

LEGEND

- Onshore study area
- First Shortlist of Converter Station Sites
- Converter Station Site Search
- Area outside onshore study area
- Settlement

Sites Available from Wilton (owned by Sembcorp)

- Industrial Development Land
- Light Industrial Development Land

0 2

Kilometres

Data Source:
Ordnance Survey data © Crown copyright and database right, 2014

PROJECT TITLE
DOGGER BANK TEESIDE A & B

DRAWING TITLE
Figure 4.13 Converter Station Locations (short list)

VER	DATE	REMARKS	Drawn	Checked
1	09/07/2013	Draft	GC	DB
2	30/08/2013	Submit for PE13	SW	DB
3	14/02/2014	Pre-DCO submission review	SW	DB

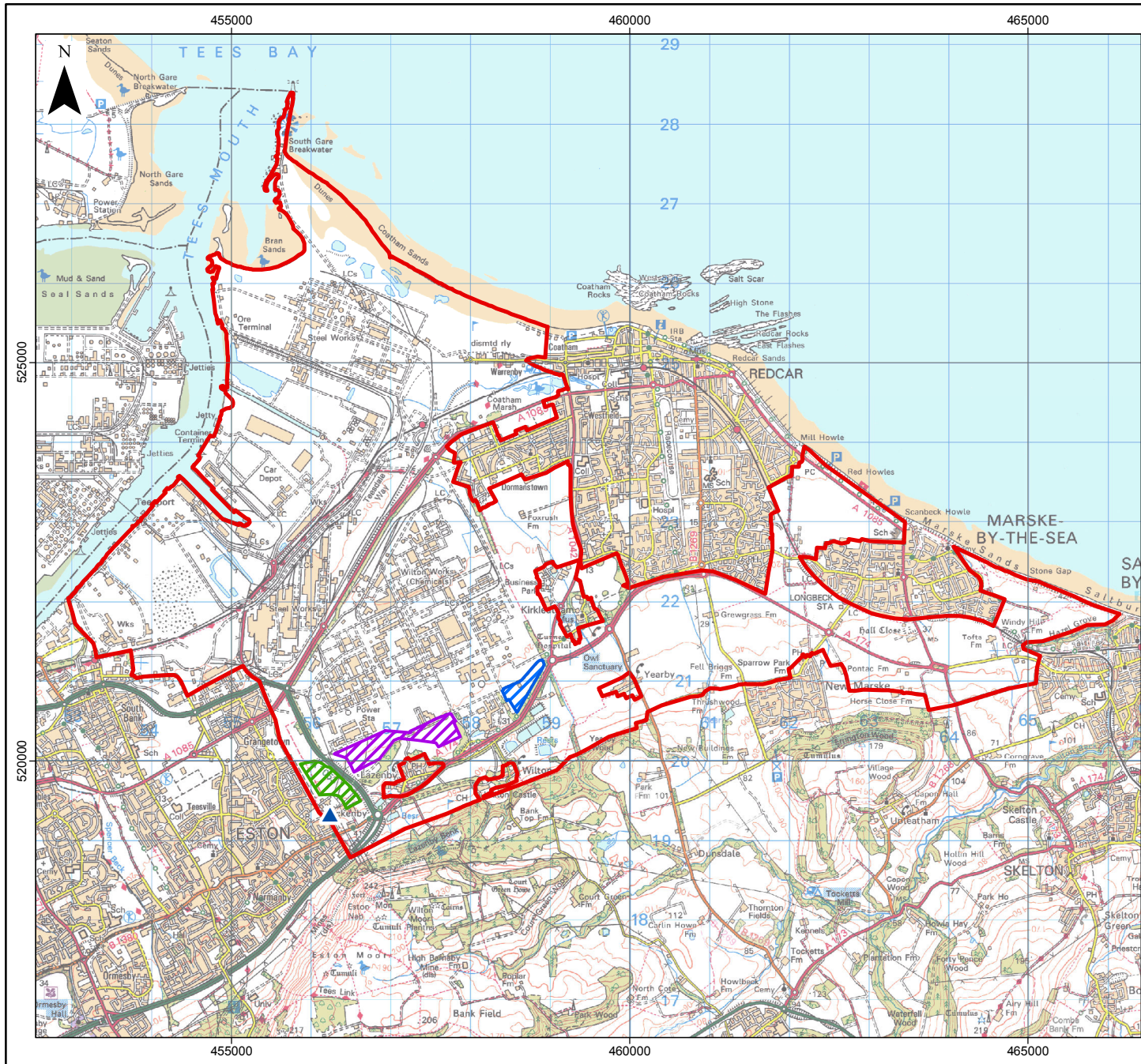
DRAWING NUMBER: **F-ONC-MA-024**

SCALE 1:55,000 PLOT SIZE A4 DATUM OSGB36 PROJECTION BNG

The concepts and information contained in this document are the copyright of Forewind. Use or copying of the document in whole or in part without the written permission of Forewind constitutes an infringement of copyright. Forewind does not warrant that this document is definitive nor free of errors and does not accept liability for any loss caused or arising from reliance upon information provided herein.

Refined short list of potential converter station sites

- 4.6.16 Consultation throughout the site selection process with landowners, and more specifically in the converter station search area with Sembcorp Utilities (UK) Limited, has been undertaken by Forewind. Inputs into the process identified areas of land which would be suitable for a converter station, and were presented to Forewind as potential converter station sites.
- 4.6.17 Initial landscape and visual, noise, traffic, land quality, ecological and capability assessments were conducted to identify potential risks, constraints and opportunities for siting of the converter station sites. The three shortlisted converter station sites (Site E, G and H) have been assessed based on known constraints and are shown in **Figure 4.14**.



