Hornsea Project Four: Environmental Statement (ES)

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APFP Regulation: 5(2)(a)

Volume A4, Annex 3.1: Selection and Refinement of the Cable Landfall

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A4.3.1
Version B

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Glossary

Term	Definition
BRAG Assessment	An assessment based on quantitative assessment and expert judgement. The ranking is defined as: • Black: Potential showstopper to development; • Red: High potential to constrain development; • Amber: Intermediate potential to constrain development; and • Green: Low potential to constrain development. Black and red constraints are critical in determining features that should be avoided wherever possible to avoid consenting risk, reduce EIA complexity and reduce the cost of mitigation. Amber and green constraints are those that may be more readily minimised or managed by employing appropriate mitigation measures.
Design Envelope	A description of the range of possible elements that make up the Hornsea Project Four design options under consideration, as set out in detail in the project description. This envelope is used to define Hornsea Project Four for Environmental Impact Assessment (EIA) purposes when the exact engineering parameters are not yet known. This is also often referred to as the "Rochdale Envelope" approach.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Projects (NSIP).
Electrical Infrastructure Study Area	The study area between the onshore substation and offshore array area.
Export cable corridor (ECC)	The specific corridor of seabed (seaward of Mean High Water Springs (MHWS)) and land (landward of MHWS) from the Hornsea Project Four array area to the Creyke Beck National Grid substation, within which the export cables will be located.
Hornsea Project Four Offshore Wind Farm	The proposed Hornsea Project Four Offshore Wind Farm project. The term covers all elements within the Development Consent Order (i.e. both the offshore and onshore components). Hereafter referred to as Hornsea Four.
Order Limits	The limits within which Hornsea Project Four (the 'authorised project) may be carried out.
the Hornsea Four array area	The Crown Estate agreement for lease (AfL) area. Note, this is not the same as the 'Study Area' which is defined on a receptor specific basis.
Landfall	The generic term applied to the entire landfall area between Mean Low Water Spring (MLWS) tide and the Transition Joint Bay (TJB) inclusive of all construction works, including the offshore and onshore ECC, intertidal working area and landfall compound. Where the offshore cables come ashore east of Fraisthorpe.
Onshore export cables	Cables connecting the landfall first to the onshore substation and then on to the NGET substation at Creyke Beck.
Onshore substation (OnSS)	Comprises a compound containing the electrical components for transforming the power supplied from Hornsea Project Four to 400 kV and to

Term	Definition
	adjust the power quality and power factor, as required to meet the UK Grid Code for supply to the National Grid. If a HVDC system is used the OnSS will also house equipment to convert the power from HVDC to HVAC.
Orsted Hornsea Project Four Ltd.	The Applicant for the proposed Hornsea Project Four Offshore Wind Farm Development Consent Order (DCO).
Planning Inspectorate (PINS)	The agency responsible for operating the planning process for Nationally Significant Infrastructure Projects (NSIPs).
Transition Joint Bay (TJBs)	TJBs are pits dug and lined with concrete, in which the jointing of the offshore and onshore export cables takes place.
Wind turbine	All the components of a wind turbine, including the tower, nacelle, and rotor

Acronyms

Acronym	Definition
AfL	Agreement for Lease
BAP	Biodiversity Action Plan
BGS	British Geological Survey
BRAG	Black, Red, Amber, Green (Assessment Criteria)
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
Coxx	Commitment (followed by number)
CPA	Closest Point of Approach
CPO	Compulsory Purchase Order
DBA	Desk Based Assessment
DCO	Development Consent Order
DP	Dynamic Positioning
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
EISA	Electrical Infrastructure Study Area
ERYC	East Riding of Yorkshire Council
ES	Environmental Statement
GIS	Geographical Information System
HDD	Horizontal Directional Drilling
IFCA	(Association of) Inshore Fisheries and Conservation Authorities
MCZ	Marine Conservation Zone
MHW	Mean High Water
MLW	Mean Low Water
MoD	Ministry of Defence
MWLS	Mean Low Water Spring
NOAA	National Oceanic and Atmospheric Administration
NSIP	Nationally Significant Infrastructure Project
OFTO	Offshore Transmission Owner
OnSS	Onshore Substation
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate

Acronym	Definition
RPSS	Route Planning and Site Selection
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SCI	Site of Community Importance
SMP	Shoreline Management Plan
SPA	Special Protected Area
SPUE	Sightings Per Unit of surveillance Effort
SSSI	Site of Special Scientific Interest
TCE	The Crown Estate
TJB	Transition Joint Bay
UK	United Kingdom
UKC	Under Keel Clearance
UXO	Unexploded Ordnance
WWI	World War One
WWII	World War Two

Units

Unit	Definition
ha	Hectare(s)
km	Kilometre(s)
m	Metre(s)
m/yr	Metre(s) per year

1. Introduction

1.1 Background

1.1.1 Overview of Hornsea Four Approach

1.1.1.1 Orsted Hornsea Project Four Limited ('the Applicant') is proposing to develop Hornsea Project Four Wind Farm (hereafter 'Hornsea Four'). The route planning and site selection (RPSS) process for Hornsea Four has followed an iterative approach to ensure the most appropriate solution was identified efficiently, with due consideration of environmental, technical and commercial matters. The five key stages are shown in **Table 1**.

Table 1: Hornsea Four Route Planning and Site Selection Stages.

Stage	Associated Document
Stage 1: Identification of the AfL and Grid Connection	Volume A1, Chapter 3: Site selection and consideration of alternatives
Stage 2: Identification of an Electrical Infrastructure Study area	Volume A1, Chapter 3: Site selection and consideration of alternatives
Stage 3: Identification of the Landfall	Volume A4, Annex 3.1: Refinement of the Cable Landfall
Stage 4: Identification of the Onshore Substation (OnSS) site	Volume A4, Annex 3.3: Selection and Refinement of the Onshore Infrastructure
Stage 5: Identification of the Offshore and Onshore Export Cable Corridor (ECC)	Volume A4, Annex 3.2: Selection and Refinement of the Offshore Infrastructure and Volume A4, Annex 3.3: Selection and Refinement of the Onshore Infrastructure

1.1.1.2 The Hornsea Four Electrical Infrastructure Study Area (EISA) is largely defined by the AfL (location of the Hornsea Four array area) and grid connection point at Creyke Beck (location of the OnSS). These two locations formed the eastern and western extents of the Electrical Infrastructure Study Area (EISA). The EISA has been used to structure the RPSS reporting format, with:

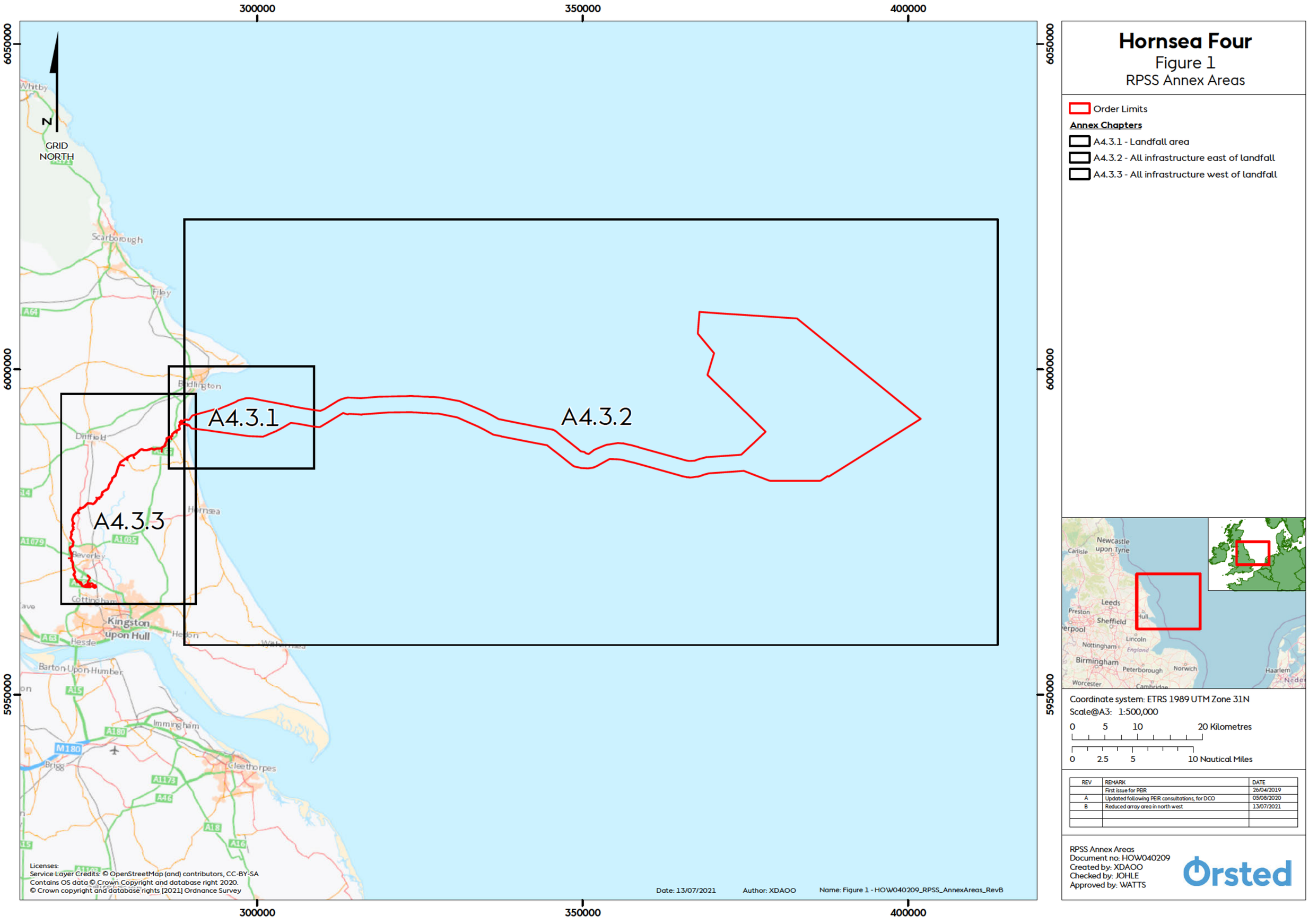
- Landfall covered in **Volume A4, Annex 3.1: Refinement of the Cable Landfall**;
- all Hornsea Four offshore infrastructure east of landfall covered in **Volume A4, Annex 3.2: Selection and Refinement of the Offshore Infrastructure**; and
- all Hornsea Four onshore infrastructure to the west detailed in **Volume A4, Annex 3.3: Selection and Refinement of the Onshore Infrastructure**.

1.1.1.3 This is shown in **Figure 1**.

Hornsea Four

Figure 1

RPSS Annex Areas



Order Limits

Annex Chapters

- A4.3.1 - Landfall area
- A4.3.2 - All infrastructure east of landfall
- A4.3.3 - All infrastructure west of landfall

Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:500,000

0 5 10 20 Kilometres

0 2.5 5 10 Nautical Miles

REV	REMARK	DATE
	First issue for PEIR	26/04/2019
A	Updated following PEIR consultations, for DCO	05/08/2020
B	Reduced array area in north west	13/07/2021

RPSS Annex Areas
Document no: HOW040209
Created by: XDAOO
Checked by: JOHLE
Approved by: WATTS

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1.1.2 Hornsea Four Programme and Timeframes

1.1.2.1 The RPSS process has been structured incrementally, with early and frequent stakeholder engagement prioritised, through public consultation, landowner liaison and regular stakeholder correspondence. This is set out in **Table 2**. The RPSS process specific to landfall is shown in **Figure 2**.

Table 2: Hornsea Four RPSS Programme.

Stage	Description
EIA Scoping October 2018	• 2,000 m onshore ECC scoping boundary and indicative 200 m permanent ECC and 700 m temporary works area; • OnSS search area; • Landfall search area; and • 3,000 m offshore ECC scoping boundary.
Scoping – Preliminary Environmental Information Report (PEIR) consultation	• Feedback and comments from informal public consultation events, landowner liaison and stakeholders on the scoping report and scoping boundary.
PEIR July 2019	• 80 m onshore ECC inclusive of permanent and temporary works areas with indicative construction access points; • Compounds: logistics, Horizontal Directional Drilling (HDD) and/or storage compounds outside of the permanent cable corridor for auxiliary works. • Access: Area required for access (temporary or permanent) to the construction and/or operation and maintenance activities. • OnSS site; • Two landfall options; and • 1,500 m offshore permanent ECC with 500 m temporary works areas buffer either side of ECC.
Section 42 and 47 consultation	• Feedback from stakeholders and members of the public upon receipt of more detailed environmental assessment work will further inform the RPSS process.
Landfall Working Group	• Feedback and comments from organised working groups with nearby stakeholders.
DCO Application Q4 2021	• Onshore ECC (80 m) which will contain all permanent (electrical cables and Transition Joint Bays (TJBs)) and temporary works for construction works and soil storage. The details of which will be developed during detailed design; • Compounds: logistics, Horizontal Directional Drilling (HDD) and/or storage compounds outside of the permanent cable corridor for auxiliary works; • Access: Area required for access (temporary or permanent) to the construction and/or operation and maintenance activities; • OnSS: preferred site within the onshore substation search area; • Landfall: preferred site within the landfall search area; and • Offshore ECC (1,500 m): the area within which the export cable route and temporary works area (500 m buffer either side of ECC) are planned to be located.

