Hornsea Project Three
Offshore Wind Farm

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Preliminary Environmental Information Report:
Chapter 4 – Site Selection and Consideration of Alternatives

Date: July 2017

Hornsea 3
Offshore Wind Farm

DONG energy

Environmental Impact Assessment

Preliminary Environmental Information Report

Volume 1

Chapter 4 – Site Selection and Consideration of Alternatives

Report Number: P6.1.4

Version: Final

Date: July 2017

This report is also downloadable from the Hornsea Project Three offshore wind farm website at:
www.dongenergy.co.uk/hornseaproject3

DONG Energy Power (UK) Ltd.

5 Howick Place,

London, SW1P 1WG

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Prepared by: Hornsea Project Three, RPS and GoBe

Contributors: DONG Energy Power (UK) Limited

Checked by: Julian Carolan, Jennifer Brack, Emily Woolfenden, Henry Burrows and Richard Grist

Accepted by: Sophie Banham

Approved by: Stuart Livesey

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Glossary

Term	Definition
Appropriate Assessment (AA)	An assessment that is carried out by a competent authority in the context of a HRA.
Department for Business, Energy and Industrial Strategy (BEIS)	UK government ministerial department with responsibilities for business, industrial strategy, science, innovation, energy, and climate change. The department replaced DECC in Quarter three of 2016.
Department for Environment, Food and Rural Affairs (Defra)	UK government ministerial department with responsibilities for safeguarding the natural environment, supporting the food and farming industry, and sustaining the rural economy.
Department of Energy and Climate Change (DECC)	Former UK ministerial department with responsibilities for the energy industry and climate change policy. Replaced in Quarter Three of 2016 by the Department for BEIS.
Marine Licence	A permit of consent to carry on/out a licensable activity within inshore and offshore areas. The MMO is responsible for marine licensing in English inshore and offshore areas and for Welsh and Northern Ireland offshore areas.
Marine Management Organisation (MMO)	Organisation with the responsibility for implementing the requirements of the MCAA 2009.
Renewable Energy Strategy (RES)	Published in 2009 and sets out the path by which the UK can meet the legally-binding target of 15% energy consumption from renewable sources by 2020.
Renewable Energy Zone (REZ)	A zone established under the Energy Act 2004 which is beyond the limits of the UK territorial sea, but broadly matches the UK EEZ in which the UK can exercise rights over the production of energy from renewable technologies.
Strategic Environmental Assessment (SEA)	The systematic decision support process, aiming to ensure that environmental and other sustainability aspects are considered effectively in policy, planning and programme making.
Statement of Community Consultation (SoCC)	A document describing how the project promoter intends to consult the local community about the project proposals.

Acronyms

Unit	Description
AfL	Agreement for Lease
AC	Alternating Current
AfL	Agreement for Lease
AONB	Area of Outstanding Natural Beauty
CAA	Civil Aviation Authority
CAP	Civil Aviation Policy
CION	Connections and Infrastrcuture Options Note
CWS	Community Wildlife Site
DBA	Desk Based Assessment
DC	Direct Current
DCO	Development Consent Order
DECC	Department for Energy and Climate Change
ECR	Export Cable Route
EIA	Environmental Impact Assessment
HDD	Horizontal Directional Drill
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IMO	International Maritime Organisation
LNR	Local Nature Reserve
MHWS	Mean High Water Springs
MCZ	Marine Conservation Zone
NGET	National Grid Transmission Limited
NNR	National Nature Reserve
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
OESEA	Offshore Energy Strategic Environmental Assessment
PEI	Preliminary Environmental Information
PEIR	Preliminary Environmental Information Report
REZ	Renewable Energy Zone

Unit	Description
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SCI	Site of Community Importance
SEA	Strategic Environmental Assessment
SNCI	Site of Nature Conservation Importance
SoCC	Statement of Community Consultation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TCE	The Crown Estate
UK	United Kingdom
ZAP	Zone Appraisal and Planning

Units

Unit	Description
GW	Gigawatt
Ha	Hectares
km	Kilometre
m	Metre
MW	Megawatt
nm	Nautical mile

4. Site Selection and Consideration of Alternatives

4.1 Introduction

4.1.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) provides a description of the site selection process and the approach undertaken to date by Hornsea Project Three offshore wind farm (hereafter referred to as Hornsea Three) to identify the various elements of the site and reasonable alternatives as the project has developed.

4.1.1.2 This chapter outlines the chronological staged approach to defining the spatial boundaries and constituent parts of the Hornsea Round 3 Zone (the 'former Hornsea Zone') and Hornsea Three. It also explains and details as required under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (as amended) (the EIA Regulations), the main alternatives considered for the project, including location and infrastructure options.

4.1.1.3 The Secretary of State (SoS) must be made aware of the main reasons for the choice between alternative options (including for example, relevant environmental, social and economic factors) and the overarching National Policy Statement for Energy (NPS EN-1) (DECC, 2011) highlights the requirements to be met under applicable Environmental Impact Assessment (EIA) legislation. More detail on the legislative obligations and the information to be provided is set out in section 4.2 below.

4.1.1.4 Hornsea Three is the third project to be proposed within the former Hornsea Zone. The first project to be proposed, Hornsea Project One, submitted an application to the Secretary of State in July 2013 and was awarded a Development Consent Order (DCO) on 10th December 2014. The project commenced onshore construction in early 2016, with offshore construction due to begin in 2017. Hornsea Project Two was the second project to be proposed and was awarded a DCO on 16th August 2016. HornseaThree is closely related to Hornsea Projects One and Two, both in terms of its nature and location of the offshore array. As such, where matters relating to the offshore array area(s) have been discussed and agreed during consultation on Hornsea Projects One and Two, and are applicable to the Hornsea Three EIA, they have been incorporated into this PEIR.

4.1.1.5 The approach taken to the development of Hornsea Three is based on early engagement with a wide range of stakeholders. Each phase of consultation is designed to provide opportunities for stakeholders to review and influence the relevant spatial and project design decisions throughout the process of project development.

4.1.1.6 Alternative options for methods of construction, operation and maintenance and decommissioning have been considered alongside different technologies and materials in this Preliminary Environmental Information Report (PEIR) in order to assess, so far as possible at this stage in the project, the potential environmental effects.

4.1.1.7 This chapter is also concerned with site selection and the main alternatives which have been considered for the project location and its associated infrastructure options (cables, HVAC booster stations, substations and platforms).

4.1.1.8 This chapter is set out in chronological order to describe the stages of the design iteration from inception to the point of PEIR submission. It also explains the anticipated further work that will be undertaken after PEIR. Accordingly the following structure is adopted:

- Stage 1 - Identification of the former Hornsea Zone;
- Stage 2 - Identification of the Hornsea Three array area within the former Hornsea Zone;
- Stage 3 – Identification of Grid Connection Location and Strategic Landfall Appraisal:
    - High level connection options;
    - National Grid Connection Offer; and
    - Landfall appraisal.
- Stage 4 – Refinement of Project Options:
    - Landfall;
    - Offshore components; and
    - Onshore components.
- Stage 5 - Identification of Project for Scoping, Statement of Community Consultation (SoCC) and Phase 1.A Consultation:
    - Landfall;
    - Offshore components; and
    - Onshore components.
- Stage 6 - Refinement of Project for Phase 1.B Community Consultation Events and EIA preparation:
    - Landfall;
    - Offshore components; and
    - Onshore components
- Stage 7 - Refinement of Project for PEIR; s42 and s47 Consultation (Phase 2 Consultation):
    - Landfall;
    - Offshore components; and
    - Onshore components.

