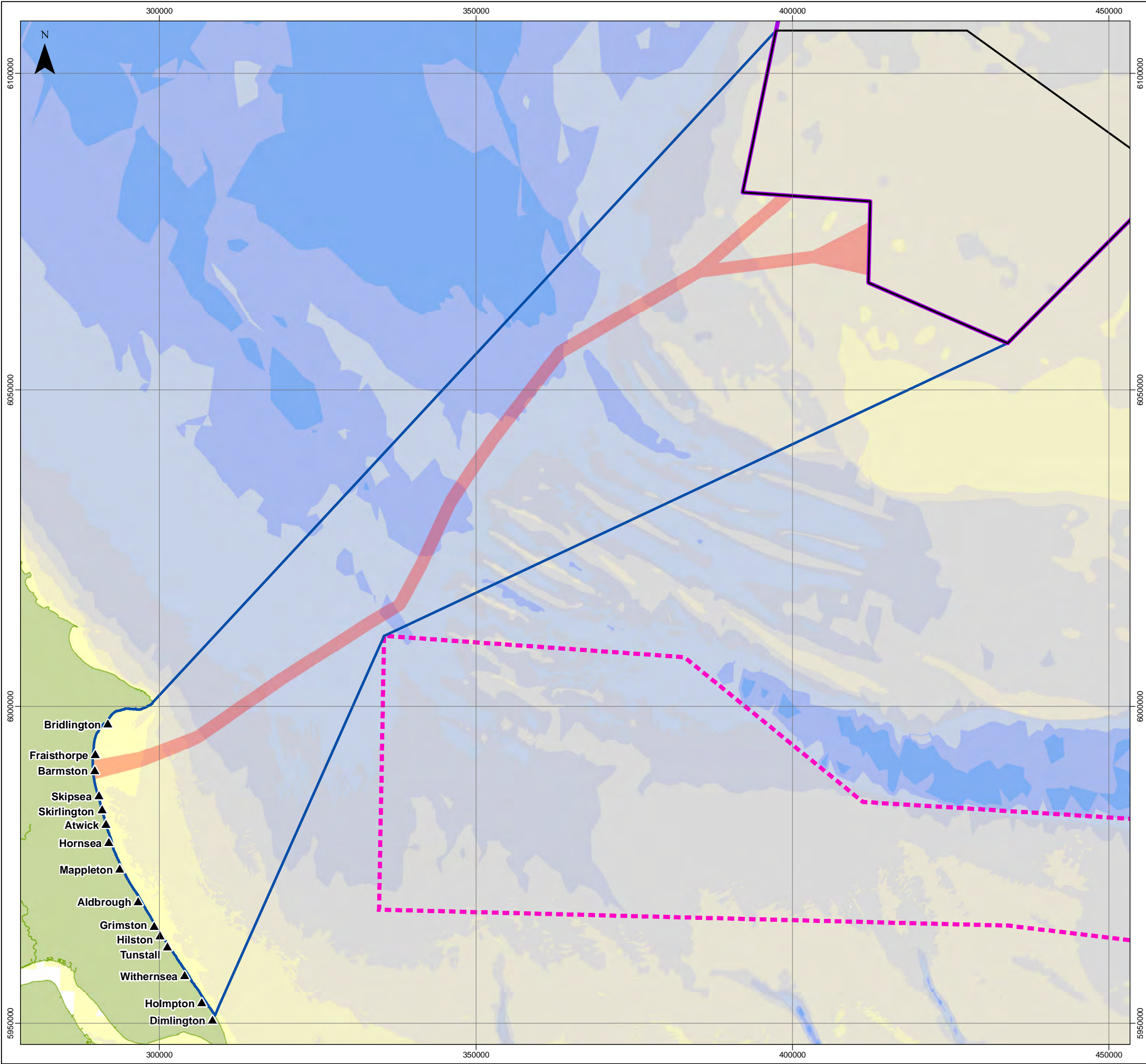
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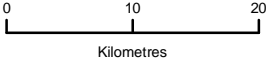
## 5 Conclusion

- 5.1 The selected offshore export cable corridor for the Dogger Bank Creyke Beck projects is shown in Figure 5.1
- 5.2 The corridor selection has utilised both desk-based and specific survey data in order to identify an appropriate corridor and relied upon the expertise of technical experts.
- 5.3 It is considered, that the 2km corridor is broad enough to locate the cables required for the Dogger Bank Creyke Beck development and maintain flexibility to microsite around objects identified following further survey work.



- LEGEND**
- Dogger Bank Round 3 Zone
  - Tranche A Boundary
  - Initial offshore cable study envelope
  - Hornsea Round 3 Zone
  - Offshore Cable Corridor for Geophysical Survey

Data Sources:  
R3 Zones © TCE, 2010.  
Bathymetry © SeaZone Solutions Ltd, 2011 [022010.005]  
Ordnance Survey © Crown copyright and database right, 2011



PROJECT TITLE ***DOGGER BANK R3 DEVELOPMENT***  
**Export Cable Survey Route**

DRAWING TITLE  
**Figure 5.1**  
**Final Offshore Cable Corridor**

VER	DATE	REMARKS	Drawn	Checked	Approved
1	11/11/2011	First Issue	PR	KG-C	GL

DRAWING NUMBER: **M-DES-0031-01**

SCALE	1:600,000	PLOT SIZE	A3	DATUM	WGS84	PROJECTION	UTM31N
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## Appendix 1

Royal Haskoning (2011) Technical note on cable corridor characteristics

# **Dogger Bank Project One**

## Offshore Envelope Characterisation

April 2011  
Final Report





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Drafted by Peter Gaches  
Checked by Rob Staniland  
Date/initials check RS 13.11.2011  
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Date/initials approval KGC 14.11.2011



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## 1 PROJECT ONE: OFFSHORE ENVELOPE CHARACTERISATION

### 1.1 Introduction

- 1.1.1 Forewind have commissioned Royal Haskoning to assist in the identification of a 2km wide export cable corridor (for Project One) from the chosen landfall on the Holderness coast out to the exit point of Tranche A.
- 1.1.2 The purpose of this document is therefore, to identify consenting considerations that may have a material bearing on route selection, and subsequently based on the outcome of this process to identify potential 2km wide cable corridor/s from the exist point of Tranche A to align with the recommended route in the inshore study area.
- 1.1.3 **Table 1** provides an overview of the relevance that each parameter (as considered within the consenting process) may have on the Project One offshore export cable corridor identification process. The study area for the offshore export cable corridor is defined by the Scoping envelope (Forewind, 2010), Tranche A boundary and the limit of the inshore export cable corridor assessment (Forewind 2011).