LEGEND

- Onshore Scoping Area
- ▲ Lackenby 400kV substation

Converter Station Sites

- E
- G
- H

0 3

Kilometres

Data Source:
Ordnance Survey data © Crown copyright and database right, 2014

PROJECT TITLE
DOGGER BANK TEESIDE A & B

DRAWING TITLE
Figure 4.14 Converter Station Sites (preferred)

VER	DATE	REMARKS	Drawn	Checked
1	09/07/2013	Draft	GC	DB
2	30/08/2013	Submit for PE13	SW	DB
3	14/02/2014	Pre-DCO submission review	SW	DB

DRAWING NUMBER:
F-ONC-MA-025

SCALE	1:75,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG
-------	----------	-----------	----	-------	--------	------------	-----

The concepts and information contained in this document are the copyright of Forewind. Use or copying of the document in whole or in part without the written permission of Forewind constitutes an infringement of copyright. Forewind does not warrant that this document is definitive nor free of errors and does not accept liability for any loss caused or arising from reliance upon information provided herein.

Preferred Converter Stations Site for Dogger Bank Teesside A & B

- 4.6.18 Site G is the largest of the three shortlisted sites, and has the potential to easily accommodate the required converter stations for Dogger Bank Teesside A & B (further details can be found within **Appendix 6F**).
- 4.6.19 The opportunities with this site are that the site size provides flexibility of design to avoid localised constraints and allows for optimisation and future site expansion. The eastern half of Site G was preferred due to the electricity lines that cross the western half of the site.
- 4.6.20 The risks associated with the site are that it has a small amount of contaminated land on the northern edge, but this could be avoided through micro-siting and by amending the site footprint. The initial ecology assessment highlighted some potential habitat for water voles, and there is potential for a noise impact on the nearby village of Lazenby, which could however be mitigated given the opportunities for design optimisation within the site.
- 4.6.21 The combination of low consenting risks, a receptive landowner, and site design optimisation afforded by such a large site combine to identify Site G as the preferred converter stations site for Dogger Bank Teesside A & B.

4.7 Stage 6 – Identification of onshore cable corridor (from the landfall to the existing NGET substation at Lackenby)

- 4.7.1 This site selection stage identified the preferred route of the HVDC cable from the identified landfall to the preferred converter stations site within the Wilton Complex. Subsequently, the HVAC cable route from the converter station to the grid connection point at the existing NGET substation at Lackenby was identified.

Design and technical assumptions

- 4.7.2 A number of technical and design assumptions were identified during this stage of the process, to enable the cable route selection. These were:
- The preferred 'Landfall Two' option between Redcar and Marske-by-the-Sea, as the preferred landfall location;
 - The minimum capacity of a single cable route will be 1GW;
 - Cable routes accommodating a cable system of 2GW will be required to each of the converter station sites within the Wilton Complex;
 - Each 1GW project will require a cable route construction width of up to 18m within agricultural land (i.e. an 18m wide 1GW cable route, a 36m wide 2GW (2x18m wide) route (this is subject to refinement through the on-going site selection process);
 - The construction width may be reduced within road surfaces to 7.5m wide for 1GW, 18m wide for 2GW (to be agreed in consultation with Sembcorp Utilities (UK) Limited; and

- Onshore transition pits at the landfall point to connect the offshore export cables to the onshore cables.

Approach to cable route selection

4.7.3 The cable routing selection was an iterative assessment process based on the following approach:

- A review of data collected as part of the Zonal Characterisation (Zoc) document;
- Analysis of data in GIS to identify development considerations;
- Options based on the three initial landfall points identified by Forewind;
- A comparison between each of the options identified; and
- Further assessment and consultation to define the route.