4.1.1.9 The final two stages of the site selection process, which will take place after the PEIR stage, are as follows:

- Stage 8 - Further refinement of Project Design following review of Consultation Responses & EIA Studies; and
- Stage 9 - Submission of final preferred option(s) as part of the DCO application.

4.1.1.10 Hornsea Three is currently at the end of Stage 7 in this iterative process. Refinement of the project will continue throughout and beyond the PEIR stage having regard to the responses received to consultation at all stages, and ongoing project engineering design work, in addition to further survey data that may be collected increasing Hornsea Three's understanding of the environment, and engineering feasibility.

4.2 Legislation and guidance

4.2.1.1 Schedule 4 of the EIA Regulations requires that the preliminary information included in a PEIR should (insofar as compiled by the applicant) include "an outline of the main alternatives studied by the applicant and an indication of the main reasons for the applicant's choice, taking into account the environmental effects".

4.2.1.2 Furthermore, under the Habitats Regulations and Offshore Habitats Regulations, a consideration of alternatives to the proposed project would be required if it is determined the development is likely to have a significant effect on a European Site that may adversely affect the integrity of the site.

4.2.1.3 This chapter of the PEIR provides a description of the reasonable spatial and geographical alternatives that have been studied by Hornsea Three and, where appropriate to contextualise the applicant's choice, a comparison of the environmental effects between different options is provided. In some cases (for example, the array layout) alternatives form part of the assessment and are considered in detail in the relevant chapters of the PEIR.

4.2.1.4 From a policy perspective the National Policy Statement for Renewable Energy Infrastructure (NPS EN-3) does not contain a general requirement to consider alternatives or to establish whether the proposed project represents the best option. However, paragraph 4.4.2 of the Overarching National Policy Statement for Energy (NPS EN-1) (DECC, 2011) highlights requirements under the EIA Regulations, Habitats Regulations and Offshore Habitats Regulations regarding the consideration of alternatives, notably:

- "*applicants are obliged to include in their Environmental Statement, as a matter of fact, information about the main alternatives they have studied. This should include an indication of the main reasons for the applicant's choice, taking into account the environmental, social and economic effects and including, where relevant, technical and commercial feasibility*"; and
- "*in some circumstances there are specific legislative requirements, notably under the Habitats Directive, for the [Secretary of State] to consider alternatives. These should also be identified in the Environmental Statement by the applicant.*"

4.2.1.5 Requirements under the Habitats Regulations and the Offshore Habitats Regulations are addressed in the Draft Report to Inform Appropriate Assessment, submitted as part of this PEIR.

4.2.1.6 Where there is a policy or legal requirement to consider alternatives, paragraph 4.4.3 of NPS EN-1 (DECC, 2011) highlights other guiding principles that the Secretary of State should consider when deciding what weight should be given to alternatives, specifically:

- "*the consideration of alternatives in order to comply with policy requirements should be carried out in a proportionate manner;*
- *the [Secretary of State] should be guided in considering alternative proposals by whether there is a realistic prospect of the alternative delivering the same infrastructure capacity (including energy security and climate change benefits) in the same timescale as the proposed development;*
- *where (as in the case of renewables) legislation imposes a specific quantitative target for particular technologies or (as in the case of nuclear) there is reason to suppose that the number of sites suitable for deployment of a technology on the scale and within the period of time envisaged by the relevant NPSs is constrained, the [Secretary of State] should not reject an application for development on one site simply because fewer adverse impacts would result from developing similar infrastructure on another suitable site, and [he] should have regard as appropriate to the possibility that all suitable sites for energy infrastructure of the type proposed may be needed for future proposals;*
- *alternatives not among the main alternatives studied by the applicant (as reflected in the Environmental Statement) should only be considered to the extent that the [Secretary of State] thinks they are both important and relevant to [his] decision;*
- *as the [Secretary of State] must decide an application in accordance with the relevant NPS (subject to the exceptions set out in the Planning Act 2008), if the [Secretary of State] concludes that a decision to grant consent to a hypothetical alternative proposal would not be in accordance with the policies set out in the relevant NPS, the existence of that alternative is unlikely to be important and relevant to the [Secretary of State's] decision;*
- *alternative proposals which mean the necessary development could not proceed, for example because the alternative proposals are not commercially viable or alternative proposals for sites would not be physically suitable, can be excluded on the grounds that they are not important and relevant to the [Secretary of State's] decision;*
- *alternative proposals which are vague or inchoate can be excluded on the grounds that they are not important and relevant to the [Secretary of State's] decision; and*
- *it is intended that potential alternatives to a proposed development should, wherever possible, be identified before an application is made to the [Secretary of State] in respect of it (so as to allow*

appropriate consultation and the development of a suitable evidence base in relation to any alternatives which are particularly relevant). Therefore where an alternative is first put forward by a third party after an application has been made, the [Secretary of State] may place the onus on the person proposing the alternative to provide the evidence for its suitability as such and the [Secretary of State] should not necessarily expect the applicant to have assessed it."

4.2.1.7 The National Policy Statement for Renewable Energy Infrastructure (NPS EN-3) states at paragraph 2.6.81 that the applicant should include an assessment of the effects of installing cable across the intertidal zone which should include information, where relevant, about:

- "*any alternative landfall sites that have been considered by the applicant during the design phase and an explanation for the final choice*"; and
- "*any alternative cable installation methods that have been considered by the applicant during the design phase and an explanation for the final choice.*"

4.3 The Horlock Rules

4.3.1.1 The relevance of planning and environmental considerations in the siting of onshore substations was set out by the Central Electricity Generating Board and more recently reviewed and adopted by National Grid in the 'Horlock Rules'. The Horlock Rules are a set of guidelines produced by National Grid to assist those responsible for siting and designing substations to mitigate the environmental effects of such developments (National Grid, 2003). They are still referred to and used by National Grid when undertaking planning studies for new infrastructure although they now have to be considered alongside other guidance in National Policy Statements, the National Planning Policy Framework, Development Plan documents and other sources. National Grid still applies the guidance in the Horlock Rules.

4.3.1.2 The principles embodied in the Horlock Rules are relevant to the infrastructure at the proposed onshore HVAC substation/HVDC converter station and HVAC Booster Station. The rules contain principles that have been relied upon over the years in routine planning studies by National Grid, and which have subsequently been endorsed in Ministerial decisions and at Public Inquiries.

4.3.1.3 In the Horlock Rules, National Grid states that it will encourage generators to adopt the guidelines when working with National Grid on proposals for substations, sealing end compounds or line entries. These guidelines also confirm that consideration must be given to environmental issues at the earliest stage in order to keep adverse effects to a reasonably practical minimum in the planning of new substations.