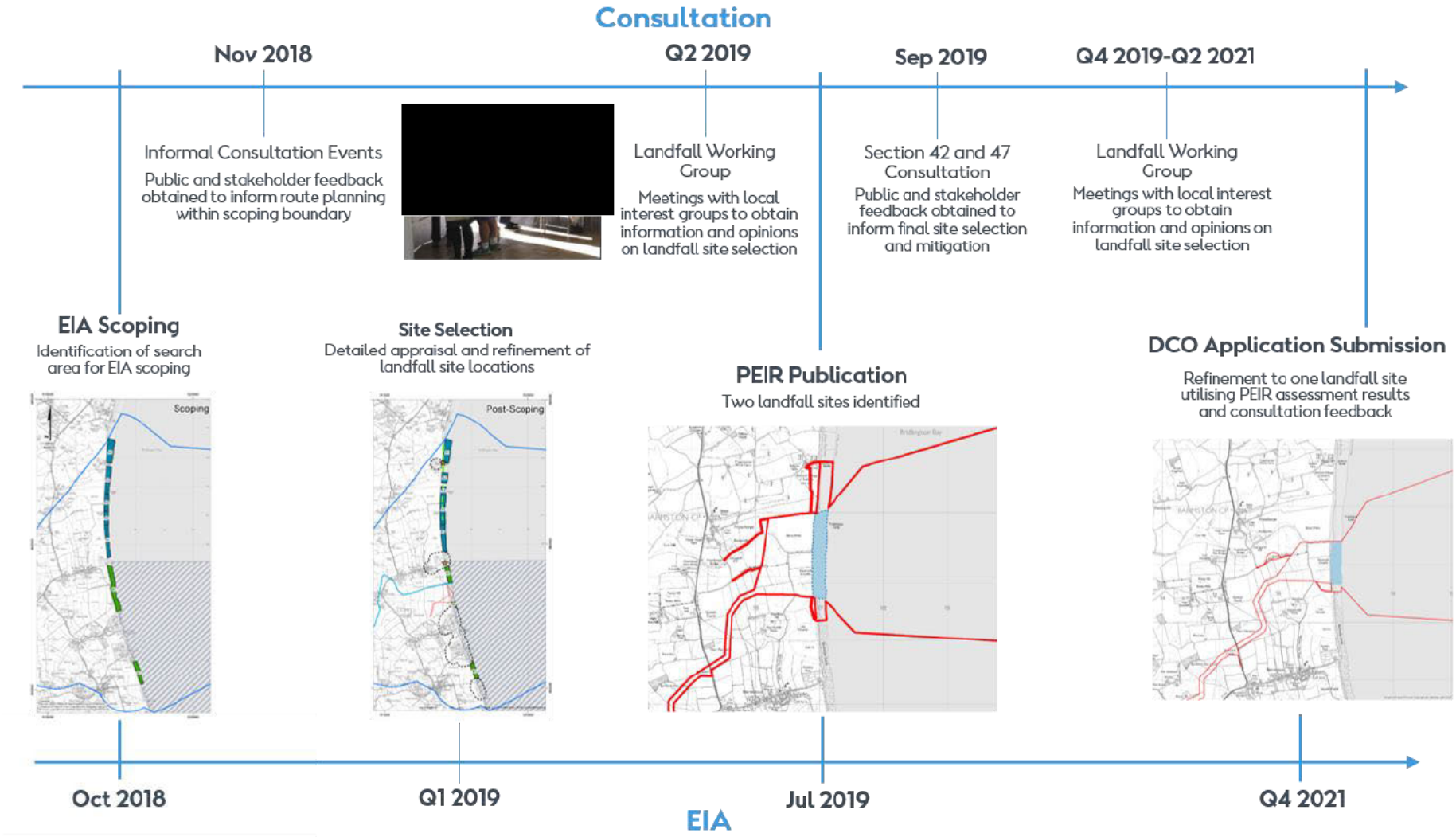


Figure 2: Landfall Site Selection Timeline.

1.2 Purpose of the Annex

1.2.1.1 This purpose of this annex is to document the decision making behind the refinement of the landfall since identification of the EISA up to submission of the Environmental Statement (ES). The offshore project element comprises all infrastructure seaward of the landfall (as shown in **Figure 1**). This Annex documents:

- Stage 3 – Identification of the Landfall.

1.2.1.2 Prior to submission of the ES, the Applicant has engaged with a range of stakeholders with regards to the progress of the project and emerging project design matters. Stakeholders that were consulted as part of the ongoing RPSS process, from project inception to DCO application submission, included:

- The Planning Inspectorate;
- East Riding of Yorkshire Council (ERYC);
- The Environment Agency;
- Natural England;
- Highways Agency;
- The Wildlife Trust;
- Landowners;
- Parish Councils;
- Seaside Caravan Park;
- The British Horse Society;
- Coastal and Intertidal Zone Archaeological Network (CITiZAN);
- East Riding Archaeological Society;
- Hornsea Sailing Club;
- North Eastern Inshore Fisheries and Conservation Authority (NEIFCA); and
- Members of the public at local information events held in East Riding and surrounds during October 2018 and at formal consultation events held in September 2019.

1.3 Project Elements

1.3.1.1 The Hornsea Four offshore electrical transmission system will consist of up to six export cables that will come ashore within a 1.5 km wide offshore ECC. At landfall, a maximum of 6 transition TJBs will connect the offshore and onshore export cables, to facilitate the transition from offshore to onshore.

2. Stage 3: Identification of the Landfall

2.1 Guiding Principles

2.1.1.1 The cable landfall point is the location at which the offshore ECC intersects with the coastline. The landfall covers the shallow approaches, the intertidal area, and the onshore route through to the transition jointing bay. The landfall installation techniques considered were either open-cut or HDD methods.

2.1.1.2 The general guiding principles for landfall site selection were to:

- select the shortest route (hence reduce environmental impacts by minimising footprint and electrical transmission losses (most efficient project));
- avoid key sensitive features where possible and where not, seek to mitigate impacts, supported by the following commitments:
  - **Co44:** The Holderness Inshore Marine Conservation Zone (MCZ) will not be crossed by the offshore export cable corridor including the associated temporary works area; and
  - **Co45:** The Holderness Offshore MCZ will not be crossed by the offshore export cable corridor including the associated temporary works area.
- minimise disruption to populated areas (built-up areas and associated buffer zones are illustrated in black hashed lines in Figure 3B), supported by the following commitments:
  - **Co49:** There will be no permanent High Voltage infrastructure installed above surface within 110 m of residential properties and sub surface infrastructure (including the onshore export cable) within 50 m of residential properties; and
  - **Co134:** Cable installation works at the landfall area will be located at least 200 m from residential receptors;
- find a site large enough to accommodate the connection technology outlined within the design envelope.

3. Version 1 – Defining the Landfall Study Area & Search Zones

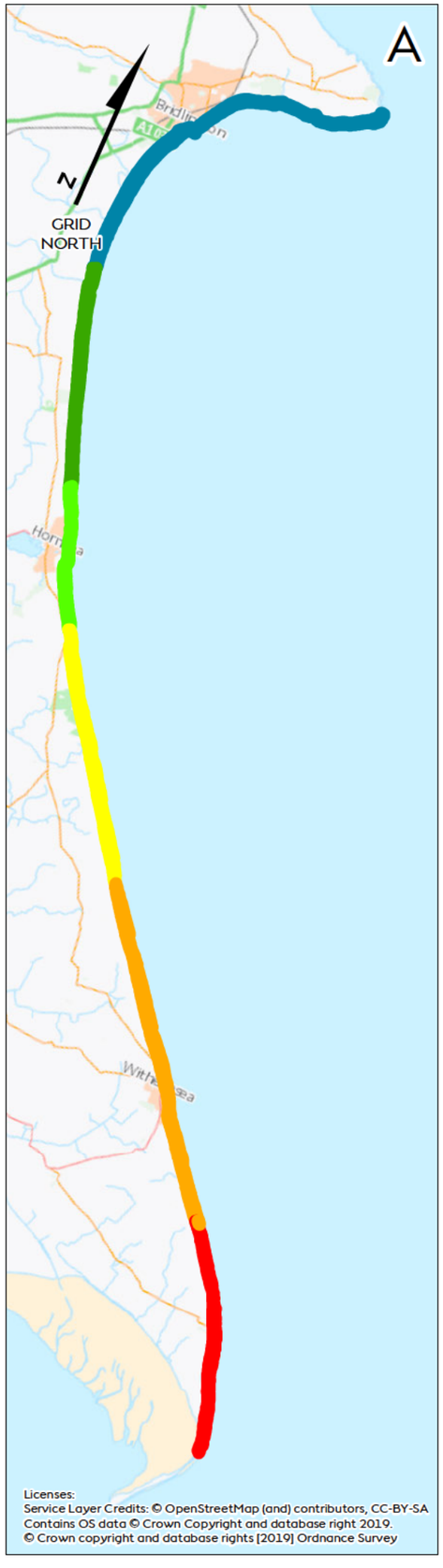
3.1.1.1 The landfall search extended from north of Spurn Head to just south of Bridlington, which was sub-divided into a series of zones. These high-level zones provided the start point for a focussed and detailed Desk Based Assessment (DBA) to aid landfall selection. It does not imply that all locations within the high-level zone were considered viable landfalls.

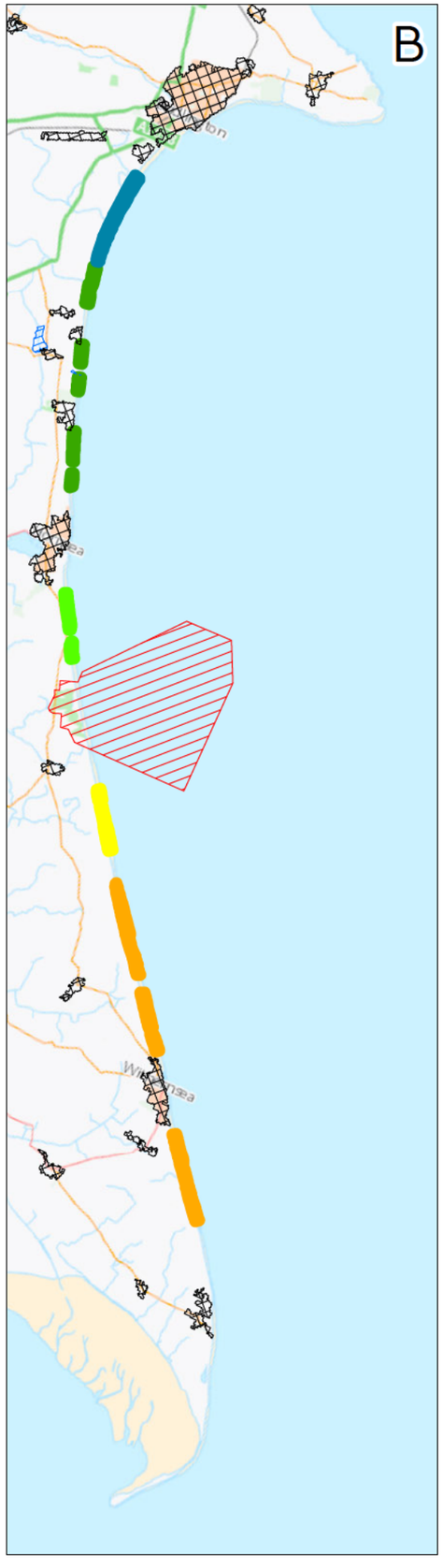
3.1.1.2 A polygon of the foreshore between Mean High Water (MHW) and Mean Low Water (MLW) was created for the coastline in the EISA. This polygon was divided into six zones based on similar geographic features listed below and illustrated in **Figure 3A**:

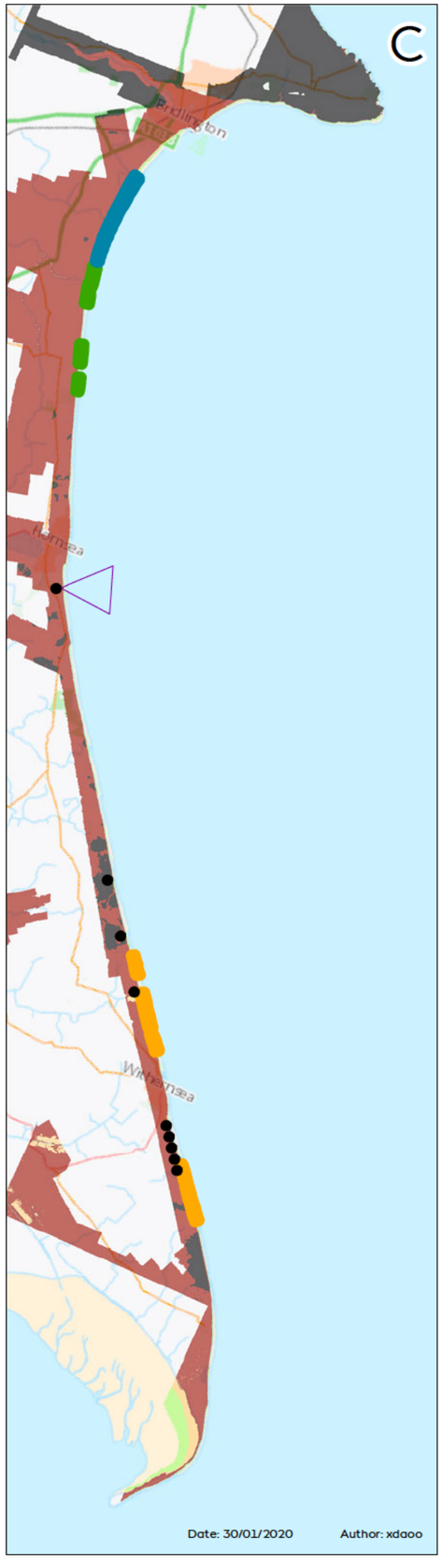
- Zone A is defined as the area between Flamborough Head and the northern extent of Dogger Bank's Creyke Beck Cable Corridor – depicted in blue in **Figure 3A**;
- Zone B consists of the area from the north boundary of Dogger Bank's Cable Corridor to the caravan park south of Atwick – depicted in dark green in **Figure 3A**;
- Zone C is the caravan park south of Atwick to the start of the residential area north of Mappleton – depicted in light green in **Figure 3A**;
- Zone D consists of the area from the north of Mappleton to the boundary between the Garton and Roos parish councils – depicted in yellow in **Figure 3A**;
- Zone E consists of the boundary between the Garton and Roos parish councils and the edge of the Dimlington Cliffs Site of Special Scientific Interest (SSSI) – depicted in orange in **Figure 3A**; and
- Zone F is from the northern extent of Dimlington Cliffs SSSI to Spurn Head – depicted in red in **Figure 3A**.

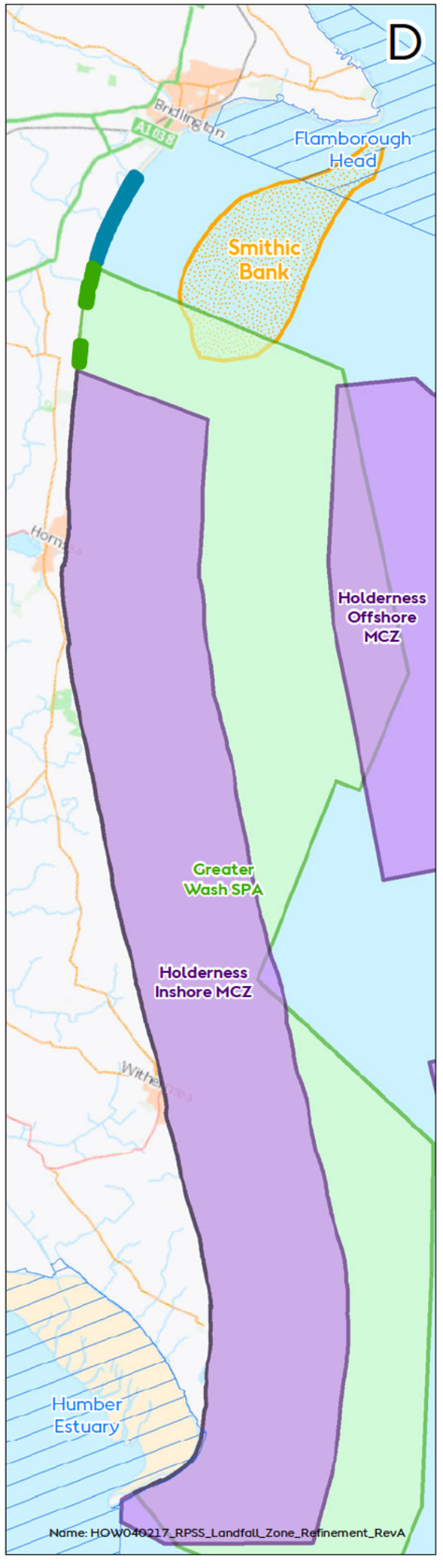
Hornsea Four

Figure 3
Version 1 – 3
Landfall Zone Refinement



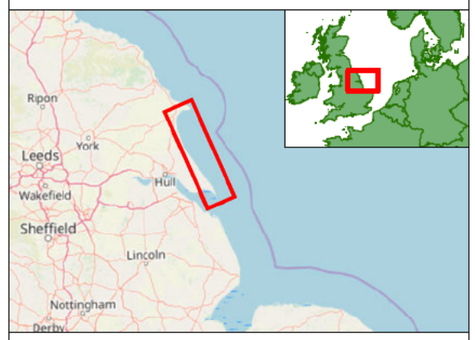






Military practice area
Built Up Area (2011 Census)
Danger Area (OS)
Landfall Zone A
Landfall Zone B
Landfall Zone C
Landfall Zone D
Landfall Zone E
Landfall Zone F
Erosion >3m/yr
(East Riding of Yorkshire Coastal Explorer)
Special Area of Conservation (SAC)
Marine Conservation Zone (MCZ)
Greater Wash Special Protection Area (SPA)
Smithic Bank

Cliff Height (Environment Agency 1m DTM)
<1m
1-5m
5-20m
>20m



Coordinate system: British National Grid
Scale@A3: 1:250,000

0 3 6 12 Kilometres
0 1.25 2.5 5 Nautical Miles

REV	REMARK	DATE
	First issue for PEIR	17/04/2019
A	Updated for DCO	23/01/2020

Landfall Zone Refinement
Document no: HOW040217
Created by: XDAOO
Checked by: JOHLE
Approved by: JULCA

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Date: 30/01/2020 Author: xdaoo

Name: HOW040217_RPSS_Landfall_Zone_Refinement_RevA

4. Version 2 - Initial Landfall Assessment

4.1.1.1 During the initial assessment phase, areas which posed extensive constraints to cable installation (e.g. by prohibiting or reducing the likely deliverability of a viable connection route) were excluded where these were readily discernible from available data. For example, extensive constraints are considered to be:

- Military practice areas;
- Danger areas;
- Areas where erosion is >3 m/yr;
- Areas with no feasible beach access within 2 km;
- Residential areas;
- Dredging areas; and
- Munitions dumps.

4.1.1.2 In addition, sections of the coastline that were immediately adjacent to residential areas, recreational areas (e.g. caravan parks), as well as areas with cliff heights of over 20 m were removed from consideration (see Figure 3B). This included Zone F in its entirety, which was unsuitable due to:

- Active cliffs of greater than 20 m height;
- Significant oil and gas infrastructure at Easington; and
- Environmental sensitivity of Spurn Head.

5. Analysis and Refinement of Coastal Landfall Options

5.1 BRAG Assessment

5.1.1.1 The remaining sections of Zones A - E were further divided into 23 sites, as shown in Figure 3B. Many of these sites were created organically when large areas were removed, following the initial landfall assessment, outlined in Section 4: Version 2 - Initial Landfall Assessment above). Sections that remained longer were split into approximately equal lengths, with boundaries based on geographical features such as field boundaries and rivers. The suitability of each of the 23 sites was determined through a Black, Red, Amber and Green (BRAG) appraisal. At a high-level, each category is defined in Table 3. The BRAG criteria was developed by the Applicant based on experience, with the definitions applied to black, red, amber and green applied consistently for both offshore and onshore infrastructure.

Table 3: BRAG Rating.

Rating	Summary
Black	Potential showstopper to development
Red	High potential to constrain development
Amber	Intermediate potential to constrain development
Green	Low potential to constrain development

5.1.1.2 Black and red constraints are critical in determining features that should be avoided wherever possible to avoid consenting risk, reduce EIA complexity and the need for mitigation. Amber and green constraints are those that may be more readily minimised or managed by employing appropriate mitigation measures. The key technical, consenting, and commercial risks areas are outlined below.

5.1.1.3 Technical Constraints:

- Nearshore and beach profile, coastal geology, and geomorphology e.g. distance to 10m depth contour for boat access; detrimental beach and seabed geology and sedimentology that could beach a vessel or bury/erode cables; presence of cliffs or eroding coast;
- Proximity to existing infrastructure e.g. existing cables, pipelines, outfalls, sub surface utilities and sea defences;
- Suitable access for construction vehicles and extent of suitable working/construction areas at HDD locations; and
- Proximity to residential areas which would limit working area or could potentially cause disturbance or require restrictive limits on construction activities.

5.1.1.4 Consenting Constraints:

- Proximity to designated sites of conservation interest (e.g. MCZ, SPA, SAC);
- Minimum disruption to important or rare features such as Habitats of principal importance (Section 41 of the 2006 Natural Environment and Rural Communities (NERC) Act) (reef or sandbank) and areas of commercial fishery importance (cockle/mussel beds etc);
- Proximity to existing infrastructure (as specified above);
- Interaction with recreation such as busy beaches, car parks or right of way/long distance trails;
- Proximity to residential areas (as specified above);
- Proximity to areas of cultural heritage (e.g. listed buildings, historical artefacts); and
- Proximity to surface water/floodplain and type of coastal protection measures.

5.1.1.5 Commercial constraints:

- Land acquisition requirements; and
- Proximity to sensitive stakeholders (e.g. cable crossings, fishing density).

6. Version 3 – Initial Landfall Zone Refinement

6.1.1.1 Based on the BRAG categories, a detailed analysis was undertaken to reduce the number of landfall options. The intention of this stage was to provide sufficient detail to enable meaningful engagement through Scoping and initial consultation with the public, whilst retaining sufficient flexibility for iterative refinement through consultation feedback and acquisition of site-specific information.

6.1.1.2 Each site was visited by a multi-disciplinary team of environmental and consenting specialists, construction and installation engineers and commercial managers to assess their viability from all perspectives (technical, site and land access, environmental and consents issues).

6.1.1.3 Following the site visits and initial review of each site against the BRAG criteria, zones B4, B5, C1, C2, C2x, D1, D2, D3, E1, E5, E6 and E7 were discounted due to technical constraints, leaving 13 sites under consideration, shown in **Figure 3C**.

6.1.1.4 The Holderness Inshore Marine Conservation Zone (MCZ) and Greater Wash Special Protected Area (SPA) represented significant constraints for Environment & Consents. The Holderness Inshore MCZ is located offshore along the coastline of East Riding of Yorkshire, including and south of landfall site B3, also covering zones C, D, E and F, illustrated in purple in **Figure 3D**. The Greater Wash SPA overlaps with the MCZ and extends further north, also encompassing landfall sites B1 and B2. An offshore ECC approaching sites B1 to E9 would therefore need to pass through the SPA and MCZ. In addition, an offshore ECC approaching sites including and north of B2 would pass through the (non-designated) sandbank feature Smithic Bank.

6.1.1.5 Since it is impossible to avoid all three areas, during the selection process the avoidance of designated sites was given the highest weighting, to support Natural England's Scoping Response in relation to the RPSS which stated, "*We advise that the cable route and infrastructure should avoid designated sites, including local designated sites, in the first instance.*" After consulting the current available guidelines (Natural England, 2019), the MCZ was classified as the top priority. This was a key factor, alongside significant technical constraints highlighted in **Table 4**, in discounting sites B3 to E9 from consideration. This is supported by the following commitment:

- **Co44:** The Holderness Inshore Marine Conservation Zone (MCZ) will not be crossed by the offshore export cable corridor including the associated temporary works area.

6.1.1.6 The rationale behind discounting landfall sites during Version 1 to Version 3 stages of refinement are summarised in **Table 4**.

Table 4: Initial Discounting Landfall Rationale.