Cable route characterisation

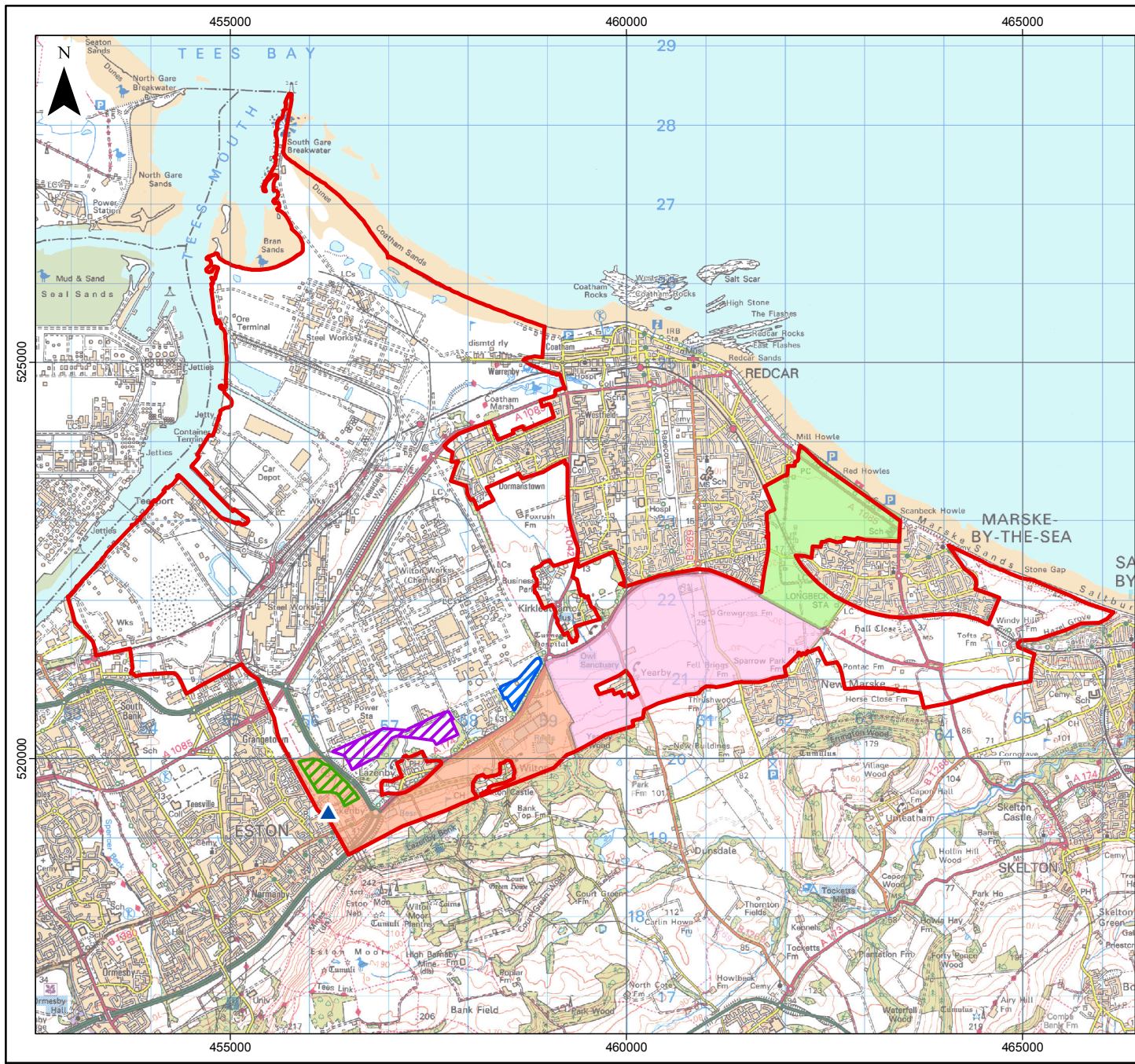
4.7.4 To aid in characterising the cable route, the land between the landfall and the Wilton Complex was divided into sections. A brief description of the three sections is provided below and the areas are shown on **Figure 4.15**.

4.7.5 **Section A:** This section includes the landfall area, the corridor between the towns of Redcar and Marske-by-the-Sea, the sewage works, main railway line, and the agricultural land and woodland up to the A174.

4.7.6 **Section B:** This section includes the agricultural land south of the A174 to the village of New Marske and Longbeck Lane. This section also includes the settlement of Yearby and continues to the A174 roundabout with the A1042 at the south east corner of the Wilton Complex.

4.7.7 **Section C:** This section includes the land directly south of the Wilton Complex adjacent to the A174. This area includes reservoirs, Wilton Golf Club and several areas of woodland and individual mature trees. Along the southern border are Neptune Wood and Wilton Wood. It also includes the land surrounding the existing NGET substation at Lackenby.

4.7.8 The assessment of each section is detailed within **Appendix 6G** which also summarises the key consenting risks associated with each option.



LEGEND

- Onshore Scoping Area
- ▲ Lackenby 400KV substation
- Section A
- Section B
- Section C

Converter Station Sites

- E
- G
- H

0 3
Kilometres

Data Source:
Ordnance Survey data © Crown copyright and database right, 2014

PROJECT TITLE
DOGGER BANK TEESIDE A & B

DRAWING TITLE
Figure 4.15 Cable Route Characterisation (Sections A-C)

VER	DATE	REMARKS	Drawn	Checked
1	09/07/2013	Draft	GC	DB
2	30/08/2013	Submit for PE13	SW	DB
3	14/02/2014	Pre-DCO submission review	SW	DB

DRAWING NUMBER:
F-ONC-MA-026

SCALE	1:75,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG
-------	----------	-----------	----	-------	--------	------------	-----

The concepts and information contained in this document are the copyright of Forewind. Use or copying of the document in whole or in part without the written permission of Forewind constitutes an infringement of copyright. Forewind does not warrant that this document is definitive nor free of errors and does not accept liability for any loss caused or arising from reliance upon information provided herein.