4.3.1.4 Table 4.1 below summarises the Horlock Rules, (National Grid, 2003), and Hornsea Three's approach to them.

4.4 Other considerations for site selection

4.4.1.1 Whilst specific constraints and how these have influenced the site selection process are discussed in more detail within specific sections of this chapter, a number of fundamental principles are inherently applied to the decision making process throughout, and these comprise:

- Shortest route preference for cable routing to minimise impacts my minimising footprint for the offshore and onshore cable routes as well as minimising cost (hence ultimately reducing the cost of energy to the consumer) and transmission losses;
- Avoidance of key sensitive features where possible and where not, seek to mitigate impacts;
- Minimise the disruption to populated areas; and
- The need to accommodate the range of technology sought within the design envelope, and exclude those options outwith the envelope (i.e. ruling out overhead lines).

Table 4.1: The Horlock Rules summary and application to Hornsea Three.

Overall system options and site selection	Hornsea Three approach (onshore)
In the development of system options including new substations, consideration must be given to environmental issues from the earliest stage to balance the technical benefits and capital cost requirements for new developments against the consequential environmental effects in order to keep adverse effects to a reasonably practicable minimum.	Environmental issues are being considered throughout the development phase, from initial desk top studies to detailed EIA studies.
Amenity, Cultural or Scientific Value of Sites	
The siting of new National Grid Company (NGC) substations, sealing end compounds and line entries should as far as reasonably practicable seek to avoid altogether internationally and nationally designated areas of the highest amenity, cultural or scientific value by the overall planning of the system connections.	All internationally and nationally designated sites have been avoided for the new onshore HVAC Booster Station and onshore HVDC converter/HVAC substation. None of the sites identified have been located within such areas.
Local Context, Land Use and Site Planning	
Areas of local amenity value, important existing habitats and landscape features including ancient woodland, historic hedgerows, surface and ground water sources and nature conservation areas should be protected as far as reasonably practicable.	All areas of local amenity value in the location of the new onshore HVAC Booster Station and onshore HVDC converter/HVAC substation site have been protected as far as reasonably practicable as part of the ongoing site analysis work. In addition, consideration was given to important existing habitats and landscape features including ancient woodland, historic hedgerows, surface and ground water sources and nature conservation areas when considering sites for the onshore HVDC converter/HVAC substation and HVAC Booster Station
The siting of substations, extensions and associated proposals should take advantage of the screening provided by land form and existing features and the potential use of site layout and levels to keep intrusion into surrounding areas to a reasonably practicable minimum.	The new onshore HVAC Booster Station and onshore HVDC converter/HVAC substation siting exercise has considered the availability of sites that benefit from existing screening, looking at existing landscaping, landform, and existing built development. The view to the new onshore HVDC converter/HVAC substation from surrounding areas will be partly screened by existing vegetation and visual mitigation such as the planting of supplementary trees and hedgerows will assist in this screening over time. Further details about potential additional planting are provided in Volume 3, Chapter 4, Landscape and Visual Resources.
The proposals should keep the visual, noise and other environmental effects to a reasonably practicable minimum.	Visual, noise and other environmental effects have been minimised as far as possible through the selection of the onshore HVAC Booster Station and the onshore HVDC converter/HVAC substation sites. For example, consideration was given to existing screening and sites were chosen away from built up areas. In addition, the assessment considers further mitigation of environmental effects as detailed in the topic chapters in Volume 3, chapter 8: Noise and Vibration. Further mitigation may be required through design and this will be considered further ahead of the final application.
The land use effects of the proposal should be considered when planning the siting of substations or extensions.	The effects on land use, planning policies and planning history on and adjacent to the alternative sites were taken into account in the selection of the onshore HVAC Booster Station and the onshore HVDC converter/HVAC substation site. The selected sites had minimal effect on land use, agriculture and recreation, and planning policy, in the area (see Volume 3, chapter 6: Land Use, Agriculture and Recreation.).
Design	
In the design of new substations or line entries, early consideration should be given to the options available for terminal towers, equipment, buildings and ancillary development appropriate to individual locations, seeking to keep effects to a reasonably practicable minimum.	The effects of likely equipment, building layouts and the cable routes into and out of the site have been taken into account in the development of the site proposals and through the assessment of environmental effects for both HVAC and HVDC options.
Space should be used effectively to limit the area required for development consistent with appropriate mitigation measures and to minimise the adverse effects on existing land use and rights of way, whilst also having regard to future extension of the substation.	The area required for the onshore HVAC Booster Station and the onshore HVDC converter/HVAC substation site was determined with reference to past project experience, an initial assessment of relevant information available from technology suppliers together with DONG Energy's current expectations regarding land required for access, landscape works and other mitigation for the components required for a 2.4 GW project. The design of the onshore HVAC Booster Station and onshore HVDC converter/HVAC substation is at an early stage and will be developed iteratively as the project progresses, in response to further consultation with stakeholders and project design work.
The design of access roads, perimeter fencing, earthshaping, planting and ancillary development should form an integral part of the site layout and design to fit in with the surroundings.	The provision of access roads and the existing road infrastructure in the vicinity, perimeter fencing etc. has been taken into account through the selection and design of the onshore HVAC Booster Station and onshore HVDC converter/HVAC substation site.
Line Entry	
In open landscape especially, high voltage line entries should be kept, as far as possible, visually separate from low voltage lines and other overhead lines so as to avoid a confusing appearance.	All cables will be buried underground to a minimum depth of 1.2 m except where obstructions prevent this in which case burial will be to a minimum depth of 0.7 m
The inter-relationship between towers and substation structures and background and foreground features should be studied to reduce the prominence of structures from main viewpoints. Where practicable the exposure of terminal towers on prominent ridges should be minimised by siting towers against a background of trees rather than open skylines.	The onshore HVAC Booster Station and onshore HVDC converter/HVAC substation site developments will not include any additional overhead line towers.

4.5 Former Hornsea Zone and project site selection process

4.5.1.1 Further to the Government's confirmed policy (as discussed in Chapter 2: Policy and Legislation) in support of offshore wind, there is a need to identify the best sites around the UK for a rapid increase in offshore wind deployment to occur, and renewable energy targets to be met. Following the development of Round 1 and Round 2 offshore wind farm sites, The Crown Estate (TCE) (as owner of the seabed) in conjunction with the Department for Energy and Climate Change (DECC) embarked on a programme of site selection for offshore wind. This formed the basis for the 'Round 3' offshore wind development programme, which included the former Hornsea Zone in its entirety.

4.5.1.2 Ahead of the identification of specific areas for offshore wind farms as part of Round 3, the Department of Energy and Climate Change conducted a Strategic Environmental Assessment for Offshore Energy in accordance with the Environmental Assessment of Plans and Programmes Regulations 2004 (the SEA Regulations). This Offshore Energy SEA (OESEA) (DECC, 2009) considered offshore wind energy, offshore oil and gas and gas storage and intended to:

- "*Consider the environmental implications of a draft plan/programme for licensing for offshore oil and gas, including gas storage, and leasing for offshore wind. This includes consideration of the implications of alternatives to the plan/programme and the potential spatial interactions with other users of the sea.*";
- "*Inform the UK Government's decisions on the draft plan/programme*"; and
- "*Provide routes for public and stakeholder participation in the process*".