**Table 1 Consenting parameter consideration for offshore export cable corridor**

Consenting Parameter	Consenting detail / risk	Considered in offshore corridor identification
Seabed topography, sediments / features	Certain ground conditions may dictate less desirable installation techniques (from a consenting perspective) and or cable protection measures such as rock placement / mattresses Certain topographic features (such as sandwaves) may require pre-sweeping	Yes (RPS work and GIS constraint mapping)
Nature Conservation Designations	Designated sites within cable corridor could lead to extra consenting effort or worst case, to installation technique or timing restrictions	Yes (GIS constraint mapping)
Sediment & Water Quality	Designated bathing areas, and or designated shellfish waters could be affected by increased suspended sediments and or contaminants	No, no such features identified within the study area
Ornithology	Presence of Special Protection Areas (SPAs) or known localised areas of key importance could require detailed consideration of potential effects	No, no such features identified within the study area (see ZoC document)
Marine Ecology	Species / features of conservation importance would require avoidance by the export cable corridor	No, no such features identified from broadscale datasets (see ZoC document). Detailed information is reliant on site survey data
Fish & shellfish resource	Demersal fish spawning grounds, such as herring, could require avoidance (during installation) in either time or space depending on their nature	Yes, (GIS constraint mapping) although site survey will provide more



Consenting Parameter	Consenting detail / risk	Considered in offshore corridor identification
		accurate information
Marine Mammals	Not envisaged a significant consenting concern from cable installation perspective	No, marine mammals occur across such broad geographic scales that they cannot have a bearing on corridor selection within the study area
Commercial Fisheries	Key grounds, especially any static fishing grounds, could be subject to disturbance by geophysical surveys and construction activity, especially if the grounds are localised and discrete in nature	Yes (GIS constraint mapping)
Shipping & Navigation	Key vessel traffic movements through / across the cable corridor would be subject to temporary disturbance during cable installation	Yes (GIS constraint mapping), but shipping routes pass through the whole study area (NW to SE) and therefore, cannot have a bearing on corridor selection (see ZoC document)
Military & Civil Aviation	Ministry of Defence (MOD) and Civil radar will not be affected by cable installation works and therefore, has no potential to influence corridor selection.  MOD practice and exercise areas (PEXA's) cross the entire study area and comprise naval and air force use. Neither of these will have influence on corridor selection as they will not be affected by the construction works.	No
Other Human Activities	Any overlap of the Project One corridor with the following would require careful consideration with regard to potential impact on the operation and or infrastructure, and may require avoidance: - Subsea cables - Oil and Gas (wells & platforms) - Pipelines - Dredging and disposal sites - Aggregate extraction areas	Yes (GIS constraint mapping)
Archaeology	Presence of the following would require avoidance: - Wrecks - Other archaeological features / records	Yes (where information available from SeaZone data). Site specific survey information will provided further detail
Seascape & Landscape	The temporary offshore works are unlikely to be visible from shore. Should on occasion the works be visible, then this will be the case for which ever route is chosen. Therefore this parameter will have no potential to influence corridor selection.	No
Socio-Economics	Choice of cable corridor within the study area will not have a material bearing on the socio-economics outside of short term impacts on the	No





Consenting Parameter	Consenting detail / risk	Considered in offshore corridor identification
	commercial fishing industry	

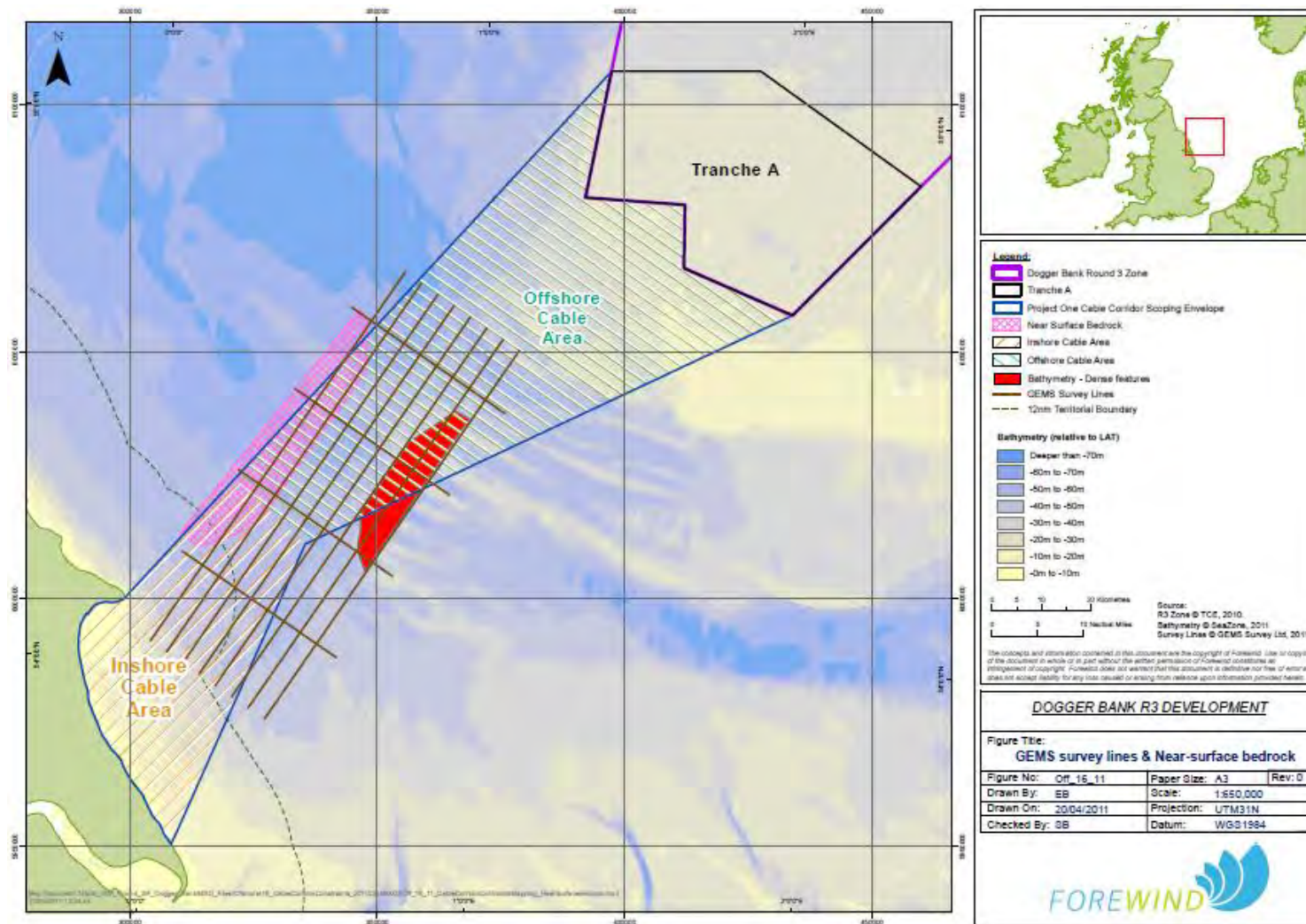
1.1.4 Based on the assumptions made in **Table 1**, those components that require further consideration therefore, comprise:

- Seabed topography, sediments and features;
- Nature Conservation Designations;
- Fish & Shellfish Resource;
- Commercial Fisheries;
- Other Human Activity; and
- Archaeology.