Discounted Landfall Options	Rationale
B4, B5	Options discounted due to: • Very high and unstable cliffs (15 – 21 m); • Very long HDD length (850 – 1800m) would be required which cable specification may not allow for; • Location within the Greater Wash SPA; • ECC to these landfall sites would need to cross the Holderness Inshore MCZ; the project has committed to avoiding this designated site (Co44). • There is no access to the foreshore from these sites; and

Discounted Landfall Options	Rationale
	• Very close proximity to the village of Atwick.
C1, C2, C2x	Options discounted due to: • Very high and unstable cliffs of 16 – 19 m (C1), 6 – 19 m (C2) and 18 m (C2x) as illustrated in Plate 1; • Long HDD of up to 1800 m would be required at C1 and C2x; • High erosion rates at C1 and C2x of 2.61 m/yr and 2.5 m/yr respectively; • Space is limited for compound; • Location within the Greater Wash SPA; • Priority habitat (maritime cliff and slope); and • ECC to these landfall sites would need to cross the Holderness Inshore MCZ; the project has committed to avoiding this designated site (Co44).
D1, D2, D3, E1	Options discounted due to: • Sites are downdrift from Ministry of Defence (MoD) firing range; • Very high and unstable cliffs (14 – 25 m) requiring very long HDD route (up to 1800 m in length); • Location within the Greater Wash SPA; • ECC to these landfall sites would need to cross the Holderness Inshore MCZ; the project has committed to avoiding this designated site (Co44); and • D1 has a priority habitat (maritime cliff and slope) to the north of the landfall.
B3, E2, E3, E4, E5, E6, E7, E8, E9	Options discounted due to: • Medium to high unstable cliffs (heights ranging from 9 – 20 m); • Located within a priority habitat (maritime cliff and slope); and • ECC to these landfall sites would need to cross the Holderness Inshore MCZ; the project has committed to avoiding this designated site (Co44).
Zone F	Entire zone discounted due to: • Cliff heights >20 m; • Environmental designations; and • Oil and gas infrastructure at Easington.

Plate 1: High, unstable cliffs within the C2x landfall zone.

7. Version 4 – Study of Shortlisted Landfall Zones

7.1.1.1 For the next stage of refinement, the BRAG criteria were updated to improve the relevance and level of detail. For example, removing certain criteria that were no longer valid and making each category quantitative. The updated BRAG criteria are provided in Appendix A, Table 7. This allowed for the selection of two preferred landfall zones to be taken forward to PEIR.

7.2 Data Collection & Analysis

7.2.1.1 Additional desk-based studies and site visits were undertaken, focussing on the remaining seven areas. The purpose of the site visits was to look at possible access routes and potential locations for a construction compound. Desktop geotechnical data was also obtained for the shortlisted landfall sites.

7.2.1.2 Data acquired, such as drone footage and aerial photography, were utilised to aid the refinement. Feedback following public consultation events was also considered. Key areas of concern to the public included:

- "The Cow Shed" farm shop and café at Fraisthorpe Beach: busy amenity for tourists and locals within A1/A2 landfall area;
- Onshore windfarm: runs parallel to A1/A2 landfall sites;
- The Barmston main drain: runs through B1 landfall site;
- Sandy & silty land: adjacent to A1-A3 landfall sites;
- Potential conflict with Dogger Bank cables: encompassing A5 & B1 landfall site locations; and
- Densely populated areas: excluded in initial refinement.

7.2.1.3 Emerging risks from the second stage of desk-based research were the extensive World War II (WWII) artefacts, spanning South from Fraisthorpe Beach, and the UK Seaside Award/Rural Beach Seaside Award gained by Fraisthorpe and Barmston Beaches respectively (considered an emerging risk due to increased likelihood of objections by users of the beach).

7.3 Landfall Assessment Conclusions

7.3.1.1 **Appendix B - Landfall BRAG Assessment Table 7 - Table 10** provide the full BRAG assessment for the Version 4 stage of refinement and a summary for each landfall site is provided below.

Site A1

7.3.1.2 Site A1 was treated as a black constraint due to the high recreational value of Fraisthorpe Beach, popular with tourists and locals alike. Moreover, the discovery of WWII anti-invasion defences and presence of an onshore wind farm directly behind the landfall rendered this site undesirable from a technical perspective so site A1 was removed from consideration.

Sites A5 & B1

7.3.1.3 Updated information on the Dogger Bank Creyke Beck development indicated their proposed Offshore Cable Corridor encompassed both the A5 and B1 landfall site locations. This would pose difficulties, especially for offshore cable installation, as it is considered unfeasible to cross the cable in such shallow waters. The risk was therefore deemed too high, so sites A5 and B1 were discounted from further assessment.

Site B2

7.3.1.4 Site B2 presented a technically favourable site. It avoided the Dogger Bank offshore cable crossing and the sandbank feature Smithic Bank, had a good compound site location, excellent access and would render both offshore and onshore cable routes 2 km shorter. However, site B2 is located within the Greater Wash SPA and the compound location is very close to residential properties and Skipsea Primary School. Furthermore, the proposed landfall compound is situated within church land where it would be difficult to reach a commercial agreement. Following the commentary in **Paragraph 6.1.1.4**, during the

selection process, the avoidance of designated sites was given the highest priority. This was reflected by the avoidance of the Holderness Inshore MCZ in Version 3 of the landfall zone refinement. In Version 4 of the landfall zone refinement, the Greater Wash SPA was considered the next highest priority and was a key factor in discounting site B2. The combination of its location within a designated site and proximity to residential properties, meant that the disadvantages of the site significantly outweigh the advantages and so B2 was discounted from further assessment.

Site A2

7.3.1.5 Whilst site A2 was a reasonably favourable landfall location, it presented several disadvantages in particular:

- Unfavourable access (in comparison to other remaining sites);
- Onshore cable route constrained by onshore wind turbine inland from site;
- Close proximity to high amenity beach, therefore likely to cause greater public disruption; and
- Close proximity and high prevalence of WWII artefacts, therefore risk posed by sensitive stakeholders.

7.3.1.6 As such, A2 was deemed less favourable than the other remaining sites and was discounted from further assessment.

7.3.1.7 The rationales for discounting certain sites are summarised in **Table 5** and they key constraints associated are represented visually in **Figure 4**.

Table 5: Post-Scoping Discounting Landfall Rationale.

Discounted Landfall Options	Rationale
A1, A2	Within/neighbouring Fraisthorpe Beach: • UK Seaside Award; • Popular destination with tourists and locals; • Busy café (The Cow Shed Tearoom) and car park; and • "Active Coast" scheme promoting beach walking for health. Sites contain many WWII Artefacts: • Anti-tank concrete cubes/anti-invasion defences are still positioned in the sand; and • Promoted as a tourist attraction and point of cultural heritage. Onshore windfarm located directly behind the landfall Constraint for onshore cable route
A5, B1	Dogger Bank Creyke Beck offshore cable corridor borders both sites: • Considered unfeasible to cross cable in such shallow water. Caravan Park neighbours both sites: Sensitive stakeholders: tourists, residents, Barmston Beach (Rural Beach Seaside Award)
B2	• Nearby caravan parks and residential properties; • Access required through the village of Skipsea;

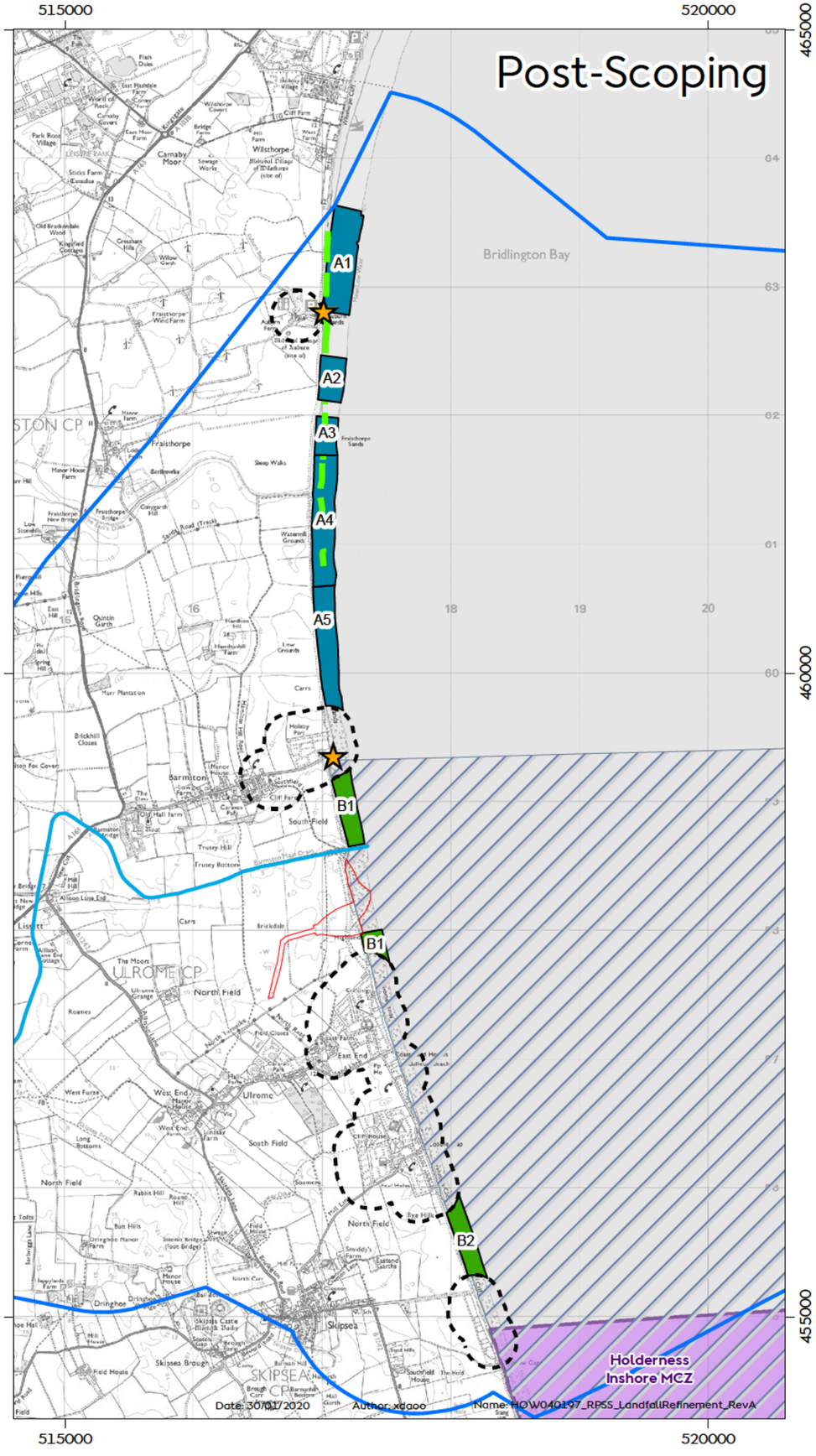
Discounted Landfall Options	Rationale
	• Located within the Greater Wash SPA; • Primary school present just inland of compound site; • Very high cliffs; potentially unstable due to high predicted erosion rate; and • Does not adjoin remaining landfalls; thus increasing project scope to progress geographically distinct sites. Landfall compound sited within church land where it will be difficult to reach a commercial agreement.

Hornsea Four

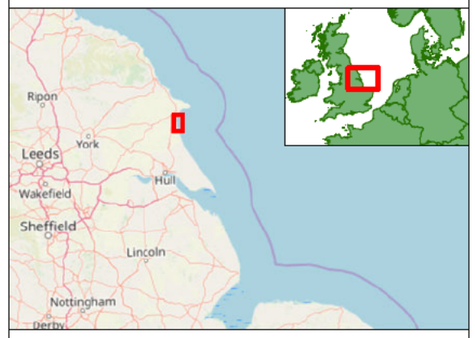
Figure 4
Post-Scoping
Landfall Refinement

Scoping

Post-Scoping



- Landfall Zone A
- Landfall Zone B
- Scoping Boundary
- Beach Award
- Barmston Main Drain
- 200m Residential Property Buffer
- WWII Artefacts
- Greater Wash SPA
- Indicative Creyke Beck A & B Permanent Land Take
- Marine Conservation Zone (MCZ)



Coordinate system: British National Grid
Scale@A3: 1:40,000

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0 0.25 0.5 1 Nautical Miles

REV	REMARK	DATE
	First issue for PEIR	17/04/2019
A	Updated for DCO	23/01/2020

Post-Scoping Landfall Refinement
Document no: HOW040197
Created by: XDAOO
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Approved by: JULCA

Ørsted

7.4 Preferred Landfall Options at PEIR

Sites A3 & A4

7.4.1.1 Following the above assessment, sites A3 and A4 were considered the most favourable from all perspectives (technical, commercial and consents). Some constraints remained, regarding access through the village of Fraisthorpe and historic artefacts, but these are generally considered to be low-risk and easily mitigated.