4.5.1.3 The OESEA itself included consideration of alternatives to the draft plan/programme for all elements covered by the SEA, including future offshore wind leasing

4.5.1.4 Following the OESEA, TCE commenced the process to identify Round 3 zones. The selection of sites for Round 3 zones was carried out in two stages, first at a strategic level, which preceded the more detailed planning of individual projects. The two stages are illustrated in Figure 4.1 below (The Crown Estate 2012).

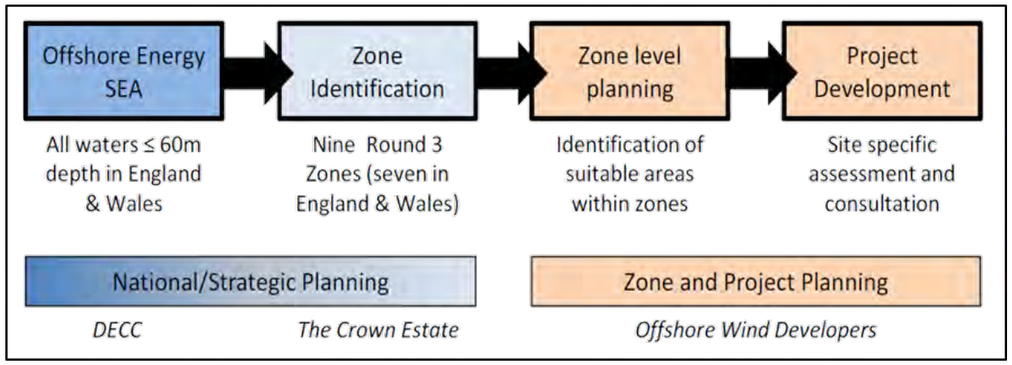

Figure 4.1: Two stage selection process of Round 3 offshore wind farms.

4.5.1.5 A number of different organisations were involved in this two-stage process. The roles and responsibilities of some of these organisations at national and project level are set out in Table 4.2 below (The Crown Estate, 2012).

4.5.1.6 It is important to note in the context of site selection for offshore wind farms, that developers are limited by this process to bidding for sites and, in the context of Round 3, within zones which have been identified by The Crown Estate. Whilst for Round 3 sites, developers were then able to identify specific projects within zones (see Stage 2 – Identification of Hornsea Three array area within the former Hornsea Zone), the location of the zones themselves were outside the control of developers and instead arose from the process outlined in Stage 1 - Identification of the former Hornsea Zone.

4.5.2 The role of The Crown Estate

4.5.2.1 The Crown Estate (TCE) is not part of Government, and does not set renewable energy policy. However, TCE Crown Estate does have a role to play in the delivery of offshore wind in line with Government policy. This is because it is the landowner of virtually the entire seabed out to the 12 nm territorial limit, and has rights under the Energy Act 2004 to issue licences for offshore wind development beyond the territorial waters limit and within the UK Renewable Energy Zone (REZ). A lease from TCE is required in order to construct an offshore wind farm, however this is the equivalent to landowner permission and does not replace the requirement for an offshore wind developer to obtain all the necessary statutory consents and licences required for the construction of the wind farm.

Table 4.2: Organisations involved in the Round 3 selection process.

Organisation	Role	Responsibilities
Department of Energy and Climate Change (DECC)	Set UK Energy Policy and thus promote offshore wind development	Undertake any required Strategic Environmental Assessments of plans. For offshore wind, this included the Offshore Energy Strategic Environmental Assessment (SEA) (DECC, 2009). In addition, DECC Undertook the OESEA2 in 2011 (DECC, 2011a).
The Crown Estate	Identified the Round 3 zones. Was the Competent Authority for the Round 3 Plan – undertook Appropriate Assessment of the Plan. Competitively tendered Round 3 zones and entered into Zone Development Agreements (ZDAs) with successful bidders.	Grant 'Agreements for Lease' for individual offshore wind farm projects within zones. Grant Leases for these project areas once statutory planning consent is achieved – a lease is necessary before construction and operation can take place.
Offshore wind farm developers / consortia	Consultees to the SEA process. Tendered for rights to develop zones in the Round 3 process and entered into ZDAs with The Crown Estate for each zone.	Select the most appropriate sites for wind farm development within the zones. Develop project plans for individual wind farms. Consult with stakeholders. Submit applications for development consent to Secretary of State. Build, operate (and ultimately decommission) projects once consented.
Statutory consultees (e.g. Natural England)	Consultees to the SEA process. Some involvement in identification of zones by The Crown Estate. Provide advice in relation to Appropriate Assessment of the Round 3 plan.	Provide advice and guidance to project development via consultation with Governmen, public bodies and developers.
Other consultees and stakeholders (including the general public) (e.g. potential offshore wind farm developers)	Consultees to the SEA process. Some involvement in identification of zones by The Crown Estate.	Input to the project development process during consultation with developers.

4.6 Stage 1 - Identification of the former Hornsea Zone

4.6.1.1 The identification of the development zones to be tendered in Round 3 was undertaken by TCE (The Crown Estate, 2012), using available data to identify areas of seabed within the area assessed by the OESEA (DECC, 2009), which had good potential for offshore wind development. TCE used its Marine Resource System (MaRS) GIS tool to undertake this analysis.

4.6.1.2 Modelling of potential zone areas within MaRS was undertaken at a national level using UK-wide datasets. Since it was important to ensure that all zones were identified on a consistent and systematic basis, datasets which provided detailed but highly localised information were not suitable for the broad analysis. This is because their inclusion in a national scale model would skew the results by providing more data in some areas than in others. However, these datasets were used during the later stages of zone identification as 'review datasets'. To delineate the Round 3 Zones, a three-stage approach was adopted – this approach is outlined below:

- Areas unsuitable for wind farm development due to the presence of one or more Exclusions to development were removed. Exclusions are defined as areas of seabed which:
  - Are already leased or licensed for another purpose or activity (e.g. a site licensed for aggregate dredging);
  - Have been granted future permission for another purpose or activity (e.g. an Agreement for Lease area for a Round 2 wind farm); or
  - Are unsuitable for development because of technical conditions or external interests (e.g. unfavourable bathymetry, or an oil platform).
- The suitability of the remaining areas of seabed were then evaluated on the basis of restrictions which were present. Restrictions are defined as activities, developments or interests which may not preclude development, but which should be considered when planning the proposed activity or development; and
- The outputs from this national scale modelling were then reviewed against a number of detailed review datasets to check for consistency. Review datasets consisted of information and data which were unsuitable for national analysis and modelling but which could be used to inform decisions about the individual zones. Examples of review datasets used include fish spawning and nursery areas, National Grid connections, Sensitive Bird Areas, and oil and gas licence blocks.

4.6.1.3 Three iterations of the process were undertaken. The first iteration (in June 2008) contained 11 zones, and discussions with a number of stakeholders were undertaken in relation to the data and modelling process which had been used to identify these zones. This included relevant Government Departments, Devolved Administrations, Statutory Consenting bodies and other national stakeholders in the maritime, navigation, aviation and environmental sectors. The focus of the stakeholder engagement was solely to assist TCE in the development of the Round 3 Programme, and therefore only programme scale issues were taken into consideration. Full public consultation on the Round 3 zones was undertaken as part of the Government's SEA process.