1.1.5 These are detailed in **Figures 1 to 7**.

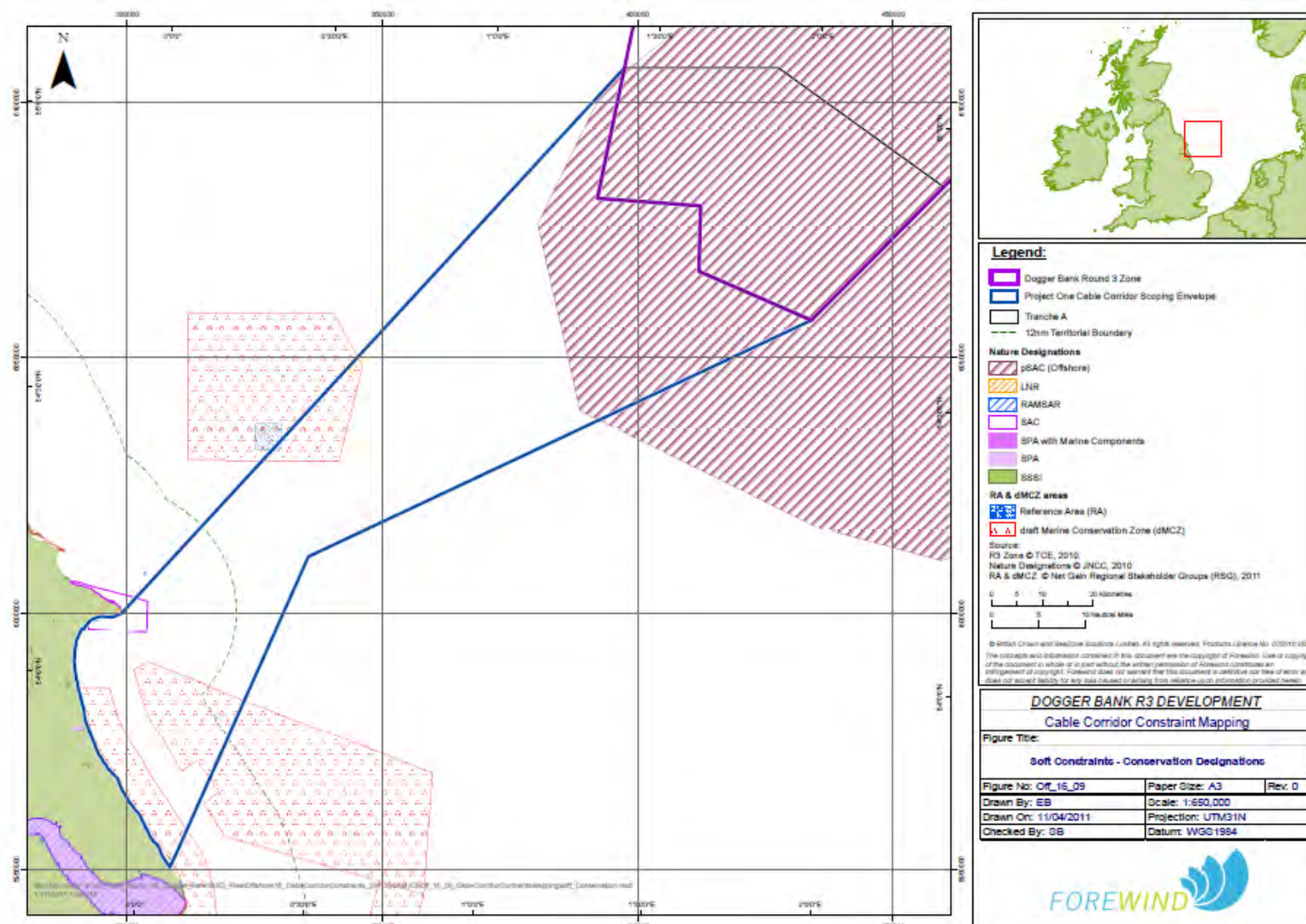


**Figure 1 Survey lines and nearshore bedrock**





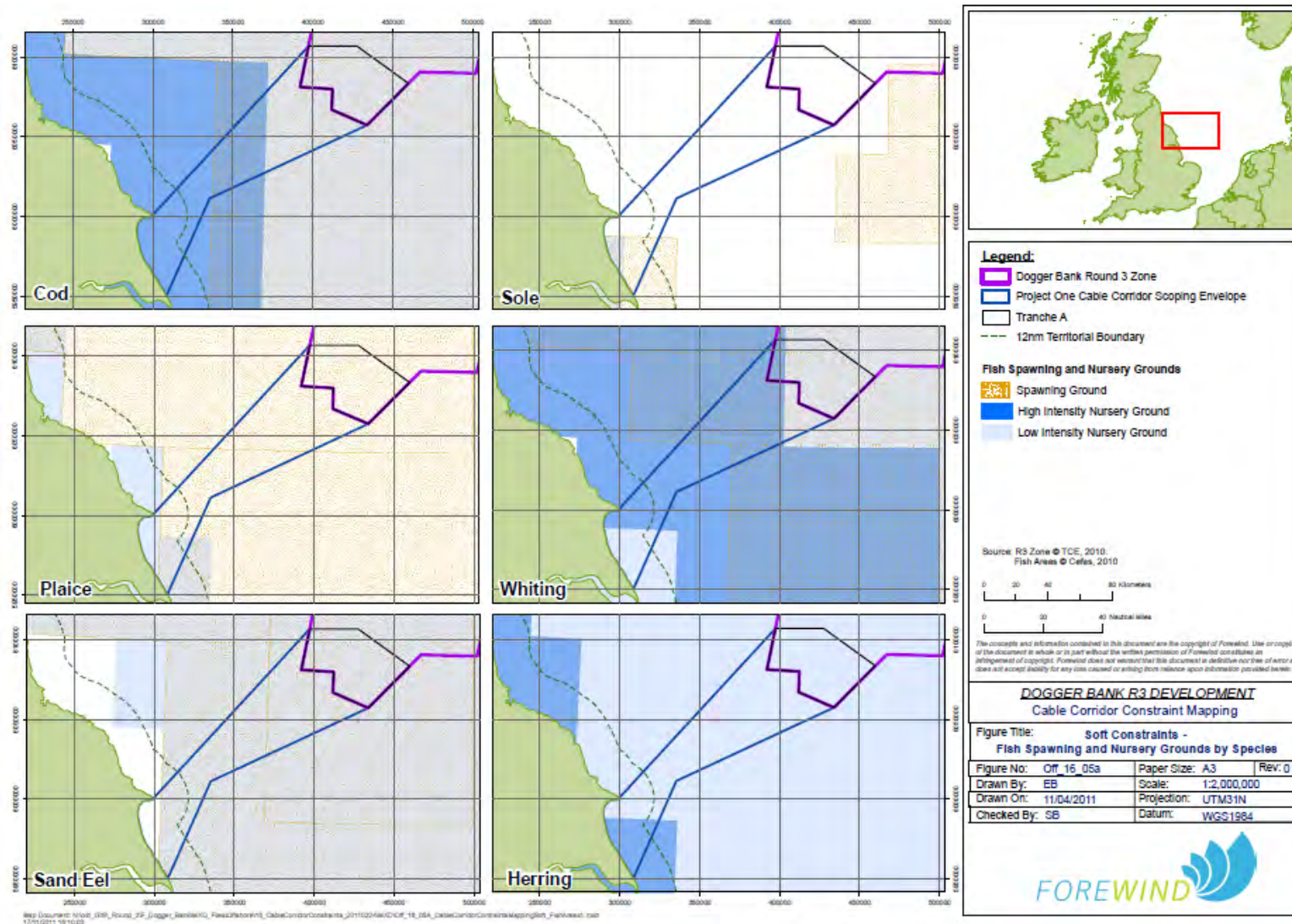
**Figure 2 Soft constraints – Conservation Designations**