7.4.1.2 It was therefore concluded that sites A3 and A4 would be taken forward in the Version 4 stage of refinement, for submission as part of the PEIR. These preferred landfall sites are illustrated in **Figure 5**.

Hornsea Four

Figure 5

PEIR Landfall Site Selection

515000

520000

465000

460000

N

GRID NORTH

CARNABY CP

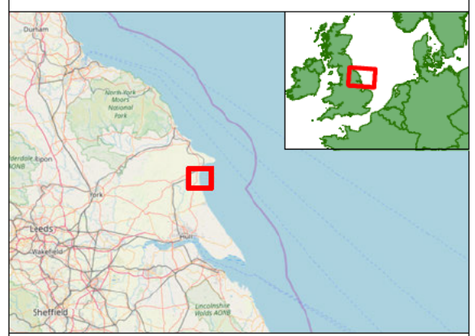
BARMSTON CP

BURTON AGNES CP

ULROME CP

Bridlington Bay

- PEIR Boundary
- Landfall Connection Works



Coordinate system: British National Grid

Scale@A3: 1:40,000

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0 0.25 0.5 1 Nautical Miles

REV	REMARK	DATE
	First issue for PEIR	22/05/2019
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Refined Landfall Zone
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Ørsted

Date: 09/11/2019 Author: xdaoo Name: HOW040196_RPSS_RefinedLandfallZone_RevA

8. Version 5 – Final Stage of Landfall Refinement

8.1 Overview

8.1.1.1 Following initial screenings, surveys and assessments, the landfall options were narrowed down to locations A3 and A4, both located South of Flamborough Head and north of the village of Barmston. The aim of the final stage of landfall refinement was to select one of the two remaining landfall options as the preferred site to be taken forward in the Hornsea Four DCO application. This selection process followed Statutory Consultation on the PEIR, with public information events held in Barmston, Lockington, Cottingham, and Foston in September 2019. Feedback from these events is outlined in **Volume B1, Annex 1.3: Applicant Regards to Section 47 Consultation Responses.** This included a preference for landfall option A4 (see consultation response ID P2_023_FF_003) which was a key consideration in informing the landfall site selection taken forward at DCO application.

8.2 Data Sources

8.2.1.1 Further site visits to the landfall were undertaken in May 2019 to aid Version 5 of the landfall site selection. The aim of the site visits was to verify the condition of the sites, gather local information and identify potential risks.

8.2.1.2 In addition to knowledge gained from site visits, a landfall evaluation was undertaken by in-house technical specialists utilising the following data:

- Aerial imagery from the Geographical Information System (GIS) base map and Google maps;
- National Oceanic and Atmospheric Administration (NOAA) charts; and
- A Geotechnical Desk Study Report and Feasibility Assessment of Hornsea Four Landfall.

8.2.1.3 The Geotechnical Desk Study assessed the potential geotechnical constraints and geohazards within the proposed landfall areas. The key information and data sources that were consulted included:

- Published academic literature;
- Geological maps;
- Borehole logs from nearby ground investigation projects, obtained from the British Geological Survey (BGS) GeoIndex System;
- Previous ground investigation reports, undertaken between 1987 and 2012, to understand the geology and geotechnical parameters across study area;
- Historical maps to understand the geological and archaeological history of the area e.g. glacial history and villages lost/abandoned from erosion; and
- WWI and WWII military coastal defence works present along the Holderness Coast.

8.2.1.4 Key findings of the technical landfall evaluation, alongside environmental and commercial considerations, are detailed in **Section 8.3**.

8.3 Landfall Assessment

8.3.1.1 A study of the geology and intertidal marine conditions of landfall sites A3 and A4 found little difference between the two sites, given their close proximity. The key differences between landfall sites are therefore driven by onshore considerations, primarily access and social factors, which are detailed below and used to inform the final site selection.

8.3.2 Northern Landfall (A3)

8.3.2.1 The beach of northern landfall (site A3) is located approximately 1.4 km East of Fraisthorpe whilst the proposed compound area is approximately 34 ha. The field which the compound will be located on is mainly flat and is currently being used for growing crops.

Access

8.3.2.2 In order to access the A3 landfall site, traffic would need to traverse across The Earl's Dyke. The site visit found that the existing bridge across The Earl's Dyke is only four metres wide and in a damaged condition, as illustrated in Plate 2 and Figure 6. A transport assessment of the bridge would therefore be required to better understand its suitability for heavy construction traffic.

Plate 2: Existing Bridge across The Earl's Dyke.

8.3.2.3 The last section of the proposed access route is unpaved and is likely to require widening and resurfacing prior to construction works. There are no existing networks that connect to

the beach for site A3, so a new 950 m temporary access track would be required to be constructed.

8.3.2.4 These factors render A3 an unpreferable option from the perspective of access and further assessments would need to take place to ensure a suitable route for construction traffic.

8.3.2.5 It is noted that construction traffic would pass to the south of the village of Fraisthorpe. To mitigate against any potential disruption, the project has made a number of commitments outlined in **Volume A4, Annex 5.2: Commitments Register**. The key commitments in relation to traffic and transport near the landfall are as follows:

- **Co144:** A Construction Traffic Management Plan (CTMP) will be developed (secured via DCO Requirement18) in accordance with the outline CTMP (which forms appendix F of **Volume F2, Chapter 2: Outline Code of Construction Practice**). The CTMP will set standards and procedures for:
  1. Managing the numbers and routing of HGVs during the construction phase;
  2. Managing the movement of employee traffic during the construction phase;
  3. Details of localised road improvements necessary to facilitate safe use of the existing road network; and
  4. Details of measures to manage the safe passage of HGV traffic via the local highway network.
- **Co62:** Temporary access points off the highway will be installed to facilitate vehicular access from the road, and into the onshore cable corridor during construction. The access points will be constructed in line with the local authorities' requirements, relevant appropriate standards and in accordance with the principles established in the Outline Construction Traffic and Travel Management Plan.

Social

8.3.2.6 Landfall site A3 is close to a popular café called "The Cow Shed", highlighted in **Figure 6**, which is popular with tourists and locals alike. Similarly, the neighbouring car park is usually very busy. The proposed route to access the beach for the A3 landfall site would require construction traffic to use the same road which leads to the café and car park.

8.3.2.7 During the formal consultation events held in September 2019, feedback was received from local residents regarding the selection of the landfall site. Their preference was for the site to be located as far as possible from The Cow Shed café. Further details are outlined in **Volume B1, Chapter 1: Consultation Report**.

8.3.2.8 In addition, the beach and nearby footpaths are frequently used for leisure activities including dog-walking and horse-riding by the local public and visitors to the area.

8.3.2.9 Given that this site is of high value to the local community, it would be an unfavourable option.

Hornsea Four

Figure 6

Post PEIR Landfall Site Assessment

Steep cliffs at access to beach

Close to popular café "The Cow Shed" and busy Car Park

Relatively flat field

Existing bridge across Earl's Dyke in bad condition

Heritage assets

Heritage assets

Undulating terrain over field

Direct access to landfall via existing Sands Road, in good condition

Lower cliff height at access to beach

516000

518000

462000

460000

Auburn Farm

Auburn Sands

Medieval Village of Auburn (site of)

Mean High

Mean Low

Fraisthorpe Sands

Sheep Walks

Earthworks

Manor House Farm

Fraisthorpe Bridge

Conygarth Hill

The Earl's Dyke

Sands Road (Track)

Watermill Grounds

Hamilton Hill

Hamiltonhill Farm

Low Grounds

Carrs

Marr Plantation

GRID NORTH

Order Limits

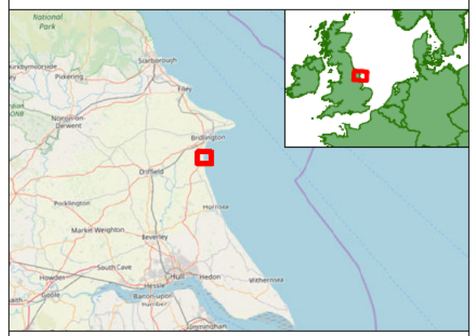
PEIR Boundary

WWII Artefacts

EA LiDAR DSM (mAOD)

High : 86.314

Low : -3.243



Coordinate system: British National Grid

Scale@A3: 1:12,500

0 125 250 500 Meters

0 500 1,000 2,000 Feet

REV	REMARK	DATE
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Post PEIR Landfall Site Assessment
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Approved by: JULCA

Ørsted

Date: 11/11/2019 Author: xdaoo Name: HOW040307_Post_PEIR_LandfallSiteAssessment

8.3.3 Southern Landfall (A4)

8.3.3.1 The beach southern landfall (site A4) is located approximately 1.7 km Southeast of Fraisthorpe whilst the proposed compound area is approximately 27 ha. The proposed field for the compound location is mainly flat, rising towards the coast and is currently being used for growing crops.

Access

8.3.3.2 Landfall site A4 can be accessed via an existing track known as Sands Road, which runs directly from the main road network, as illustrated in **Figure 6**.

8.3.3.3 The first 600 m of the access road is paved and wide enough for construction traffic, as illustrated in **Plate 3**. Further along, some parts of the proposed access track will need minor realignment where there are bends in the road, to allow wider vehicles to pass a small outbuilding. There is also a small private bridge which requires some repair work before construction traffic can pass over.

8.3.3.4 The site visit identified a suitable access route to the beach, where there is a section of low cliffs amongst the steeper elevation. This lies closer to the landfall site, allowing machines and equipment to be easily transported.

8.3.3.5 Landfall site A4 is easily accessible from the existing road network. Overall, the proposed access route is in relatively good condition, with minor repairs and widening required for construction traffic. Whilst the road may need some regrading or additional stone cover, this is considered to be minor in comparison to the construction of a new temporary access track which would be required at landfall site A3. From the perspective of access, landfall site A3 is therefore considered to be the favoured option.

Plate 3: First part of proposed access road.

Social

8.3.3.6 The beach at landfall A4 is also frequently used by local residents and visitors to the area for recreational activities, primarily walking and horse riding. However, the Southern landfall is further from The Cow Shed café, so the beach is less populated compared to the northern landfall option (A3). For this reason, it is preferred from a social perspective.

8.3.4 Additional Considerations

Heritage Assets

8.3.4.1 The site visits highlighted an abundance of artefacts from WWII across both landfall sites A3 and A4, as illustrated in **Figure 6**. In particular, the anti-tank concrete blocks which were used as a defence mechanism, as illustrated in **Plate 4** and **Plate 5**.

8.3.4.2 To ensure these assets are treated appropriately, they have been discussed with interested parties during the Landfall Working Groups and the Evidence Plan Process.

8.3.4.3 The following commitment has also been made:

- **Co198** An Enhancement Strategy will be developed in accordance with the Outline Enhancement Strategy. The Outline Enhancement Strategy will include proposed measures to provide enhancement. Proposed enhancement measures include but are not limited to; provision of historic signage at landfall; improvements to PRoWs; wider biodiversity, hydrological and social enhancement measures across the onshore Order Limits.

Plate 4: Concrete blocks on the beach of the A3 landfall site.

Plate 5: Concrete blocks on the beach of the A4 landfall site.

Coastal Erosion

8.3.4.4 A key finding of the site visits was high and steep cliffs with substantial erosion at both landfall sites A3 and A4, as illustrated in **Plate 6**.

Plate 6: Cliffs at the beach of landfall site A3.

8.3.4.5 Coastal erosion is a known feature of the Holderness Coastline and was raised in feedback from the formal consultation events held in September 2019, as detailed in **Volume B1, Chapter 1: Consultation Report**. This has therefore been a key consideration in determining the appropriate site for landfall.

8.3.4.6 During the assessment, open-cut installation was deemed unfeasible for both A3 and A4 landfall sites due to the high cliffs and substantial erosion. This is reflected in the following commitment:

- **Co187:** The installation of the offshore export cables at landfall will be undertaken by Horizontal Directional Drilling or other trenchless methods.

8.3.4.7 ERYC have produced average cliff erosion monitoring rates in metres per year for over one hundred designated points along the East Yorkshire Coast (East Riding of Yorkshire Council, 2013).

8.3.4.8 The landfall sites under assessment encompass erosion profile locations 14 (North of Earl's Dyke, Barmston), 15 (South of Earl's Dyke, Barmston) and 16 (Within Watermill Grounds to the north of Barmston) (East Riding of Yorkshire Council, n.d.). Of these locations, location 16 has the highest average cliff erosion rate of 1.64 m/yr, with locations 14 and 15 having slightly lower values of 1.52 m/yr and 1.50 m/yr respectively (East Riding of Yorkshire Council, 2013). Historic values from 1852 to 1989 were also illustrated by ERYC but were considerably lower at 0.71 - 0.95 m/yr for locations 14-16 (East Riding of Yorkshire Council, n.d.). Therefore, the average cliff erosion rate of 1.6 m/yr from location 16 for the most recent years (1989 – 2015) was considered in our assessment as a conservative estimate.