4.6.1.4 The second iteration (in September 2008) adapted the zones in the light of the discussions undertaken and with the use of a larger selection of spatial data and a more refined modelling process. This resulted in the identification of nine zones which were virtually identical to the zones offered for tender in Round 3. The final iteration (in July 2009) simply consisted of slight adjustments of the zone boundaries in order to align them more accurately with the territorial sea limits or UK continental shelf limits.

4.6.1.5 It is important to understand that the Round 3 zones were designed to bridge the gap between the large geographical area covered by the OESEA (DECC, 2009) and the specific sites needed for individual projects.

4.6.1.6 The approach taken by TCE using MaRS primarily employed broad scale national datasets to identify areas within those assessed in the OESEA (DECC, 2009) which are generally suitable for offshore wind development. In identification of the zones, TCE was fully aware that constraints to offshore wind development were present within and around the zones, and that the details of these constraints would only become apparent when development activities commenced and detailed survey work was undertaken. However, while in the absence of detailed information it was not possible to predict the most suitable areas for wind farm development within a zone with a high degree of accuracy, it was possible to identify the zones as 'areas of opportunity' within which individual projects could be identified at a later date with more detailed knowledge of the constraints.

4.6.1.7 It has been the role of offshore wind developers to further evaluate the opportunity within the zones, and address technical and environmental considerations on a project level before bringing forward projects for consenting within the statutory planning and marine licensing systems.

4.6.1.8 TCE selected and tendered the nine development zones within the area covered by the SEA (these are the 'Round 3 Zones'), and entered into a Zone Development Agreement (ZDA) with a developer for each zone. SMart Wind was originally awarded a ZDA for the former Hornsea Zone in December 2009.

4.7 Stage 2 – Identification of Hornsea Three array area within the former Hornsea Zone

4.7.1.1 SMart Wind Ltd. was awarded the rights to the development of the former Hornsea Zone by TCE in 2009. The subsequent development agreement between SMart Wind and TCE established a target capacity of 4,000 MW of generating capacity within the former Hornsea Zone, which was to be met through the development of several offshore wind farms.

4.7.1.2 The identification of individual projects within the former Hornsea Zone was undertaken by the process of Zone Appraisal and Planning (ZAP) which is a non-statutory strategic planning process recommended by TCE specifically for Round 3. SMart Wind concluded ZAP to optimise the use of the former Hornsea Zone and ensure that all proposed works were delivered safely, efficiently and with minimum while minimising impacts for stakeholders and the environment.

4.7.1.3 The aim of ZAP was to:

- Optimise the development opportunity within the zone through the identification of the most technical and environmentally suitable development sites;
- Encourage wide stakeholder engagement at a strategic level to help inform the longer-term development strategy; and
- Assess cumulative impacts across the entire zone and in relation to other nearby offshore wind farm developments and marine activities.

4.7.1.4 The original offshore boundary to delineate the location of offshore wind turbines for offshore wind farms was identified by SMart Wind through an analysis of engineering, environmental, economic and consenting risks and facilitated by stakeholder engagement. From an engineering perspective, the shallowest and flattest parts of the seabed were identified for early development, as proven technology can be installed, minimising any consenting and economic risks. Using existing bathymetric data, the shallowest area within the former Hornsea Zone was identified. In parallel with this, existing environmental 'hard constraints' in the Zone were mapped based on spatial data and guidelines available as of January 2011, including but not limited to:

- Suspended oil and gas wells (500 m buffer);
- Completed, drilled, plugged and abandoned wells (no buffer);
- Active subsurface structures (500 m buffer);
- Surface structures with helipads (6 nm buffer, based on the previous CAP 764, CAA, 2011);
- International Maritime Organisation (IMO) shipping routes;
- Bathymetric contours (5 m intervals);
- Consented developments;
- Wrecks (200 m buffer);
- Active pipelines (500 m buffer); and
- Active cables (500 m buffer).

4.7.1.5 From the ZAP process, Smart Wind identified Hornsea Project One, an area of 661.97 km² located in the central part of the former Hornsea Zone, with up to 1.2 GW of generating capacity and Hornsea Project Two, an area of 462 km² located in the central part of the former Hornsea Zone to the north of Hornsea Project One, with up to 1.8 GW of generating capacity. Both projects were identified and taken forward for EIA.

4.7.1.6 The first project to be proposed within the former Hornsea Zone was Hornsea Project One. Hornsea Project One comprises up to three offshore wind farms with a maximum combined generating capacity of 1,200 MW (although this has recently been amended to a maximum capacity of 1,218 MW). The Secretary of State granted Development Consent for Hornsea Project One on 10 December 2014.

4.7.1.7 The second project to be proposed within the former Hornsea Zone was Hornsea Project Two. Hornsea Project Two comprises up to two offshore wind farms with a maximum combined generating capacity of 1,800 MW. The Secretary of State granted Development Consent for Hornsea Project Two on 16 August 2016.

4.7.1.8 DONG Energy Wind Power A/S acquired the development rights to Hornsea Project One in February 2015 and, in August 2015, DONG Energy Power (UK) Ltd. acquired SMart Wind and the remainder of the former Hornsea Zone, together with the development rights for Hornsea Project Two, Hornsea Three and Hornsea Four. Hornsea Four has not yet been taken forward for development. Subsequently in March 2016, the Hornsea Zone Development Agreement was terminated and the Hornsea Zone has therefore been dissolved (and hence is referred to as the former Hornsea Zone). Thus, the Hornsea Zone Development Agreement was terminated and new project specific agreements, called Agreement for Leases (AfLs), were agreed with TCE for Hornsea Project One, Hornsea Project Two, Hornsea Three and Hornsea Four. These new documents replaced existing AfLs relating to the former Hornsea Zone and were created in a new format by the Crown Estate.

4.7.1.9 After the former Hornsea Zone was divided into the four separate AfLs, two of these areas remained outside of the Hornsea 1 and Hornsea 2 AfL areas. These two areas were investigated further by DONG Energy to assess which one would be most suitable for the next development. An initial risk assessment was conducted on each of these remaining two areas to assess the potential impact of oil and gas, ornithology, ground conditions and other technical criteria. Drawing on this work, a decision was made to utilise the area on the eastern section of the former Hornsea Zone first – this became Hornsea Project Three. The initial capacity of the project was up to 1.6 GW and a grid connection for this capacity had been acquired, alongside the rights to the area, from SMartWind. However, on further consideration of the full AfL area of 696 km² it was determined that the area could accommodate up to 2.4 GW capacity and hence the original grid connection agreement was no longer valid. At this point Hornsea Three commenced the process to identify a suitable connection for the increased generation capacity with National Grid (see also Stage 3 – Identification of grid connection location and initial level landfall appraisal).

4.8 Stage 3 – Identification of grid connection location and initial level landfall appraisal

4.8.1.1 The Grid Connection stage comprised a sequence of steps associated with the site selection work preceding and immediately following on from the identification of the connection point to the main National Grid infrastructure.

4.8.2 High level connection options

4.8.2.1 As explained in Stage 2 – Identification of Hornsea Three array area within the former Hornsea Zone, DONG Energy originally acquired the rights to develop Hornsea Three with an associated grid connection agreement of 1.6 GW. However, further assessment of the array area identified potential capacity within the array for up to 2.4 GW and as a result it was necessary to review the existing grid connection agreement.