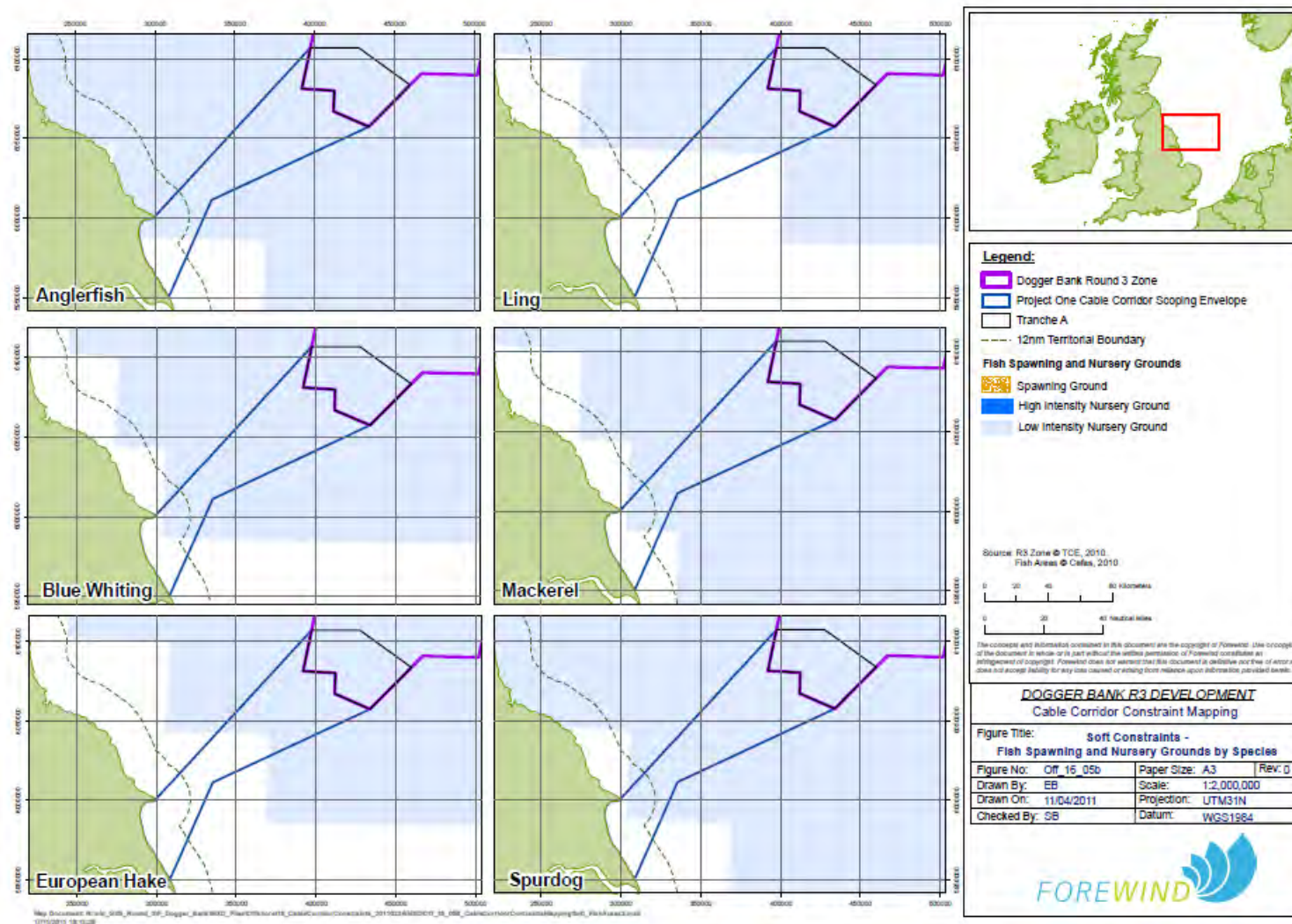


**Figure 3 Soft constraints – Fish spawning and nursery grounds by species - 1**





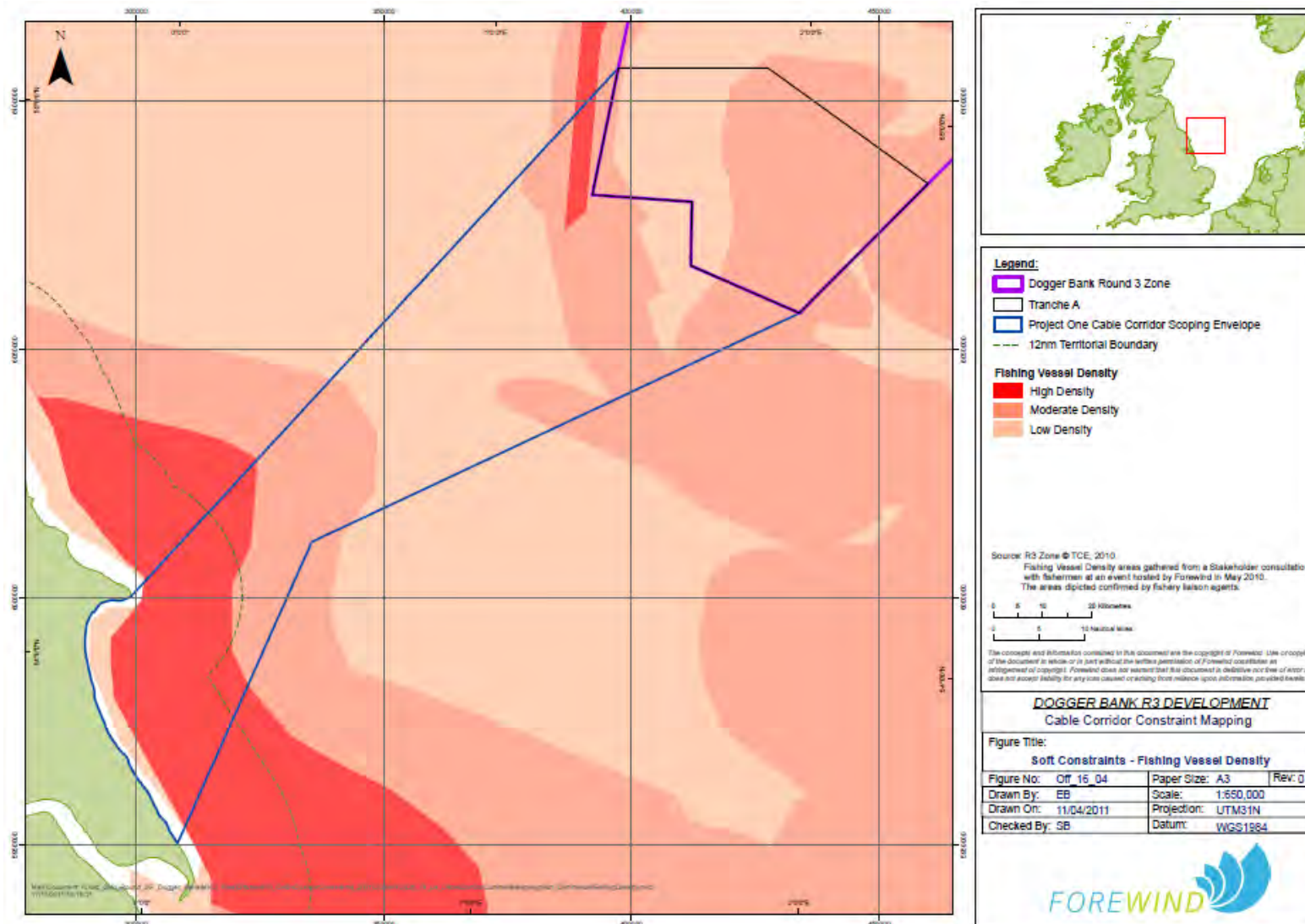
**Figure 4 Soft constraints – Fish spawning and nursery grounds by species - 2**