HVDC/HVAC long list of cable route options

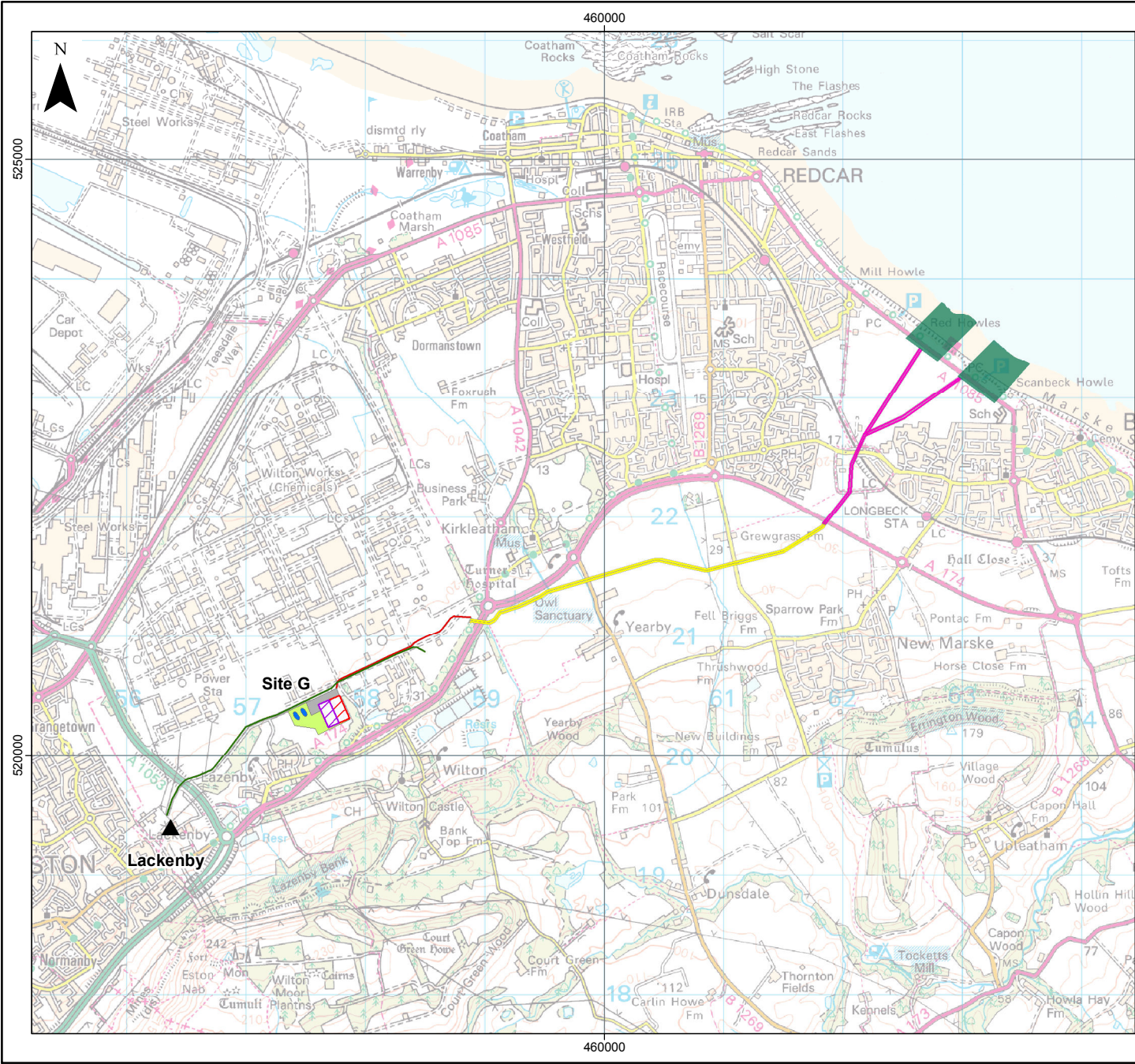
- 4.7.9 The following approach to developing a list of cable route options was adopted where practical, in order to further minimise environmental impact to the area:
- Reduce proximity to residential dwellings;
 - Minimise impacts on agricultural practices;
 - The shortest, technically and environmentally acceptable route is preferred;
 - Avoid designated sites and areas (i.e. heritage and biodiversity sites);
 - Follow existing field boundaries;
 - Minimise the number of hedgerow crossings;
 - Utilise existing gaps in field boundaries;
 - Avoid isolating parcels of land during construction; and
 - Avoid areas of important habitat, trees, ponds and agricultural ditches.

Dogger Bank Teesside A & B HVDC cable routes

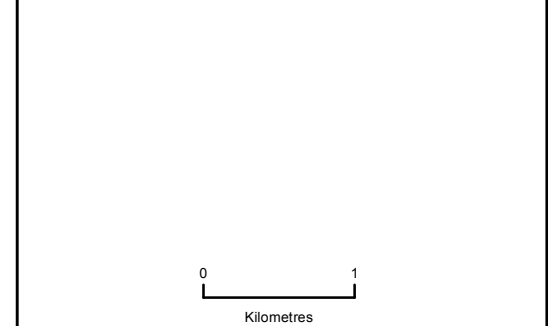
- 4.7.10 The cable route assessment focused on local communities, other infrastructure and populated areas that have the potential to influence cable route selection. Full details on the cable route assessment and the potential cable routes identified can be found in Onshore Site Selection in **Appendix 6G**. Using the technical and design assumptions outlined in this chapter, and assessing these against the identified development considerations, enabled the identification by Forewind of 49 potential cable routes to the eight shortlisted converter station sites. This stage was undertaken prior to the preferred converter station sites being chosen.

Dogger Bank Teesside A & B HVAC cable routes

- 4.7.11 Site G is the preferred site for Dogger Bank Teesside A & B. Due to the proximity of the site to the existing NGET substation at Lackenby, there was only a single route option proposed and is shown in **Figure 4.16**. This route travels west from the converter stations towards the existing NGET substation at Lackenby. The major constraint is a pinch point between wooded landscaping bunds and the new grain storage facility. Further constraints include the overhead power lines and the Greystone road. Consultation with Sembcorp Utilities (UK) Limited (as outlined in **Table 2.2**) has aided the cable route selection within the Wilton Complex and allowed identification of constraints such as utilities and operational working requirements, which has in turn allowed the route to be further developed.



- LEGEND**
- ▲ Lackenby 400KV
 - Cable Landfall Envelope
 - Laydown
 - Teesside A and B HVDC Cable
 - A2 - 2 x 1GW 18m HVDC Cable Route
 - B3 - 2 x 1GW 18m HVDC Cable Route
 - G1 - 2 x 1GW 13m HVDC Cable Route



Data Source:
Ordnance Survey data © Crown copyright and database right, 2014

PROJECT TITLE
DOGGER BANK TEESIDE A & B


DRAWING TITLE
Figure 4.16: Preferred cables routes

VER	DATE	REMARKS	Drawn	Checked
1	10/07/2013	Draft	SW	RH
3	27/07/2013	Submit for PE13	SW	RH
3	14/02/2014	Pre-DCO submission review	SW	RH