8.3.4.9 In order to calculate the preferred location for the compound site, a 50 year erosion value was assigned for the proposed construction and operational lifetime of the windfarm, which is longer than the expected overall life of the windfarm, allowing for a buffer.

8.3.4.10 Additionally, the annual erosion rate of 1.6 m/year and a 50 year cumulative erosion value of 80 m was used to preliminary indicate where the HDD drill will reach its lowest point of between of 15 – 20 m below ground level. Due to the long radius curvature of the HDD drill from the drill entry location to the deepest point, the anticipated drill entry location is preliminary assessed to be some 200 – 250 m from the cliff edge. As the offshore cables will be installed within the HDD ducts at approximately 2 m at this point and based on existing annual erosion rates, it would be expected that a time duration of between 125 and 156 years would be required to pass before the cables would be likely to become exposed due to the effects of cliff erosion.

8.3.4.11 With the above considerations taken into account, sufficient protection against erosion and the effects of climate change has been allowed for within our landfall design.

8.3.5 Comparison between A3 and A4

8.3.5.1 **Table 6** summarises the key advantages and disadvantages of each landfall site, determined during the landfall assessment. These key factors are also illustrated visually in **Figure 6**.

Table 6: Advantages and Disadvantages of Landfall Sites A3 and A4.

Landfall Site	Advantages	Disadvantages
A3 (Northern Landfall)	• Large, flat compound field; • Greater flexibility in locating of compound within field; and • No WWII artefacts at compound location.	• Poor access - route would need to cross The Earl's Dyke – existing bridge in poor condition; • New, long temporary access tracks would need to be constructed; • Construction traffic would pass closer to the village of Fraisthorpe; • Beach would need to be accessed via existing road that leads to the popular Cow Shed café and beach car park; • Closer proximity to public interface at café and beach car park, effecting beach users and businesses; and • Further from OnSS - approximately 400 m of additional onshore cable route.
A4 (Southern Landfall)	• Good access from existing road network (paved and wide enough for construction traffic); • Better beach access - beach is less crowded with tourists as further from The Cow Shed Café and beach car park; • Shorter beach access temporary track where cliffs are lower in height; • Closer to OnSS so shorter route for onshore export cables; and • Deeper depth means HDD ducts are less susceptible to erosion effects due to longer radius.	• More undulating compound field; • Existing WWII artefacts within compound field; • Less flexibility in compound placement within field; and • Private bridge on access road would require repairs.

8.4 Final Selection

8.4.1.1 Based on the above assessment, the southern landfall option (A4) was selected as the preferred landfall site. This decision was influenced by three key factors:

- Better access from existing road network, avoiding Fraisthorpe Bridge and the need for the construction of a new, long temporary access road;
- Better beach access, away from key public amenities, avoiding heavily congested commercial and public traffic at Fraisthorpe beach; and
- Shorter onshore cable route, avoiding the crossing of The Earl's Dyke.

8.4.1.2 The final landfall site to be taken forward in the DCO application is illustrated in Figure 7.

Hornsea Four

Figure 7

DCO Landfall Site Selection

515000

520000

465000

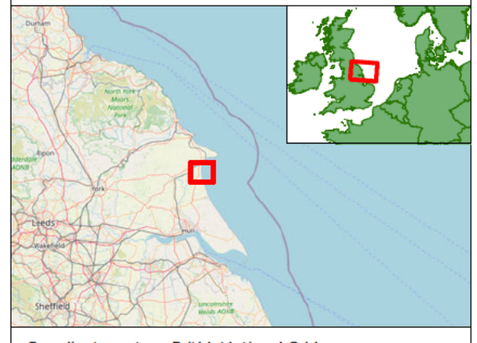
460000

N

GRID NORTH

Order Limits

Landfall Connection Works



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0 0.25 0.5 1 Nautical Miles

REV	REMARK	DATE
	First issue for DCO	17/02/2021

DCO Landfall Site Selection
Document no: HOW040308
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Ørsted

Date: 17/02/2021 Author: XDAOO Name: Figure 7 - HOW040308_DCO_Landfall Site Selection

9. Conclusion and Next Steps

9.1.1.1 Stage 3 of the RPSS (identification of the landfall) sought to identify the appropriate landfall area that will be required for Hornsea Four. The refinement process comprised of the following 5 stages:

- Version 1 – Defining the Landfall Study Area & Search Zones;
- Version 2 – Initial Landfall Assessment;
- Version 3 – Initial Landfall Zone Refinement;
- Version 4 – Study of Shortlisted Landfall Zones; and
- Version 5 – Final Stage of Landfall Refinement.

9.1.1.2 At each stage, the landfall areas were assessed with the studies becoming more detailed with each version of the refinement.

9.1.1.3 The final landfall option presented in **Figure 7** (comprising Site A4) has been derived through a combination of physical, commercial, and environmental considerations, balanced alongside technical feasibility. Decisions have been made by a multi-disciplinary team, taking into consideration formal consultation feedback as well as detailed site visits and desktop studies.

9.1.1.4 The Applicant has selected one stretch of the Holderness coastline for the landfall of the offshore export cables, with a total length of 0.7 km from North to South, to be taken forward in the DCO application. Refinement of the landfall at this stage ensures the EIA and DCO application remains on track as well as establishing a focussed area for onshore and nearshore geophysical and geotechnical surveys to be undertaken. These detailed site investigations will determine the exact locations where the cables will eventually make landfall.

10. References

East Riding of Yorkshire Council (2013). *Cliff Erosion Rates* [Online] Available at: https://www.eastriding.gov.uk/coastalexplorer/pdf/Erosion%20Band%20Values%20April%202013.pdf [Accessed 8 November 2019].

East Riding of Yorkshire Council (n.d.). *Cliff Erosion Data Table* [Online] Available at: https://www.eastriding.gov.uk/coastalexplorer/pdf/Cliff_erosion_data_table.pdf [Accessed 8 November 2019].

Natural England (2019) *Holderness Inshore MCZ Advice on Operations* [Online] Available at: https://designatedsites.naturalengland.org.uk/Marine/FAPMatrix.aspx?SiteCode=UKMCZ0035&SiteName=&SiteNameDisplay=Holderness+Inshore+MCZ&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality= [Accessed 31 January 2020].

Appendix A – Landfall Constraints Appraisal Criteria

Table 7: Landfall BRAG appraisal criteria for technical, environmental and commercial constraints.

Type of Constraint	Constraint	Black	Red	Amber	Green
Technical	Cliff height	>20 m	5 – 20 m	1 – 5 m (open cut still possible)	No cliffs
	Open Cut/HDD Possible	Neither	HDD Only	Open Cut Only	Both
	Geology	n/a	Rock	Soft clay and loose sand	Firm - v. stiff clay & medium dense - v. dense sand
	Distance to 10m Depth Contour	n/a	> 5 km	1.5 – 5 km	<1.5 km
	Presence of sea defences	Sheet piles >15 m	Sheet piles	Seawall / Large Dunes	Clear beach
	HDD Drill Length	> 2 km	1 – 2 km	500 – 1000 m	< 500 m
	Space for onshore compound (200 x 100m min)	No	n/a	n/a	Yes
	Space available for duct welding and stringing	n/a	No	n/a	Yes
	Beach Access	No feasible beach access within 2 km	Bridging sea defences	Within 2 km	Direct access within 500 m
	Compound Access	No feasible access to compound	New roads/tracks required	Minor trackway upgrades	Suitable pre-existing access direct to compound
	Length of intertidal	n/a	>2 km	500m – 2 km	< 500 m
	Nearshore obstacles	Dredging areas, munitions dumps	Wrecks, UXOs, 2 or more obstacles	2 obstacles, high fishing density	None
	Shoreline Topology	n/a	>12 degree slope	> 8 degree slope	Flat / Gentle Slope
	Nearshore seabed characteristics	n/a	Hard substrate, extensive rocky outcrops, very stiff clays	Intermediate, soft clays etc	Sandy bed, gravels

Type of Constraint	Constraint	Black	Red	Amber	Green
	Geohazards (erosion)	> 3 m/yr	Less than 3 m/yr	Less than 2 m/yr	Less than 1 m/yr
Environmental and Consenting	Nature conservation	Within internationally or nationally protected habitat/species: - MCZ; - SSSI Units (dependent upon condition).	Within 2 km of internationally or nationally protected habitat/species: - SPA/SAC/Site of Community Importance (SCI); - MCZ; - Priority Habitats; - Biodiversity Action Plan (BAP) habitats; - SSSI Units.	Within 5 km of internationally or nationally protected habitat/species: - SPA/SAC/SCI; - MCZ; - Priority Habitats; - BAP habitats; - SSSI Units.	> 5 km from internationally or nationally protected habitat/species: - SPA/SAC/SCI; - MCZ; - Priority Habitats; - BAP habitats; - SSSI Units.
	Coastal Protection measures	Area defined as "Hold the Line" in Shoreline Management Plan (SMP)	Area defined as "Advance the Line" in SMP	Area defined as "Managed Realignment" in SMP	Area defined as "No Active Intervention" in SMP
	Surface water & floodplain	Development boundary overlaps with main river designated as feature of European/National SCI	Main river crossing or main drainage system within 10 0m	Within 100 –200 m of a main river crossing or main drainage system	>200 m of main river crossing or main drainage system
	Proximity to residential area	<50 m from residential properties	> 50 m and <200 m from residential properties	200– 500 m from residential properties	Residential properties >500 m
	Historic Environment	<50 m from Listed Building or HER	>50 m and <200 m from Listed Building or HER	200 m – 500 m from Listed Building or HER	>500 m from Listed Building or HER
	Cultural heritage	<50 m of cultural heritage assets (anti-tank posts)	>50 m and <200 m of cultural heritage assets (anti-tank posts).	200 m – 500 m from cultural heritage assets (anti-tank posts).	>500 m from cultural heritage assets (anti-tank posts).
	Amenity and recreation	Within Blueflag beach/UK seaside award/tourist area/facilities (subject to seasonality)	>50 m and <200 m from Blueflag beach/UK seaside award/tourist area/facilities within close	Within 200 m – 500 m of Blueflag beach/tourist area/facilities within	>500 m of Blueflag beach/UK seaside award/tourist area/facilities within

Type of Constraint	Constraint	Black	Red	Amber	Green
			proximity (200 m) (subject to seasonality).	proximity (none within 500 m) (subject to seasonality).	proximity (none within 1000 m) (subject to seasonality).
	Planning Applications	Within planning application area that is approved or pending consideration.	>50 m and <200 m of planning application area that is approved or pending consideration.	>200 m and <500 m of planning application area that is approved or pending consideration.	>500 m of planning application area that is approved or pending consideration.
Commercial	Electrical export cable	n/a	Agreement for crossing of an electrical export cable (or Offshore Transmission Owner (OFTO) AfL/Lease area) is likely to be required as landfall site coincides with another project's landfall (note: this classifies as red as not only the agreement for crossing is required, but also buy-in from The Crown Estate (TCE) to grant us an OFTO AfL with such an overlap with another project's OFTO AfL).	Agreement for proximity to an electrical export cable (or OFTO AfL/Lease area) is likely to be required as landfall site is proximate another project's landfall	No proximity or crossing to an electrical export cable (or OFTO AfL/Lease area).
	Static fishing density	n/a	Centre for Environment, Fisheries and Aquaculture Science (CEFAS) and Inshore Fisheries and Conservation Authorities (IFCA): > 0.1 static gear Sightings Per Unit of surveillance Effort (SPUE)	CEFAS and IFCA static gear sightings: 0.026 – 0.1 SPUE	CEFAS and IFCA static gear sightings: < 0.025 SPUE

Type of Constraint	Constraint	Black	Red	Amber	Green
	Disturbance	Permanent disturbance/loss of use to homes or businesses.	Highly urbanised location likely to significantly impact/temporary close businesses and significantly impact local residents.	Some impact expected to nearby residential properties and/or businesses.	Rural location with little to no impact expected to any nearby properties and/or businesses.
	Voluntary agreement	Case for Compulsory Purchase Order (CPO) cannot, on objective grounds, be justified given impact on private interests, special category land, and/or human rights.	Case for CPO justified, but challenging considering significant impact on private interests, special category land, and/or human rights.	Case for CPO likely to be justified, but problematic, considering impact on private interests, special category land, and/or human rights.	Case for CPO likely to be justified and non-problematic, considering negligible impact on private interests, special category land, and/or human rights.
	Utilities	n/a	Significant presence of utilities and pipelines with a significant impact expected to cable placement and landfall.	Some utilities and pipelines present with some impact to cable placement and landfall.	Few utilities present with very limited impact to cable placement and landfall.
	Ownership	n/a	Inalienable land and Crown Land (excluding TCE) own the landfall site = land which cannot be CPO'd such as National Trust, Government Departments such as MoD etc.	Small landholdings likely to require multiple agreements to cover landfall site.	Large landholdings likely to be within private ownership.
	Access to landfall	n/a	Significant distance from nearest public highway (>3 km) & wider road network is extremely poor with significant upgrades needed with significant impact expected to	Long distance from suitable public highway (1 –3 km) with significant upgrades to permanent/temporary tracks required along private land with minor impact to landowners	Access to suitable public highway nearby (<1 km) without significant upgrades to permanent/temporary tracks required & little or no temporary passing

Type of Constraint	Constraint	Black	Red	Amber	Green
			landowners being able to conduct their business.	conducting their & a limited number of temporary passing places likely on the wider road network.	places required on wider road network.
	Public access	n/a	Popular seaside destination with lots of open public space which is highly likely to cause significant issues in the test for CPO.	Site likely to be frequently accessed by public but minor impact expected to public areas.	Infrequent or no public access to beach/landfall site with little impact to public access expected.
	Development	n/a	Indicative development potential: Significant development potential.	Indicative development potential: Minor development potential.	Indicative development potential: land is highly unlikely to be developed in the foreseeable future.
	Connection to Grid	n/a	Considerable onshore cable connection required to connect to grid.	Reasonable length onshore cable connection required (>10 km <60 km) to connect to grid.	Short onshore cable connection required (<10 km) to connect to grid.