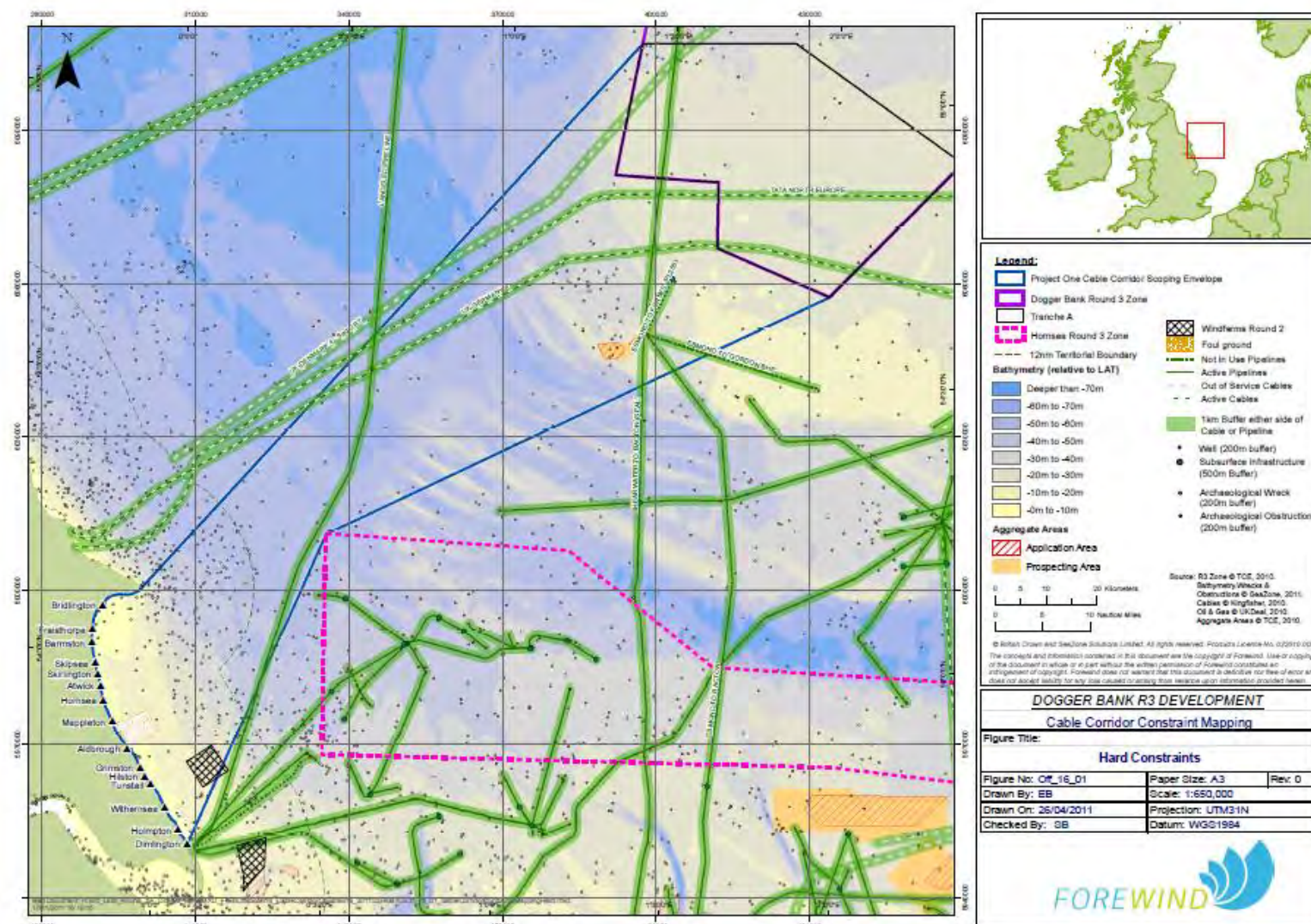


**Figure 5 Soft constraints – fishing vessel density**



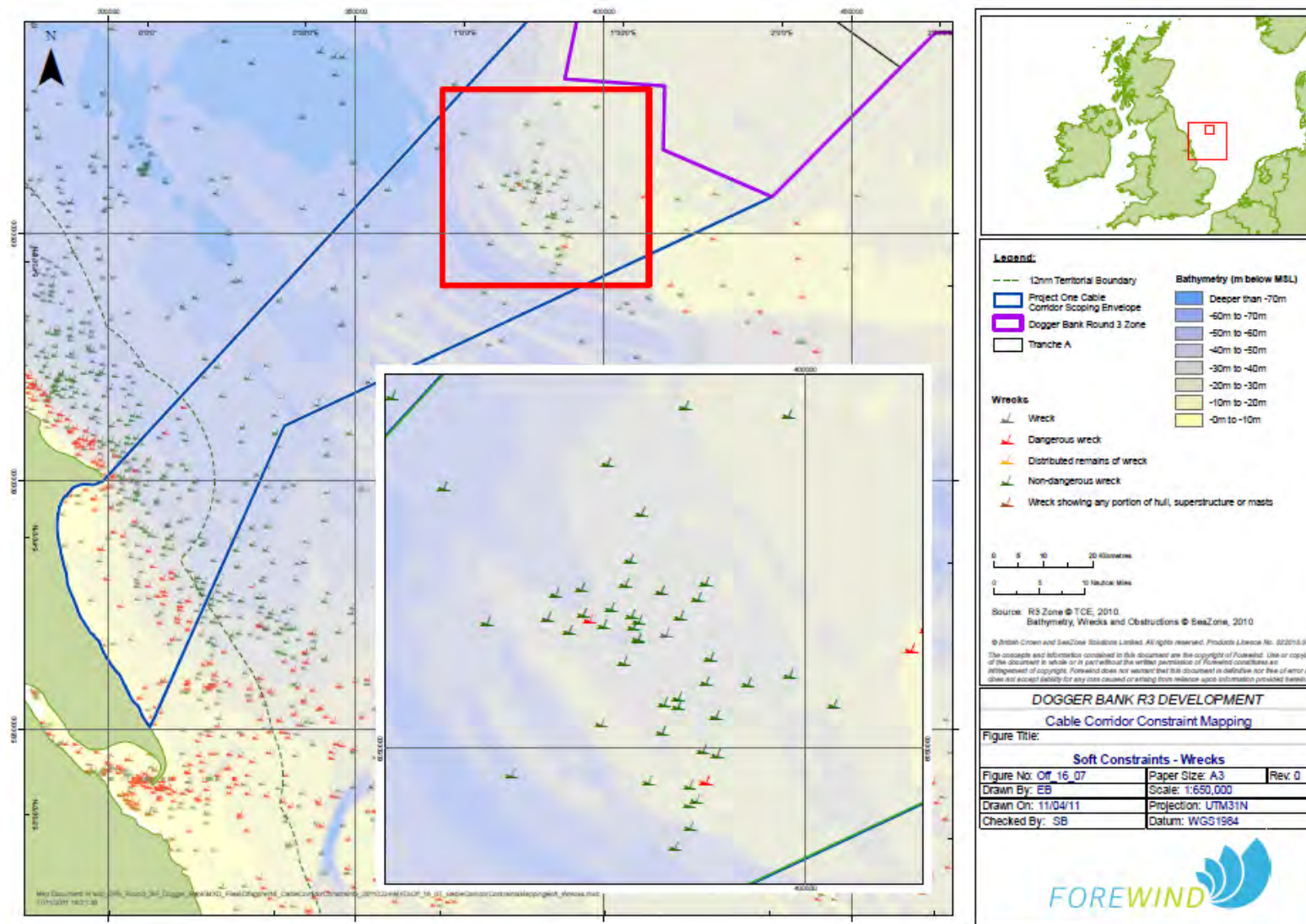


**Figure 6** Consenting parameter consideration for offshore export cable corridor





**Figure 7 Soft constraints - Wrecks**





## **2 EXPORT CABLE CORRIDOR IDENTIFICATION**

2.1.1 The following paragraphs provide a summary of the implications of the consideration of the above parameters on the offshore export cable corridor identification.

### **2.2 Seabed topography, sediments and features**

2.2.1 A thorough review and discussion of the seabed conditions has been commissioned by Forewind (as reported in RPS, 2010). Within this report it is evident that there are two main features that could represent material consideration for the offshore export cable corridor identification process with regard to consenting risk:

- Areas of exposed or near surface bedrock; and
- Areas of extensive active sandwaves.

2.2.2 Areas of near surface or exposed bedrock may be present in the northern half of the far western extents of the study area. In these areas, Holocene sediments, typically gravel or sand rich, form a thin veneer (< 1m) under which lies the bedrock. This could preclude trenching altogether in these areas and other methods such as rock cutting, rock dumping or the use of geotextiles could be considered for cable protection (RPS, 2010). The use of such methods is likely to result in concern from the Statutory Nature Conservation Bodies (SNCBs) (namely, the Joint Nature Conservation Committee (JNCC) and Natural England), due to the potential effects on the receiving environment and change to existing conditions that these methods may represent. Therefore, whilst not mandatory, avoidance of such areas is therefore, considered advisable if possible.