DRAWING NUMBER:
F-ONL-MA-009

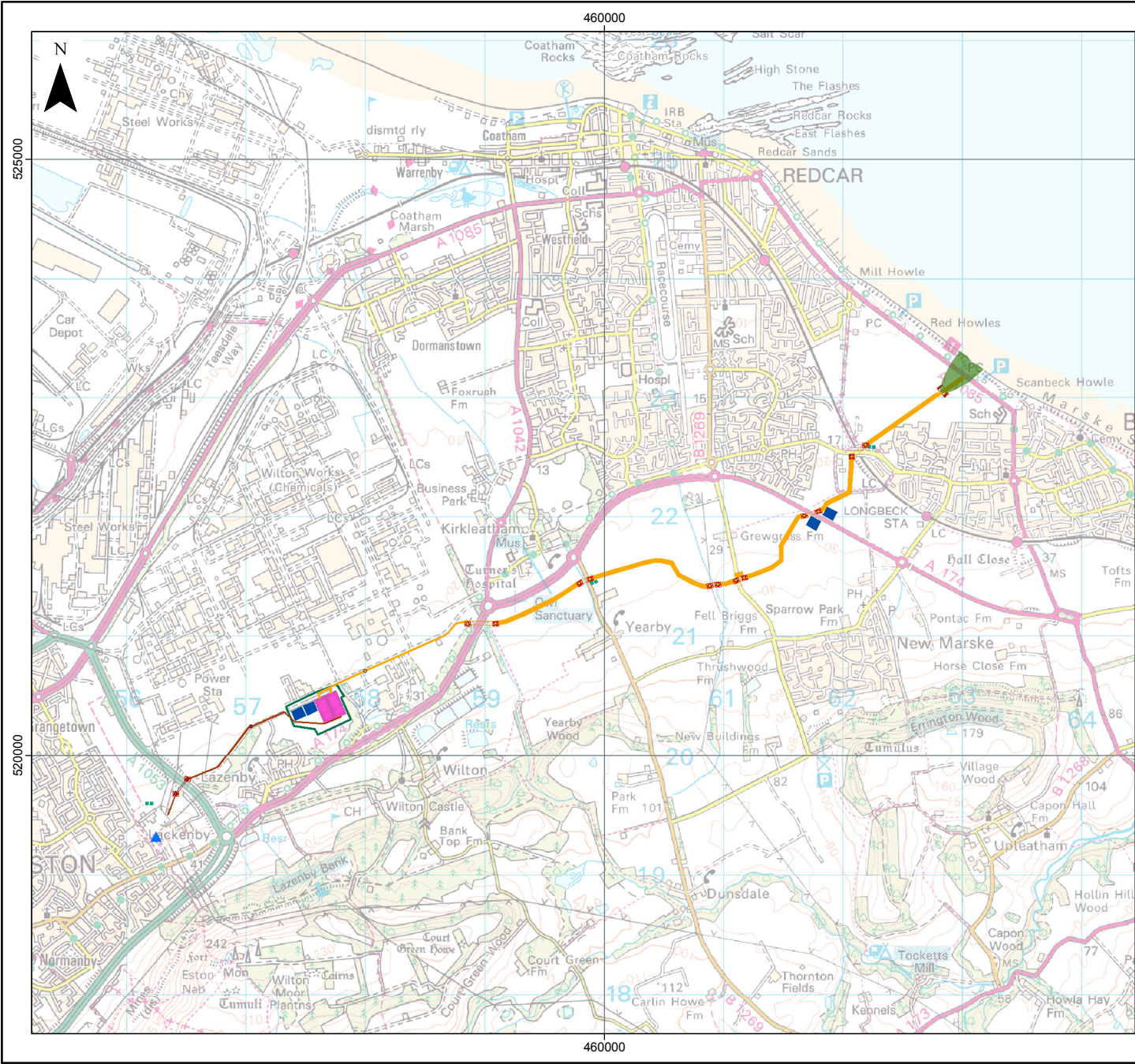
SCALE 1:50,000 PLOT SIZE A4 DATUM OSGB36 PROJECTION BNG

The concepts and information contained in this document are the copyright of Forewind. Use or copying of the document in whole or in part without the written permission of Forewind constitutes an infringement of copyright. Forewind does not warrant that this document is definitive nor free of errors and does not accept liability for any loss caused or arising from reliance upon information provided herein.



Dogger Bank Teesside A & B HVDC and HVAC micrositing work

- 4.7.12 Site selection is an iterative process and will continue to be informed by the findings of the on-going impact assessment and stakeholder (including landowners) engagement work.
- 4.7.13 There were a number of options for micro-siting the cables which came from consultation with landowners and Forewind. These options were each assessed by the EIA team, taking into account the considerations and data collected through the EIA process to date. Some of the options were ruled out due to their potential environmental impact or physical constraints (such as utilities), and other options were taken forward.
- 4.7.14 The cable route was amended as shown in **Figure 4.17**, following these discussions and after full constraints analysis was undertaken.
- 4.7.15 Due to the iterative nature of the site selection process, the cable route was then further refined to reflect changes in number and size of the primary and intermediate compounds, and refinement of the cable landfall envelope. The scheme layout and design were used to inform the EIA assessments and are shown in **Figure 4.18**.