4.8.2.2 Hornsea Three began discussions with National Grid Electricity Transmission Limited (NGET) in 2016, with the objective of identifying potential grid connection locations for Hornsea Three's increased generating capacity. At this point the National Grid commenced the Connections and Infrastructure Options Note (CION) process (see also paragraph 4.8.3.1 below). A number of potential grid connection locations (see Figure 4.2) were considered through this process based on an understanding of the grid infrastructure capacity in relation to the location of the Hornsea Three array area, the potential capacity of Hornsea Three and its target connection timescale. The connection locations identified comprised:

- Norwich Main;
- Walpole;
- Necton;
- Bicker Fen; and
- Eye.

4.8.2.3 The indicative routes shown on Figure 4.2 were not subject to any environmental constraint analysis and therefore, simply represent straight lines to the coast and then to the potential connection points.

4.8.2.4 Early engagement with National Grid identified the five possible connections listed above. At that time, it was not considered likely that there would be any opportunity to connect to the national grid network to the north of Boston due to grid capacity constraints during the anticipated timeframe in which Hornsea Three would require a connection. Options to the south of Norfolk were discounted based on distance from the array area.

4.8.3 National Grid connection offer

4.8.3.1 The aim of the CION is to provide an assessment of the options to connect a project to the National Electricity Transmission System (NETS). The process facilitates an appraisal of a variety of options and identifies the preferred onshore connection points and offshore transmission network configuration for the project. The CION is developed to initially make a representative Connection Offer to an applicant and subsequently develop the most economic and efficient design option for the connection of a project. This is assessed by both National Grid and the Developer from an economic and strategic perspective, in terms of the additional costs and investments required for the connection, based on the capacity requested and the timing of when the developer predicts that the connection will be required. An important element of this assessment is the cost that will be passed on to the consumer (the public and businesses) as a result of the works which will be required to ensure the network can accommodate the project. As part of the economic assessment, the CION considers the total life cost of the connection – assessing both the capital and projected operational costs to the onshore network (over a project's lifetime) to determine the most economic and efficient design option. Whilst a developer inputs into this process in terms of the comparative costs for different options which National Grid may consider, the eventual offer is determined by National Grid.

4.8.3.2 On 27 May 2016, Hornsea Three was formally offered a grid connection at Norwich Main Substation (Norwich Main) as a result of this process.

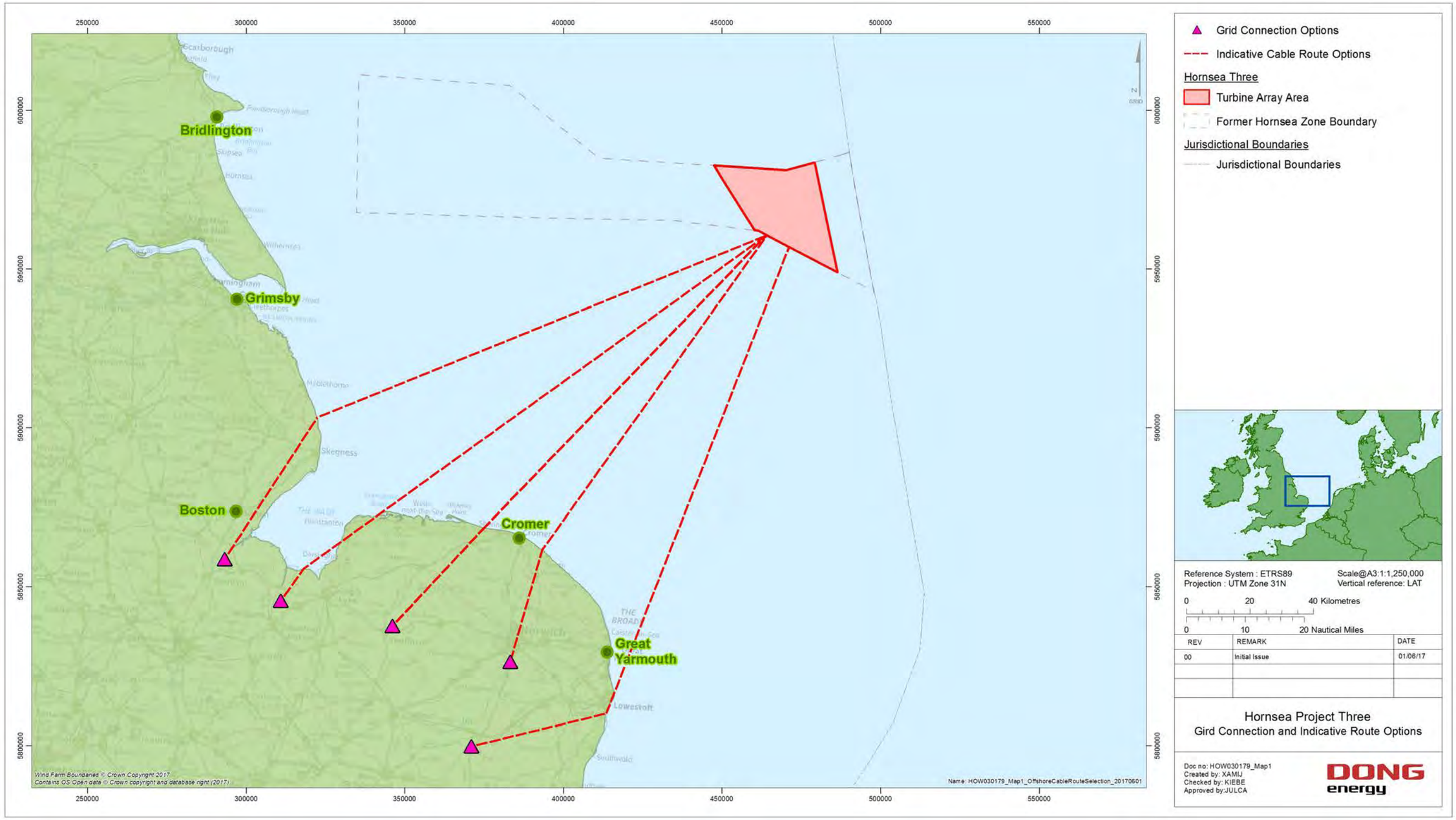

Figure 4.2: High level connection mapping.

4.8.4 Initial landfall appraisal

4.8.4.1 Following on from the National Grid connection offer, an initial desk based assessment (DBA) of potential landfall options on the North Norfolk coast was undertaken. This process applied those principles as set out in section 4.4 of this Chapter along with consideration of the following consenting constraints (to be avoided where possible):

- Avoid high (>20 m) and/or geomorphically active coastal cliffs;
- Ensure foreshore access for vehicles during construction;
- Avoid residential property;
- Avoid Common Land;
- Avoid land designated for nature conservation (e.g. SPA, SAC etc);
- Avoid land used for defence purposes;
- Avoid excessive take of Class 1 Agricultural Land;
- Minimise 3rd Party interaction for burial requirements;
- Realistically acheivable length of HDD (or similar technology) to cross the sea defences;
- Suitable working area to allow for drilling operations (if required);
- Feasibility to install jointing bays and cable pull-in;
- Suitable access for inspection and maintenance;
- Limit the amount of private land required;
- Minimise crossings of linear natural features and infrastructure, e.g. rail, road, water and utilities and where possible, aim to cross at 90°;
- Do not run adjacent to railway lines;
- Avoid underground or subsea rock/solid substrates;
- Avoid steep gradients/banked verges;
- Avoid areas of standing water; and
- Avoid areas of ancient woodland habitats or other areas of woodland likely to have nature conservation interest.