2.2.3 In the southern half of the offshore study area a large area of active sandwaves (known as The Sand Hills group) exists. These sandwaves within this area reach heights of 12m to 21m. It is noted within the RPS report that due to the technical constraints posed by such features, pre-lay sandwave or sandbank shaving may be employed to reduce gradients and attain sufficient burial depth should trough laying not be possible (RPS, 2010).

2.2.4 Furthermore, as these sandwaves are active, movement could also create freespan problems where the cable is no longer supported (RPS, 2010). Although not detailed in the RPS report, under such circumstances freespan would require protection, through methods such as placement of material underneath the span. Any such action would be a consenting concern due to impacts on the receiving environment (change in habitat and impacts on fauna).

2.2.5 Further investigation in the area where the bedrock and sandwave fields exist within the study area was undertaken by a geophysical survey (GEMS, 2010). Interpretation of the GEMS bathymetric survey data suggests that sandwaves extend further northwest than indicated by BGS and the RPS Report, extending as far as ML2 (see Figure A1) (ETA, 2011). The identification of the interface between the 'sandwave' and 'bedrock' sectors is subject to ongoing interpretation of the pinger data. Preliminary judgement by ETA would suggest that a corridor between lines ML1 and ML3, may avoid the expected bedrock area whilst encountering only small sandwaves (ETA, 2011).





- 2.2.6 Whilst neither passage through areas of exposed or near surface bedrock, and areas of extensive active sandwaves represents an insurmountable consenting challenge, avoidance of such areas should be given consideration within the offshore export cable corridor identification process.