Appendix B - Landfall BRAG Assessment

Table 8: Landfall BRAG assessment for sites A1 and A2.

Constraint		Zone A1	Zone A2
Technical Review	Cliff height Geology Distance to 10 m Depth Contour Presence of sea defences HDD Drill Length Space for onshore compound (200 x 100 m min) Space available for duct welding and stringing Beach Access Compound Access Length of intertidal	• Low cliffs (8 m) for large area of section enabling possibilities for open cut solution; • Open field ranging several hundred meters back from cliff, enabling TJB for both HDD or open cut beyond the 25-year erosion line; • No sea defence installed, except a few minor concrete blocks on the beach; • Flexibility in area for positioning both compound and TJB; • Direct access to beach possible along existing track; • Average erosion is 0.62 m/yr, compound would have to be at least 17 5m back from the cliff; • Compound located in agricultural field, access through Fraisthorpe along existing road (Suitability of the road (two sharp bends) requires assessment and the coastal bridge to be checked for weight restrictions). A TJB alternative access track (660 m) could be achieved around buildings to the west and would avoid the coastal interface and bridge. Access can be built directly from A165 as an option to avoid Fraisthorpe if required. Access through Fraisthorpe will need to be checked; • OS intertidal is 150 m wide; • Approximately 8 km to the 10 m depth contour offshore. 3 km offshore is a disused spoil ground marked by a west cardinal buoy; • 1500 m drill shot would go past the 5 m depth contour;	• Low cliffs (6-8 m) for large area of section enabling possibilities for open cut solution; • Sheet piling and open cut to be considered; • Open field ranging several hundred meters back from cliff, enabling TJB for both HDD or open cut beyond the 25-year erosion line; • No sea defences; • Some indication of weak/unstable cliffs due to farm drainage; • Flexibility in area for positioning both compound and TJB; • Direct access to beach possible along existing track; • Average erosion is 0.38 m/yr, compound would have to be at least 170 m back from the cliff; • Compound located in agricultural field, access through Fraisthorpe along existing road, additional track required (220 m) off the road to access the compound. Access can be built directly from A165 as an option to avoid Fraisthorpe if required; • OS intertidal is approx. 200 m; • Approximately 8 km to 10 m depth contour, offshore route will pass very close to west cardinal mark; • 1500 m drill shot would go past the 5 m depth contour; • No nearshore bathymetry is available to asses' ability for vessels/barges to ground out for shore pull operations;

Constraint		Zone A1	Zone A2
	Nearshore obstacles Shoreline Topology Nearshore seabed characteristics Geohazards (erosion)	• No nearshore bathymetry is available to assess ability for vessels/barges to ground out for shore operations; • Area is known for high couler numbers on surface and until otherwise confirmed, it has been assumed that vessels/barges shall be afloat during operations; • Based on 25-year erosion line, Closest Point of Approach (CPA) with a fully loaded barge (3 m) by 2 m draught and 1 m Under Keel Clearance (UKC), the safe point of installation at MLWS would be at a 800 m minimum distance to TJB; and • Similarly, the CPA for a fully loaded Dynamic Positioning (DP) vessel (7 m + 2 m UKC) the safe point of installation at MLWS would be at a 1700 m minimum distance to TJB.	• Area is known for high boulder numbers on surface and until otherwise confirmed, it has been assumed that vessels/barges shall be afloat during operations; • Based on 25-year erosion line, Closest Point of Approach (CPA) with a fully loaded barge (3 m) by 2 m draught and 1 m UKC, the safe point of installation at MLWS would be at an 800 m minimum distance to TJB; and • Similar, the CPA for a fully loaded DP vessel (7 m + 2 m UKC) the safe point of installation at MLWS would be at a 1700 m minimum distance to TJB.
Environmental Review	Nature conservation	• Around 4 km from the A1 compound to the boundary of Flamborough Head SAC to the North and SPA to the South; • Sensitive bird area, Royal Society for the Protection of Birds (RSPB) vested interest (Flamborough Head), sensitive stakeholders; and • Within impact risk zone of Flamborough Head SSSI.	Outside of protected area boundary.

Constraint		Zone A1	Zone A2
	Coastal Protection measures	Area defined as "no active intervention" in SMP.	Area defined as "no active intervention in SMP. N.B. - Scattered remains of groynes and other shore parallel wooden revetment in various stages of degradation
	Surface water + floodplain	None identified	None identified
	Proximity to residential area	Small number of residential properties to the immediate north (first property ~0.5 km from proposed compound, additional properties ~0.8 km from proposed compound) and a farmyard, Auburn farmhouse, and café to the south (~ 0.4 km away).	Medieval village of Auburn located ~900 m from proposed compound.
	Historic Environment	• Medieval village of Auburn ~300 m from proposed compound; • Listed Buildings (St Edmunds Church ~ 2 km from proposed compound).	• Medieval village of Auburn located ~900 m from proposed landfall compound; • Listed Buildings (St Edmunds Church and Manor Farmhouse located approximately 1.5 km from proposed compound).
	Cultural heritage	A1 landfall site is within Fraisthorpe beach where significant WWII anti-tank concrete cubes and defences are positioned in the sand, providing an interesting focal point for visitors & advertised as tourist attraction.	A2 landfall site is within ~50 – 200 m of Fraisthorpe beach where significant WWII anti-tank concrete cubes and defences are positioned in the sand, providing an interesting focal point for visitors & advertised as tourist attraction.
	Amenity and recreation	• A1 landfall site is within Fraisthorpe beach which won a UK Seaside Award in 2018 & has 557 reviews on Google as a tourist attraction; • "The Cow Shed Teashop" (busy café) is located at Fraisthorpe Beach; • Large parking area North of the café; • Busy beach with many recreational activities: (dog-)walking, sailing, horse-riding; • The council advertises an "Active Coast" scheme to promote walking for health along the coast.	A2 landfall site is within ~50 – 200 m of Fraisthorpe beach which won a UK Seaside Award in 2018 & is very popular with local residents and tourists (see notes in A1).
	Planning Applications	Planning application area approximately 250 m from A1 site.	No planning applications in proximity of site.
Commercial Review	Electrical export cable	• Site A1 is very likely to require a crossing agreement with Dogger Bank Creyke Beck export cable route;	• Site A2 is very likely to require a crossing agreement with Dogger Bank Creyke Beck export cable route.

Constraint		Zone A1		Zone A2	
	Static fishing density	• CEFAS and IFCA static gear sightings: <0.025 SPUE.		• CEFAS and IFCA static gear sightings: <0.025 SPUE.	
	Disturbance Voluntary agreement Utilities Ownership Access to landfall Public access Development Availability of laydown areas Connection to Grid	• Relatively unconstrained site. Fairly rural location with small number of residential properties to the immediate north and a farmyard, farmhouse, and café to the south; • Recent onshore wind farm developed nearby. Utility services are set back a reasonable distance from the coast so it is assumed a solution for any difficult crossings should be fairly easy to achieve; • Utility searches suggest no material risk; • Potential challenges to access landfall site due to long distance from A165. Potential access to beach 160 m South. No direct access to beach unless new temporary access constructed through 8 m high cliffs.		• Relatively unconstrained site. Rural location with farmyard, farmhouse, and café to the north; • Recent onshore wind farm developed nearby. Utility services are set back a reasonable distance from the coast so it is assumed a solution for any difficult crossings should be fairly easy to achieve; • Utility searches suggest no material risk; • Access to single track lane approximately 500 m to the west. To avoid a number of bends a private farm track could be upgraded in part to facilitate access; • Potential beach access 180 m North and 250 m South. No direct access to beach unless new temporary access constructed through cliffs.	

Table 9: Landfall BRAG assessment for sites A3 and A4.

Constraint		Zone A3	Zone A4
Technical Review	Cliff height Open Cut/HDD Possible Geology Distance to 10 m Depth Contour Presence of sea defences HDD Drill Length Space for onshore compound (200 x 100 m min) Space available for duct welding and stringing Beach Access Compound Access Length of intertidal Nearshore obstacles Shoreline Topology	• Low cliffs (6 – 8 m) for large area of section enabling possibilities for open cut solution; • Sheet piling and open cut to be considered; • Some part of section, cliff is below 1 m; • Open field ranging several hundred meters back from cliff, enabling TJB for open cut beyond the 25 year erosion line; • No sea defences; • Flexibility in area for positioning both compound and TJB; • Beach access at the same location as A1 and A2, approximately 1300 m away; • Average erosion is 0.6 m/yr, compound would have to be at least 190 m back from the cliff; • Compound located in agricultural field, access through Fraisthorpe along existing road and track, additional track required (1000 m) off the road to access the compound; • Access can be built directly from A165 as an option to avoid Fraisthorpe if required; • OS intertidal is approx. 180 m; • Approximately 7900 m – 10 m depth contour; • 1500 m drill shot would go past the 5 m depth contour; • No nearshore bathymetry is available to assess ability for vessels/barges to ground out for shore pull operations. Area is known for high boulder numbers on surface and until otherwise confirmed, it has been	• Low cliffs (8 – 11 m) for some area of section enabling possibilities for open cut solution; • Sheet piling and open cut to be considered; • Open field ranging back from cliff, enabling TJB for open cut beyond the 25 year erosion line; • No sea defences; • Flexibility in area for positioning both compound and TJB; • Beach access at same location as A1 and A2, approx. 1900 m away, or access at caravan park at Barmston, access here would have to be checked as looks as though road has collapsed; • Average erosion is 1.3 m a year, compound would need to be at least 215 m back from cliff; • Compound located in agricultural field (several options); access track required (1000 m) off the Bridlington road; • OS intertidal is 165 m; • Approximately 7800 m – 10 m depth contour; • 1500 m drill shot would go past 5 m depth contour; • No nearshore bathymetry is available to assess ability for vessels/barges to ground out for shore pull operations. Area is known for high boulder numbers on surface and until otherwise confirmed, it has been assumed that vessels/barges shall be afloat during operations; • Based on 25 year erosion line, Closest Point of Approach (CPA) with a fully loaded barge (3 m) by 2

Constraint		Zone A3	Zone A4
	Nearshore seabed characteristics Geohazards (erosion)	assumed that vessels/barges shall be afloat during operations; • Based on 25 year erosion line, Closest Point of Approach (CPA) with a fully loaded barge (3 m) by 2 m draught and 1 m UKC, the safe point of installation at MLWS would be at an 800 m minimum distance to TJB; and • The CPA for a fully loaded DP vessel (7m + 2m UKC) the safe point of installation at MLWS would be at a 1700 m minimum distance to TJB.	m draught and 1 m UKC, the safe point of installation at MLWS would be at an 800 m minimum distance to TJB; and • Similar, the CPA for a fully loaded DP vessel (7 m + 2 m UKC) the safe point of installation at MLWS would be at a 1700 m minimum distance to TJB.
Environmental Review	Nature conservation	Outside of protected area boundary.	Outside of protected area boundary.
	Coastal Protection measures	Area defined as "no active intervention in shoreline management plan.	Area defined as "no active intervention in shoreline management plan.
	Surface water + floodplain	None identified	None identified
	Proximity to residential area	• Settlement of Fraisthorpe is ~1.3 km from proposed compound; and • Manor Farmhouse located ~1.5 km from proposed compound.	• Fraisthorpe is ~1.5 km from proposed compound; • Small cluster of properties ~1.0 km from proposed compound; and • Manor Farmhouse located ~ 1.8 km from proposed compound.
	Historic Environment	• Medieval village of Auburn ~900 m from proposed compound; and • Listed Buildings (St Edmunds Church and Manor Farmhouse located ~1.5 km from proposed compound).	• Listed Buildings (St Edmunds Church and Manor Farmhouse) located ~1.8 km from proposed compound.
	Cultural heritage	A3 landfall site is within 200 – 500 m of Fraisthorpe Beach, where significant WWII anti-tank concrete cubes and defences are positioned in the sand, providing an interesting focal point for visitors & advertised as tourist attraction.	• From drone footage & aerial photography, WWII assets are located ~500 m from Northern boundary of A4 landfall site; and • Heritage site called Watermill Grounds is located within proposed compound area.