4.8.4.2 It is noted that not all of the above aspirational criteria could be met for each landfall option, but the zones identified (see Figure 4.3) were considered areas where landfall could be feasible whilst minimising overlap with the key constraints. This appraisal process resulted in the identification of five ‘zones’ for further detailed investigation:

- Zone 1 – Titchwell to Holkham;
- Zone 2 – Salthouse to Cromer;
- Zone 3 – Overstrand to Sidestrand;
- Zone 4 – Happisburgh to Waxham; and
- Zone 5 – Heacham to Hunstanton.

4.9 Stage 4 – Refinement of project options

4.9.1.1 Subsequent to the confirmation and acceptance of the of grid connection offer a high level appraisal of landfall options and more detailed site selection process was undertaken to identify more specific project components comprising:

- A refined landfall zone;
- A broad offshore export cable corridor search area (encompassing potential future HVAC booster station locations); and
- A broad onshore export cable corridor search area (encompassing potential future HVAC booster station and onshore substation locations).

4.9.1.2 The intention of this stage was to identify sufficient detail to enable meaningful engagement through Scoping and Phase 1.A consultation with the public, whilst retaining sufficient flexibility for iterative refinement through consultation feedback and acquisition of site specific information. The process by which areas for these project components were selected and others discounted is described in the following paragraphs with the information presented in chronological order reflecting the iterative nature of the process (i.e., refinement of landfall zones followed by offshore and onshore route appraisal then feeding back into a further refinement of the remaining landfall zones).

Figure 4.3: North Norfolk coast landfall appraisal.

4.9.2 Refinement of coastal landfall options

4.9.2.1 All five of the landfall zones (described in Stage 3) were visited by a multi-disciplinary team of environmental and consenting specialists, construction and installation engineers and commercial managers.

4.9.2.2 The constraints considered for landfall site selection are as set out in section 4.4 along with a consideration of the following technical, consenting and cost implications:

- Technical constraints:
  - Nearshore and beach profile & coastal geology and geomorphology;
  - Proximity to existing infrastructure;
  - Access; and
  - Proximity to residential areas.
- Consenting constraints:
  - Proximity to designated sites / features;
  - Proximity to existing infrastructure;
  - Interaction with recreation; and
  - Proximity to residential areas.
- Commercial constraints:
  - Land acquisition requirement;
  - Construction costs for landfall works; and
  - Cost implications for offshore and onshore cable length.

4.9.2.3 The assessment of landfall zones identified that all five zones would have a level of technical, consenting and commercial risk associated with them. However, zones 1, 3 and 5 were identified as being significantly more challenging due to limited foreshore access (all three), high (>40 m) geomophologically active cliffs (zone 3) and highly variable nearshore shallow bathymetry, requiring long and complex intertidal works (zone 1 and 5) and therefore, were recommended for exclusion. Landfall within Zones 2 and 4 were taken forward for further detailed consideration. This process involved a consideration of the offshore and onshore constraints associated with connecting to either zone 2 or 4.

4.9.3 Appraisal of offshore export cable corridor options

4.9.3.1 Having refined the number of Landfall Zones (from five to two), a number of early marine Export Cable Route (ECR) options were identified and appraised to ensure that the candidate landfall sites (within Zones 2 and 4 – see Figure 4.3) were technically viable, from an offshore connection perspective. The options were developed and refined following a phased approach including:

i. A screening of physical and environmental constraints and opportunities within the study area (see Table 4.3); and
ii. Identification of potential marine ECR corridor options.

4.9.3.2 The guiding principles as set out in section 4.4 were applied to the development of potential marine ECR options, the routes within each search area were 1.5 km wide but were indicative only at this early stage.

4.9.3.3 Several Marine ECRs were developed, initially along a straight-line approach. These were then modified taking acccount of key physical and environmental constraints as outlined in Table 4.3. The key driver to ECR development was the minimisation of ECR Length and avoidance of, or minimising overlap with hard constraints, where possible. Figure 4.4 presents several of the high-level marine ECR options that were developed from the Hornsea Three AfL to landfall Zone 2 and Zone 4.

4.9.3.4 It was established that routing to either zone 2 or 4 would result in interaction with designated sites (as would have any other of the landfall options considered), however, the level of interaction with designated sites (whilst retaining a realistic design that was not overly convoluted) could be reduced through routing to landfall zone 2.

4.9.3.5 Routing to either zone 2 or 4 would also result in the crossing of a considerable number of existing linear infrastructure assets. However, the number of crossings are heightened when considering landfall at zone 4, and the number of crossings that would be required close to shore (associated with the assets connecting into Bacton gas terminal) would create a significant challenge both technically and commercially. Furthermore, the Project became aware of a sandscaping scheme associated with the assets connecting to the Bacton gas terminal that has been proposed around landfall zone 4 which would likely further increase the technical, consenting and commercial challenges of making landfall in this area. Minimising the number of crossings and commercial interactions is preferable from a technical, environmental and cost perspective and therefore, there was a clear preference in this regard for landfall zone 2.

Table 4.3: Marine ECR Planning Constraints.

Constraint	Preference	Mitigation
Ground Conditions (Rock/Chalk)	Avoid	Correct tool selection, reduced burial
UXO	Avoid	Survey and re-routing
Military PEXA	Avoid	No mitigation, avoid
Dredging Areas	Avoid	Re-route, deep burial
Dumping Grounds (Military)	Avoid	No mitigation, avoid
Wrecks	Avoid	No mitigation, avoid
Navigation Aids	Avoid	No mitigation, avoid
Boulders	Avoid if possible	Boulder clearance operations, re-routing
Cables (Crossing)	Avoid if possible and where not possible, minimise number	Re-routing, crossing agreement with associated measures
Cables (Proximity)	Avoid if possible	Re-routing, proximity agreement with associated measures
Pipelines (Crossing)	Avoid if possible and where not possible, minimise number	Re-routing, crossing agreement with associated measures
Pipelines (Proximity)	Avoid if possible	Re-routing, proximity agreement with associated measures
Offshore Infrastructure (Rigs etc.)	Avoid/maintain separation distance	Re-routing, proximity agreement with associated measures
Shallow Water	Avoid if possible	Vessel selection or rerouting
Depressions	Avoid if possible	Correct tool selection, reduced burial or re-routing
Seabed Mobility	Avoid if possible	Correct tool selection, dredging, re-routing
Sandwaves, Megaripples etc.	Avoid if possible	Correct tool selection, dredging, re-routing
Excessive Slopes	Avoid if possible	Correct tool selection, dredging, re-routing
Dumping Grounds (General)	Avoid if possible	Re-route, dredging
Foul Ground	Avoid if possible	Re-route, soil investigation
Anchorage Areas	Avoid if possible	Re-route, move anchorage site, deep burial
Designated sites of nature conservation interest	Avoid if possible	Mitigate through design
Potential Annex I habitat (reef and sandbank)	Avoid if possible	Mitigate through design
Sensitive fish species (herring, sprat, sandeel) spawning grounds	Avoid if possible	Mitigate through design
Areas of commercial fishery importance.	Avoid if possible	Mitigate through design
Planned Developments (Cables and Pipelines)	Manageable	Stakeholder engagement
Ground Conditions (Soft)	Manageable	Correct tool selection, reduced burial
Ground Conditions (Hard)	Manageable	Correct tool selection, reduced burial
Traffic Separation Systems (TSS)	Manageable	Notice to mariners, VHF broadcasts
Shipping routes	Manageable	Notice to mariners, VHF broadcasts
Export Cable Paralleling	Manageable	Route Planning
Fishing Grounds	Manageable	Re-route, deep burial