## **2.3 Nature Conservation Designations**

- 2.3.1 The Dogger Bank pSAC extends out into the offshore cable corridor area. Cable installation through the pSAC will be unavoidable. Efforts to minimise the number of cable / pipeline crossings (and therefore, alteration to seabed habitat) within the pSAC is recommended.
- 2.3.2 The presence of the potential MCZ in the western half of the study area is of material importance. Avoiding this area (if designated) may not be mandatory however; cable installation techniques may be limited by its management measures and consenting effort increased to prove no significant effects.

## **2.4 Fish & Shellfish Resource**

- 2.4.1 No evidence of restricted demersal spawning grounds within the study area exists. It is suggested therefore, that this parameter will not influence offshore export cable corridor identification.

## **2.5 Commercial Fisheries**

- 2.5.1 High levels of commercial fishing activity exist in the north of the study area, to the west of Dogger Bank. These are associated with the sandeel fisheries and do not represent static gear fishing (therefore, can easily avoid temporary disturbance during cable installation). Therefore, from a consenting perspective, whilst minimising disturbance to fishing activity and its grounds is preferable, it is not envisaged that such activity should have a strong bearing on the cable corridor selected.

## **2.6 Other Human Activity**

- 2.6.1 All offshore oil and gas infrastructure (wells and platforms) will need to be avoided by the cables. There are a number of such features (mostly wells) throughout the study area, but not at a density that would warrant avoidance of a corridor through any particular area as clearance can be achieved through micro-siting of cables.
- 2.6.2 Some of the pipelines and cables within the study area will need to be crossed at some juncture by the export corridor. Keeping the number of crossings to a minimum would be advantageous to reduce the level of impact associated with habitat change and impact on fauna. Therefore, avoidance of the Esmond, Gordon and Forbes pipelines (that are out of use, but still present) in the south of the study area is recommended, as is crossing any cable or pipeline only once.
- 2.6.3 Furthermore, ensuring cable and or pipeline crossings were kept out of the pSAC where possible would also be preferable (to reduce the level of habitat change within the designated site). Whilst it may not be possible for the Shearwater to Bacton (SEAL) pipeline that crosses the whole study area, by having a cable corridor that ran parallel to



the two existing cables, or to the south of these, would ensure no cables were crossed in the pSAC.

- 2.6.4 There is one large Aggregate prospecting area in the southern half of the study area with two application areas contained within. These should be avoided to reduce impacts on these activities and increased cumulative concerns on other ecological parameters.
- 2.6.5 There are no dredging or disposal sites within the study area.
- 2.6.6 There are a number of MOD PEXAs within the study area, associated with Naval and Air Force activity. None of these are likely to have a consenting risk with regard to cable installation, and all cover the whole study area width, therefore, they will have no influence on the offshore export cable corridor identification process.

## **2.7 Archaeology**

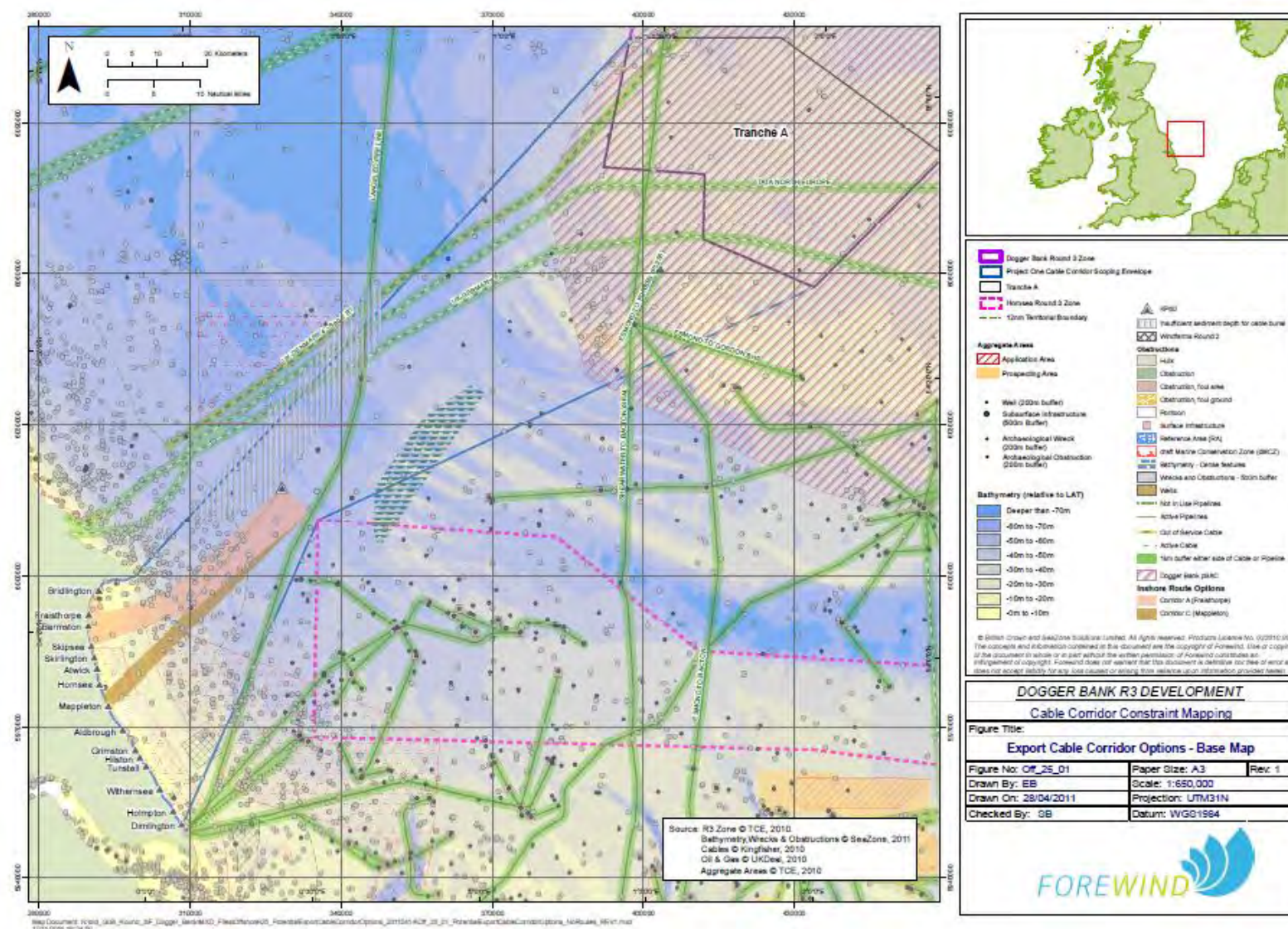
- 2.7.1 There are a number of wrecks and archaeological obstructions within the study area. The density of these across much of the study area is low. However, one region within the central part of the study area relatively close to the Zone has a notably higher density of wrecks. Discussion with Forewind's shipping consultants (Anatec) has revealed that these are mostly likely to represent fishing vessels that are reflective of the high levels and long history of fishing activity on the edge of the Dogger Bank. The reasoning for the apparent hotspot of wrecks is unclear, although may be attributable to wave climates created during storm conditions as the deeper water to the northwest of the Bank meets the shallower water of the Dogger Bank.
- 2.7.2 Wrecks and archaeological obstructions will be required to be avoided. However, it is considered that the majority of such features can be avoided through micro-siting of cables within a 2km wide corridor, and therefore, they should not directly influence the offshore export cable corridor identification process at the density observed within the study area. With regard to the wreck hotspot area however, careful consideration should be given to any corridor through this area. A gap (of around 5km) does appear to exist through the middle of the area, and therefore, it may be most practicable to align any corridor that passes through this area, with the gap.