Constraint		Zone A3	Zone A4
	Amenity and recreation	• A3 landfall site is within 200 – 500 m of Fraisthorpe Beach which won a UK Seaside Award in 2018 & is very popular with locals and tourists (see notes in A1); and • Drone video shows many people walking along beach in A3 area.	None identified
	Planning Applications	No planning applications in proximity of site.	No planning applications in proximity of site.
Commercial Review	Electrical export cable Static fishing density	• Site A3 is very likely to require a crossing agreement with Dogger Bank Creyke Beck export cable route; and • CEFAS and IFCA static gear sightings: <0.025 SPUE.	• Site A4 is very likely to require a crossing agreement with Dogger Bank Creyke Beck export cable route- and • CEFAS and IFCA static gear sightings: <0.025 SPUE.
	Disturbance Voluntary agreement Utilities Ownership Access to landfall Public access Development Availability of laydown areas Connection to Grid	• Relatively unconstrained site. Rural location with no nearby residential properties or buildings; • Recent onshore wind farm developed nearby. Utility services but are set back a reasonable distance from the coast so it is assumed a solution to any difficult crossings should be fairly easy to achieve; • Utility searches suggest no material risk; • Access to single track lane approximately 1.1 km distant. Zone dissected by The Earl's Dyke making access across challenging; • Direct access to beach via new temporary access within zone potentially possible.	• Relatively unconstrained site. Rural location with no nearby residential properties or buildings; • Utility searches suggest no material risk; • Access to single track lane approximately 1.35 km distant; • Beach access 130 m south. No direct access to beach unless new temporary access constructed through cliffs.

Table 10: Landfall BRAG assessment for sites A5 and B1.

Constraint		Zone A5	Zone B1
Technical Review	Cliff height Open Cut/HDD Possible Geology Distance to 10m Depth Contour Presence of sea defences HDD Drill Length Space for onshore compound (200 x 100m min) Space available for duct welding and stringing Beach Access Compound Access Length of intertidal Nearshore obstacles	• No cliffs/low cliffs of 4 – 11 m in large parts of sections. A few dunes separating the beach from the marshland behind it; • Uncertainty on feasibility for access and workability in the marsh/wetland; • No sea defences; • Open-cut possible; • Potential beach access from caravan park at Barmston but this needs to be checked; • Average erosion is 1.055 m, compound would have to be at least 180 m back from cliff; • Compound access through village of Barmston to be assessed for construction traffic or direct access constructed from A165; • OS intertidal is approx. 130 m; • Approximately 7600 m – 10 m depth contour, 1500 m drill shot would go past 5 m depth contour; • No nearshore bathymetry is available to assess ability for vessels/barges to ground out for shore pull operations. Area is known for high boulder numbers on surface and until otherwise confirmed, it has been assumed that vessels/barges shall be afloat during operations; • Based on 25 year erosion line, Closest Point of Approach (CPA) with a fully loaded barge (3 m) by 2 m draught and 1m UKC, the safe point of installation at MLWS would be at an 800 m minimum distance to TJB; and	• Variety in cliff heights. From approx. 5 – 13 m height; • Open cut solution may be possible in few distinct locations; • Sheet piling and open cut to be considered where possible; • HDD is potentially possible at landfall location but that it requires further analysis of cable-pull lengths and the potential for de-rating of cables which is not considered in this assessment; • Open field ranging back from cliff, enabling TJB for both HDD or open cut beyond the 25 year erosion line; • No sea defences; • Flexibility in area for positioning both compound and TJB; • Some ground instability in cliffs observed due to excessive agricultural land draining; • Potential beach access from caravan park at Barmston, this will need to be checked, or from caravan park 1 km to the South, again this needs to be checked; • Average erosion is 1.3 m/yr, compound will have to be at least 190 m from the cliff; • Compound access through village of Barmston, check suitability for construction traffic or direct access to be constructed from A165;

Constraint		Zone A5	Zone B1
	Shoreline Topology Nearshore seabed characteristics Geohazards (erosion)	• Similar, the CPA for a fully loaded DP vessel (7 m + 2 m UKC) the safe point of installation at MLWS would be at a 1700 m minimum distance to TJB.	• Outfall pipe in north of site which needs to be avoided; • OS intertidal is approx. 145 m; • Approximately 7400 – 10 m depth contour; and • 1500 m drill shot extends past 5m depth contour.
Environmental Review	Nature conservation	This option is on the boundary of the SPA located approximately 0.5 km away.	• Located within Greater Wash SPA; and • Located within SSSI impact risk zone.
	Coastal Protection measures	Area defined as "no active intervention" in shoreline management plan.	Area defined as "no active intervention" in SMP N.B. Rock dumping on headland to the north and south. Concrete encased outfall of Barmston Marsh Drain across the foreshore to low water and protected by rock dumping on upper foreshore.
	Surface water + floodplain	• None identified; • Three minor drains located 200 –700 m from proposed compound location.	Barmston Main Drain is within B1 site.
	Proximity to residential area	• Proposed compound location is approximately 200 –300 m from caravan park, which is a tourist hot-spot; • Barmston Beach is located at the bottom of the caravan park (designated Bathing Beach, Rural Beach Seaside Award); and • Village of Barmston is in between sites A5 & B1 approximately 0.7 km from proposed compound location.	• Proposed compound location is approximately 0.3 km from village of Barmston and approximately 0.5 km from caravan park which is a tourist hot-spot; • Barmston Beach is located at the bottom of the caravan park (designated Bathing Beach, Rural Beach Seaside Award); and • No residential properties to the South.
	Historic Environment	6 Listed Buildings on road in to Barmston from A165 (approx. 0.75 km in length)	6 Listed Buildings on road in to Barmston from A165 (~0.4 – 1.7 km from site)
	Cultural heritage	No cultural heritage identified	• No cultural heritage identified in close proximity; • Old Hall Farm/Moat is ~1.25 km from proposed compound site.
	Amenity and recreation	• Barmston Beach is approximately 200 – 500 m from A5 site. This is a designated bathing beach and has won a rural	• Barmston Beach is approximately 200 – 500 m to the North of B1 site. This is a designated bathing

Constraint		Zone A5	Zone B1
		beach seaside award. It is a tourist hot-spot given its proximity to the caravan park; • Barmston Beach caravan park overlooks the proposed compound works area.	beach and has won a rural beach seaside award. It is a tourist hot-spot given its proximity to the caravan park; • Barmston Beach caravan park lies ~400 m to the North of proposed compound location.
	Planning Applications	Planning reference: 13/02451/STPLF (Erection of 1 no. wind turbine (55 m to hub and 84 m to tip) and associated infrastructure) is pending consideration and lies approximately 700 m from A5 site.	Planning application area above caravan park (unsure of status) approximately 600 m from B1 site.
Commercial Review	Electrical export cable Static fishing density	• Site A5 is very likely to require a crossing agreement with Dogger Bank Creyke Beck export cable route; and • CEFAS and IFCA static gear sightings: <0.025 SPUE.	• Site B1 would imply a significant overlap with Dogger Bank's OFTO AfL area; and • CEFAS and IFCA static gear sightings: <0.025 SPUE.
	Disturbance Voluntary agreement Utilities Ownership Access to landfall Public access Development Availability of laydown areas Connection to Grid	• Relatively unconstrained site. Rural location with no nearby residential properties or buildings except for southern part which abuts a caravan park; • Utility searches suggest no material risk; • Long distance from suitable public highway to avoid built up areas; and • Number of options for direct access onto beach.	• Constrained site due to Dogger Bank DCO corridor and EA outfall; • Fairly rural location; • Approximately 700 m of new track to facilitate access required & B1242 approximately 2 km distant; • Utility searches suggest no material risk; • Limited options for direct access onto beach with their own constraints.

Table 11: Landfall BRAG assessment for site B2.

Constraint		Zone B2	
Technical Review	Cliff height Open Cut/HDD Possible Geology Distance to 10 m Depth Contour Presence of sea defences HDD Drill Length Space for onshore compound (200 x 100 m min) Space available for duct welding and stringing Beach Access Compound Access Length of intertidal Nearshore obstacles Shoreline Topology Nearshore seabed characteristics Geohazards (erosion)	• Very high and unstable cliffs (10 – 12 m). Not suitable for open cut, long HDD required; • HDD is potentially possible at landfall location but it requires further analysis of cable pull lengths and the potential for de-rating of cables which is not considered in this assessment; • The method of long HDD could be used to overcome both the coastal erosion problem and the unstable cliffs, which could represent a health and safety issue during construction; • Subject to type of installation vessel/barge, a total drilled length of between 730 – 1500 m (depending on the specific erosion rate and cliff height at the chosen landfall) may be required to achieve the necessary depth where the cliffs are high. Although this drill length is technically feasible, the cable specification may not allow for this length; • Open field ranging back from cliff, enabling TJB for HDD beyond the 25 year erosion line; • No sea defences at this location; • Flexibility in area for positioning both compound and TJB; • Potential beach access from Skipsea Sands Holiday Park; • Average erosion is 2.005 m/yr, compound would have to be at least 240 m back from the cliff; • Compound would have to be located in north of site so onshore ECC could avoid Skipsea. Compound access would be through the village of Skipsea or a temporary road could be built directly from B1242; • OS intertidal is approx. 140 m; • Approximately 1800 – 10 m depth contour; • 1500 m drill shot extends past 5 m depth contour; • No nearshore bathymetry is available to assess ability for vessels/barges to ground out for shore pull operations. Area is known for high boulder numbers on surface and until otherwise confirmed, it has been assumed that vessels/barges shall be afloat during operations; • Based on 25 year erosion line, CPA with a fully loaded barge (3 m) by 2 m draught and 1 m UKC, the safe point of installation at MLWS would be at a 730 m minimum distance to TJB; and • The CPA for a fully loaded DP vessel (7 m + 2 m UKC) the safe point of installation at MLWS would be at a 1300 m minimum distance to TJB.	
Environmental Review	Nature conservation	• Located within Greater Wash SPA, Withow Gap SSSI located approximately 400 m away; • Skipsea Bail Mere SSSI is approximately 1.4 km away inland; and • Within SSSI impact risk zone.	

Constraint		Zone B2	
	Coastal Protection measures	Area defined as "no active intervention" in shoreline management plan (SMP).	
	Surface water + floodplain	• None identified; and • Minor drains ~250 m from B2 compound.	
	Proximity to residential area	• B2 landfall compound is ~0.5 km from Skipsea Primary School; • Houses to the South in very close proximity to potential works (<0.3 km from compound); • Caravan park to the North is ~0.7 km away.	
	Historic Environment	None identified	
	Cultural heritage	No cultural heritage identified	
	Amenity and recreation	None identified	
	Planning Applications	Planning application area 14/02221/PLF is approximately 800 m from B2 boundary.	
Commercial Review	Electrical export cable	• Site B2 is somewhat likely require a proximity agreement with the Dogger Bank export cable; • CEFAS and IFCA static gear sightings: 0.026 – 0.1 SPUE.	
	Static fishing density		
	Disturbance	• Relatively unconstrained site. Fairly rural location with small number of residential properties near Southern edge and caravan park on northern edge; • Approximately 770 m distant from B1242 across agricultural land; • Utility searches suggest no material risk; • No direct access to beach unless new temporary access constructed through tall cliffs; • Landowners at this site include the Church Commissioners for England which could present a commercial challenge.	
	Voluntary agreement		
	Utilities		
	Ownership		
	Access to landfall		
	Public access		
	Development		
	Availability of laydown areas		
	Connection to Grid		