LEGEND

- Cable landfall envelope
- Landfall joint transition bay (2500m²)
- Onshore cable route HVDC, Open trench
- Onshore cable route HVDC, HDD
- Onshore cable route HVAC, Open trench
- Onshore cable route HVAC, HDD
- HDD entry or exit locations (2000m²)
- Large site construction compound (9000m²)
- Small site construction compound (784m²)
- Converter station site
- Converter stations
- Lackenby 400KV substation (Teesside A+B connection)
- Cable jointing bays HVDC (36m²)
- Cable jointing bays HVAC (56m²)



Data Source:
Ordnance Survey data © Crown copyright and database right, 2014

PROJECT TITLE
DOGGER BANK TEESSIDE A & B

DRAWING TITLE
Figure 4.17: Dogger Bank Teesside A & B revised route following landowner changes

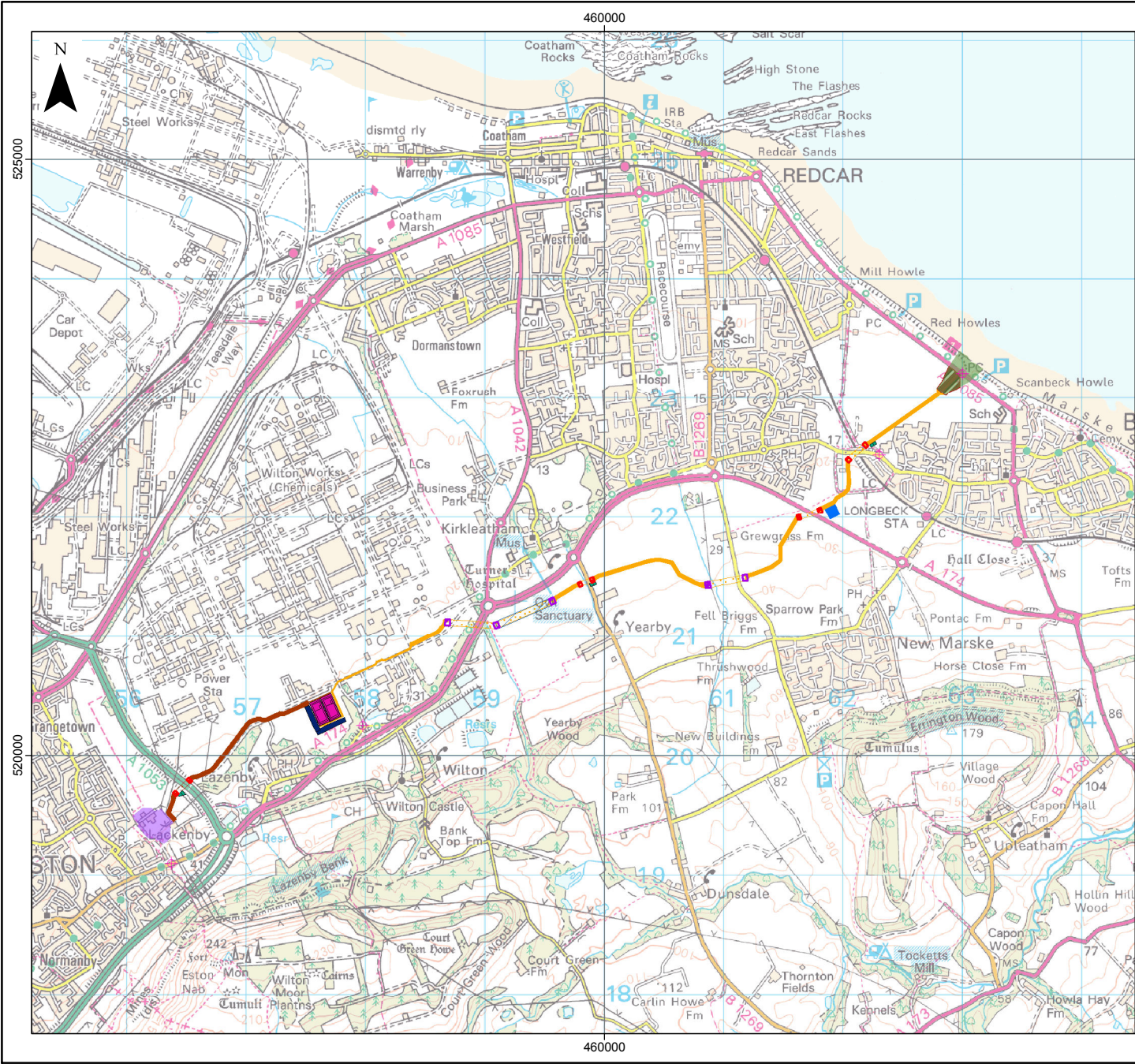
VER	DATE	REMARKS	Drawn	Checked
1	10/07/2013	Draft	SW	RH
3	27/08/2013	Submit for PEI3	SW	RH
4	14/02/2014	Pre-DCO submission review	SW	RH

DRAWING NUMBER:
F-ONL-MA-010

SCALE	1:50,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG
-------	----------	-----------	----	-------	--------	------------	-----

The concepts and information contained in this document are the copyright of Forewind. Use or copying of the document in whole or in part without the written permission of Forewind constitutes an infringement of copyright. Forewind does not warrant that this document is definitive nor free of errors and does not accept liability for any loss caused or arising from reliance upon information provided herein.