## **2.8 Summary**

- 2.8.1 A summary of these key constraints is provided in **Figure 8**.



**Figure 8 Consenting parameter consideration for offshore export cable corridor**





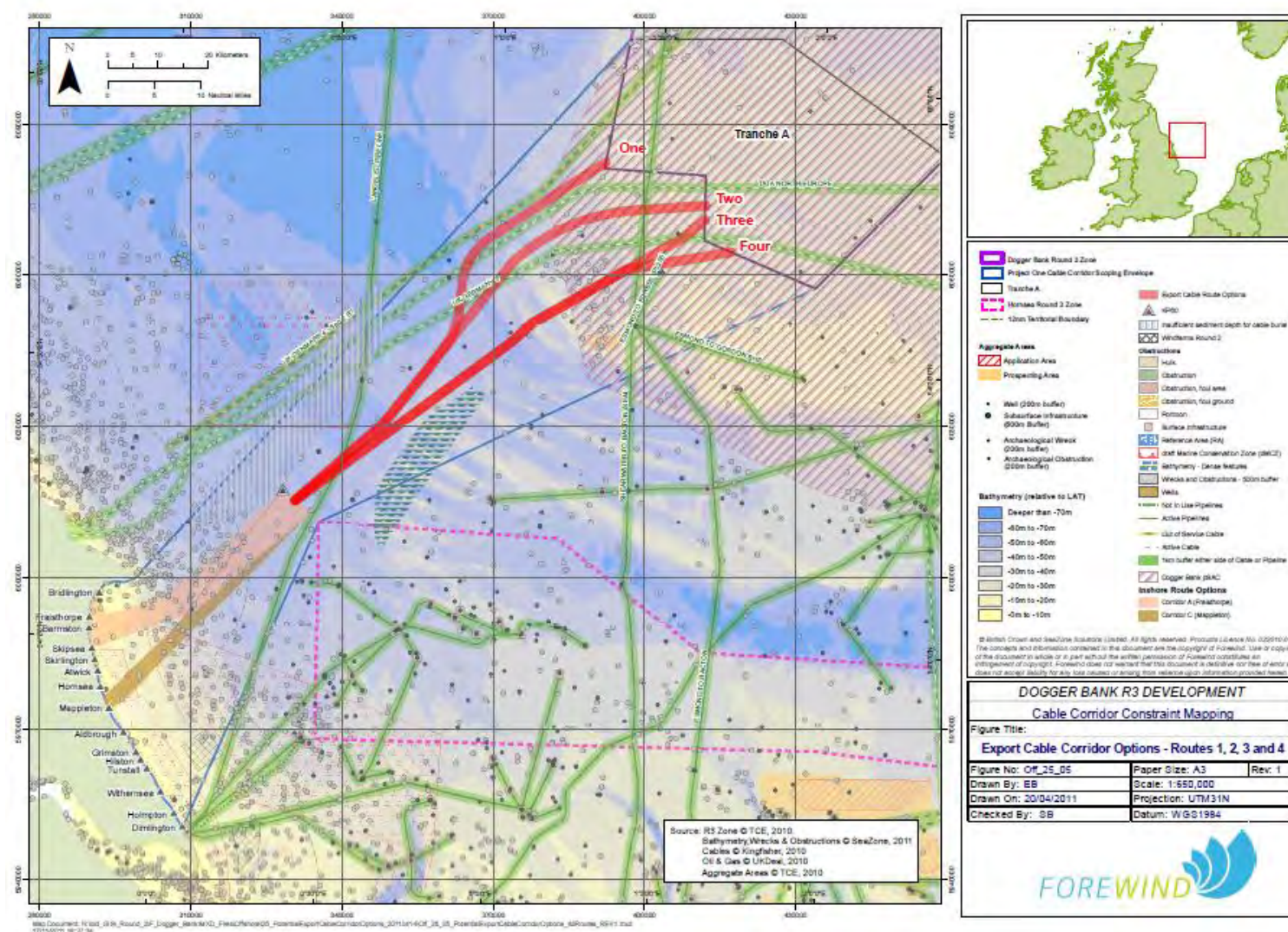


### **3 CABLE CORRIDOR SELECTION – SUMMARY RECOMMENDATIONS**

- 3.1.1 Based on the available information on the consenting parameters deemed of relevance to the offshore export cable corridor identification process, it is considered that from a consenting perspective the southern extent of the study area (that comprises The Sand Hills, the aggregate extraction licence areas, the out of use Esmond, Gordon, Forbes pipelines and the broadest extent of the Dogger Bank pSAC) should be avoided. Furthermore, a recommendation is made to avoid the potential MCZ and northern most extent of the offshore study area to avoid the near surface bedrock (which are likely to exhibit a level of geographical overlap within the study area).
- 3.1.2 Within the remainder of the study area, consideration should be given to ensuring that the cable corridor makes minimal pipeline and or subsea cable crossings, especially within the Dogger Bank pSAC area.
- 3.1.3 Potentially suitable corridors from a consenting perspective would therefore, comprise (see **Figure 9**):
- Option 1: Exit from the Tranche to the north of TATA North Europe cable with crossing of both this cable and the UK-Germany 6 cable outside of the pSAC;
  - Option 2: Exit from the Tranche between the TATA North Europe cable and UK-Germany 6 cable, with a crossing of the latter outside of the pSAC;
  - Option 3: Exit from the Tranche between the TATA North Europe cable and UK-Germany 6 cable, with a crossing of the latter inside of the pSAC; and
  - Option 4: Exit from the Tranche to the south of the UK-Germany 6 cable.
- 3.1.4 It is considered that Option 1 has the least consenting concerns, with Option 2 representing the next preferable Option from a consenting perspective.



**Figure 9 Export cable corridor options – Routes 1, 2, 3 and 4**



For more information

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