LEGEND

- Teesside A&B cable landfall envelope
- Teesside A&B landfall construction envelope
- Teesside A&B HVDC, Open trench
- Teesside A&B HVDC, HDD
- Teesside A&B HVAC, Open trench
- Teesside A&B HVAC, HDD
- Teesside A&B major horizontal directional drill entry or exit locations (2,000m²)
- Teesside A&B minor horizontal directional drill entry or exit locations (1,200m²)
- HDD or open trench to be confirmed
- Teesside A&B cable route primary construction compound (10,000m²)
- Teesside A&B intermediate construction compound (784m²)
- Teesside A&B converter stations
- Teesside A&B converter stations construction compounds (10,000m² per project)
- Lackenby 400kV substation
- Indicative access points for construction for Projects A+B

0 1
Kilometres

Data Source:
Ordnance Survey data © Crown copyright and database right, 2014

PROJECT TITLE
DOGGER BANK TEESSIDE A & B

DRAWING TITLE
**Figure 4.18:
Dogger Bank Teesside A & B
scheme design for EIA**

VER	DATE	REMARKS	Drawn	Checked
1	09/07/2013	Draft	SW	RH
3	14/02/2014	Submit for PEI3	SW	RH
4	27/01/2014	Pre-DCO submission review	SW	RH

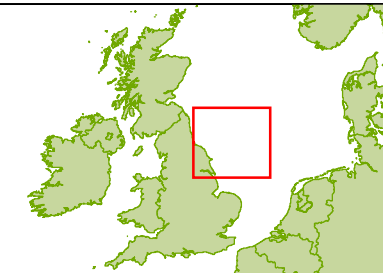
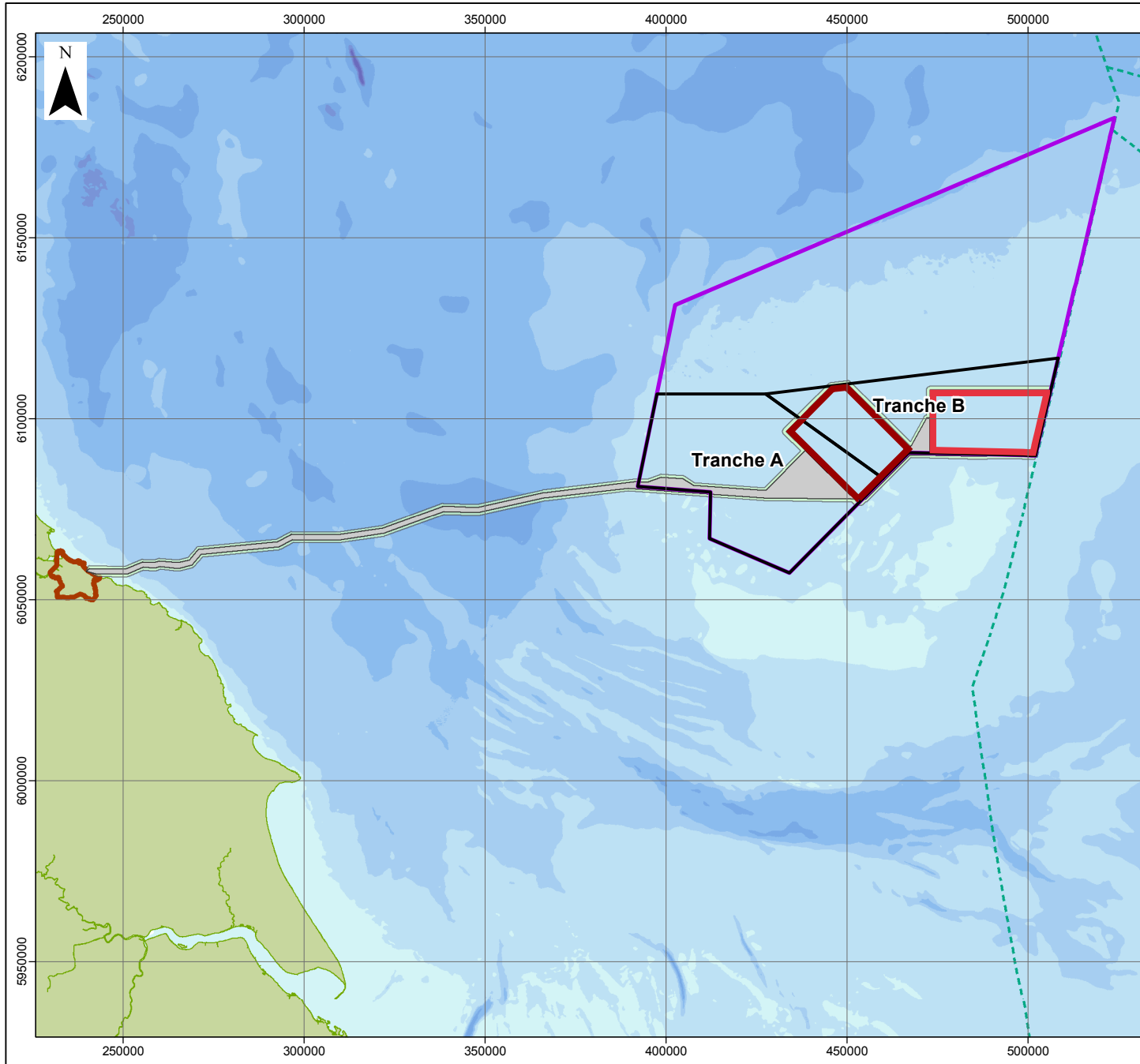
DRAWING NUMBER:
F-ONL-MA-011

SCALE 1:50,000 PLOT SIZE A4 DATUM OSGB36 PROJECTION BNG

The concepts and information contained in this document are the copyright of Forewind. Use or copying of the document in whole or in part without the written permission of Forewind constitutes an infringement of copyright. Forewind does not warrant that this document is definitive nor free of errors and does not accept liability for any loss caused or arising from reliance upon information provided herein.

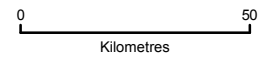
4.8 Stage 7 – Offshore cable corridor selection

- 4.8.1 The selection of a wide export cable corridor in the offshore environment is relatively more straightforward compared to the onshore, largely on account of the absence of potentially complex land use and ownership issues typically encountered on land.
- 4.8.2 The proposed offshore cable corridor is shown in **Figure 4.19** and was identified by Forewind following a further review of the known offshore constraints and analysis of reconnaissance survey data that Forewind collected within the offshore cable portion of the study area. While Forewind has identified the locations of the first two Dogger Bank Teesside projects (Dogger Bank Teesside A & B) the locations of the further two Dogger Bank Teesside projects (Dogger Bank Teesside C & D) have yet to be determined, but it is known that they will be located to the north of Tranches A and B in Tranches C and/or D. As Dogger Bank Creyke Beck A & B are located between Dogger Bank Teesside A & B and the landfall, the most direct route for the export cable corridor is between the two Dogger Bank Creyke Beck projects. To date Forewind has identified the exit point from the zone and the offshore cable corridor for Dogger Bank Teesside A & B and proposes to identify a separate corridor for Dogger Bank Teesside C & D in future.
- 4.8.3 Dogger Bank Teesside A & B export cable landfall is proposed at Marske-by-the-Sea in Redcar and Cleveland from which it will connect into the existing NGET substation at Lackenby near Eston.
- 4.8.4 The corridor is approximately 1.5km wide and connects the proposed landfall to Tranche A. The design decisions used to inform the corridor included (but were not limited to) consideration of:
- Known areas of active sandwaves and exposed bedrock within the cable envelope established during the reconnaissance survey;
 - The position of known obstructions or archaeological features such as wrecks;
 - The locations of the then draft Marine Conservation Zones (pMCZs); and
 - The locations of telecommunications cables and pipelines.
- 4.8.5 These are presented in further detail in **Appendix 6H**.



LEGEND

- Dogger Bank Zone
- Tranche Boundary
- Dogger Bank Teesside A
- Dogger Bank Teesside B
- Dogger Bank Teesside A & B Export Cable Corridor
- Temporary works area
- Onshore Cable Route Study Area
- International Boundary



Data Source:
 Round 3 offshore wind farm boundary © Crown Copyright, 2014
 Background bathymetry image derived in part from TCarta data © 2009
 UK International Boundary data supplied by UKHO using information published from open sources

PROJECT TITLE
DOGGER BANK TEESSIDE A & B


DRAWING TITLE
Figure 4.19 Proposed Offshore Cable Corridor

VER	DATE	REMARKS	Drawn	Checked
1	09/07/2013	Draft	GC	DB
2	30/08/2013	Submit for PEI3	SW	DB
3	14/02/2014	Pre-DCO submission review	SW	DB

DRAWING NUMBER:
F-ONC-MA-028

SCALE 1:1,650,000 PLOT SIZE A4 DATUM WGS84 PROJECTION UTM31N

The concepts and information contained in this document are the copyright of Forewind. Use or copying of the document in whole or in part without the written permission of Forewind constitutes an infringement of copyright. Forewind does not warrant that this document is definitive nor free of error and does not accept liability for any loss caused or arising from reliance upon information provided herein.



4.9 Summary of the site selection of Dogger Bank Teesside A & B

4.9.1 The site selection process has identified:

- The two offshore wind farms and associated array cables, collector stations and converter stations will be located within both Tranche A (Dogger Bank Teesside B) and Tranche B (Dogger Bank Teesside A & B);
- The preferred wind farm project boundaries;
- An offshore export cable corridor that is 1.5km wide from Tranche A to a preferred landfall location Marske-by-the-Sea;
- A proposed 36m wide onshore HVDC cable route from the onshore converter stations site to the preferred landfall location;
- A converter stations site within the Wilton Complex, that can accommodate the co-location of two converter stations; and
- A proposed 39m wide HVAC onshore cable route to connect the converter stations to the existing NGET substation at Lackenby.

4.10 Ongoing site selection activities

4.10.1 Site selection is an iterative process and will continue to be informed by the findings of the ongoing impact assessment work. For example the exact timings of construction activities and the precise routing of the onshore cable alignment, through individual landownership parcels, will ultimately inform the final design. However, this element of work is considered to be micrositing within the preferred site.

5 References

Business, Enterprise and Regulatory Reform (2007) Applications to the Secretary of State for Business, Enterprise and Regulatory Reform for the establishment of safety zones around offshore renewable energy installations under the Energy Act 2004. Guidance Notes. August 2007.

Department of Energy and Climate Change (2011a) Overarching National Policy Statement for Energy (EN-1)

Department of Energy and Climate Change (2011b) National Policy Statement for Renewable Energy Infrastructure (EN-3)

Department of Energy and Climate Change (2011c) National Policy Statement for Electricity Network Infrastructure (EN-5)

Forewind (2010) Dogger Bank Zonal Characterisation

Forewind (2010) Tranche A Selection Report

Forewind (2012) Dogger Bank Teesside Scoping Report

Forewind (2012) Tranche B Selection Report

Forewind (2013) The Offshore Tranche, Wind Farm Array Boundary and In-Zone Export Cable Corridor Selection Report

National Grid (undated) Guidelines on Substation Siting and Design' (The Horlock Rules)

National Grid (undated) The National Grid Company Plc and New High Voltage Transmission Lines: Guidelines on Line Routeing (The Holford Rules) and Undergrounding

Royal Haskoning (2011) Dogger Bank Teesside - Onshore Study Area Characterisation

Royal Haskoning (2011) Onshore Converter Station Site Selection – Characterisation and Long – List Optioneering Report

Royal Haskoning (2011) Onshore Converter Station Sites Identification and Characterisation Identification of Onshore Cable Corridors

Royal Haskoning (2011) Onshore Study Area Characterisation Report

Royal Haskoning (2011) Teesside Converter Station Site Identification and Characterisation

Royal Haskoning (2012) Coastal Cable Corridor Assessment Report

Royal Haskoning (2012) Onshore Site Selection Part 3