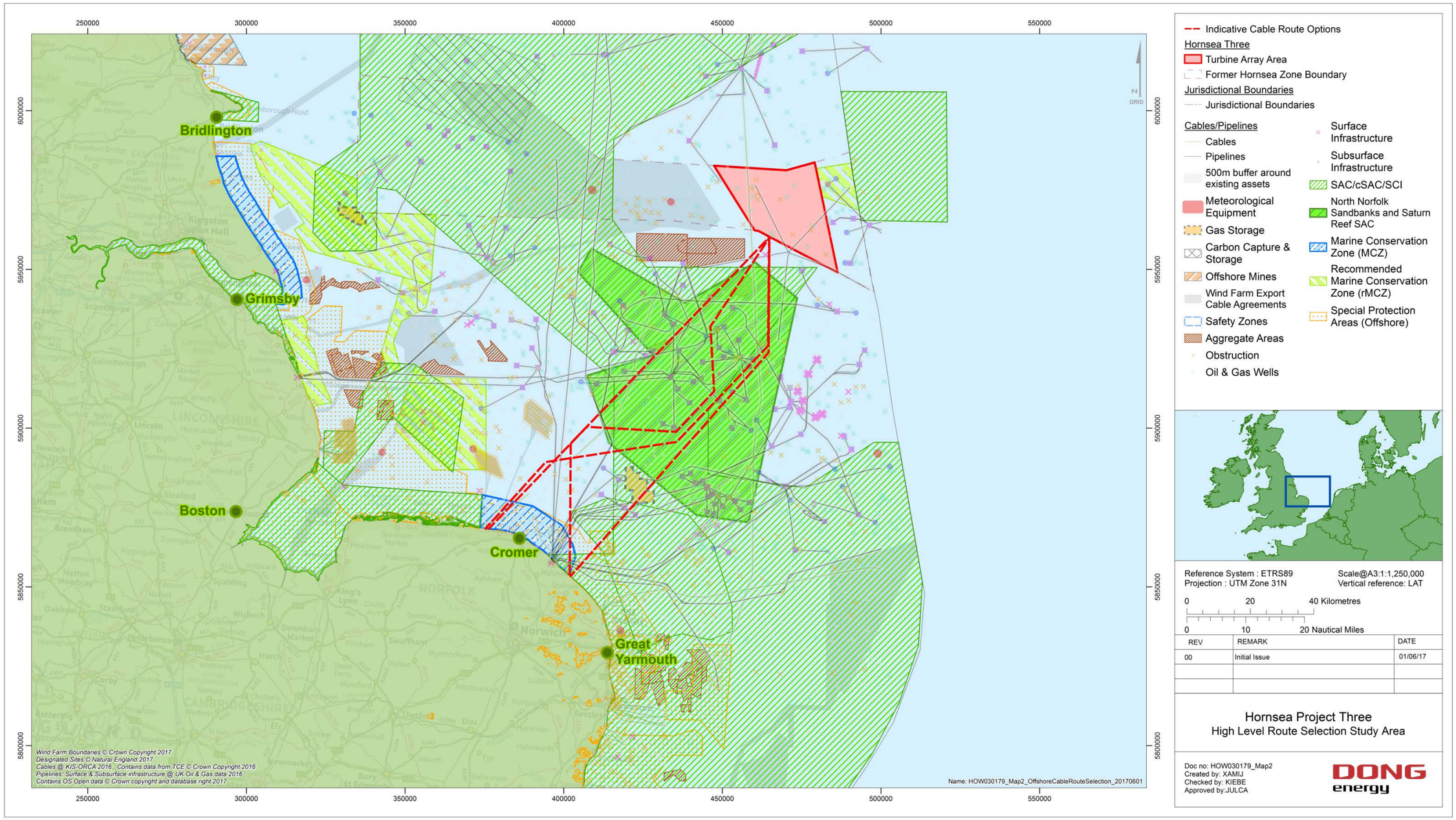

Figure 4.4: Hornsea Three marine ECR study area and high-level marine ECR corridors to landfall zones 2 and 4.

4.9.4 Appraisal of onshore cable corridor options and infrastructure

4.9.4.1 Alongside the appraisal of potential offshore ECR corridors for landfall zones 2 and 4 a similar exercise was undertaken for the onshore ECR and associated infrastructure to explore whether there were any key influencing factors from an onshore perspective on the selection of the landfall zone.

4.9.4.2 The onshore search areas were developed on the basis of making landfall at either zone 2 or zone 4 and then a grid connection at Norwich Main. Connection from zone 2 would require routing to the west of Norwich, whilst connection from zone 4 could be achieved from either the north or south of Norwich. This resulted in a larger search area associated with potential landfall zone 4 than zone 2 as depicted on Figure 4.5. The onshore search areas were intended to provide areas within which the most direct onshore routes possible between the two landfall zones and Norwich Main substation could be identified, with opportunities to avoid sensitive sites, environmental constraints, and major crossings. An area between the two landfall zones roughly between Sheringham and Wallcott, extending inland to a point near Felthorpe, was excluded from the search area on the basis any future cable routes within that area would represent a significant deviation from the most direct options available. The City of Norwich was excluded from the search area on the basis that the sufficient width of land would not be available to the project within the city boundary, any construction works within the city would cause significant disruption and the landownership and commercial considerations in that area would be too complex during all phases of the project.

4.9.4.3 The main constraints to onshore cable routeing and citing of the potential HVAC booster station considered within these search areas included proximity to the coast (for technical reasons the HVAC booster station should be as close to the coast as possible, accounting for other constraints), ecology, nature conservation designations, landscape designations, tourism and recreation, cultural heritage assets, the presence of 'fixed' assets such as infrastructure (roads, railways, rivers) and land uses (settlements, commercial development, housing, surface water bodies, woodland).

4.9.4.4 The construction elements that would be ultimately required comprise:

- Transition Joint Bays above MHWS, to connect the marine and terrestrial export cables;
- A 60 m wide permanent cable corridor;
- A 2.5 ha plus associated working area within (approximately) 10 km of the coast for the potential HVAC booster station;
- Cable jointing bays, and link boxes at intervals along the cable corridor (approximately 1 per km);
- Temporary cable route construction compounds;
- Temporary major crossing construction compounds;
- Temporary construction access roads; and
- Temporary cable corridor haul roads.

4.9.4.5 The onshore cable corridor search area was explored at a high level using GIS and desk-based studies (including review of aerial photography), taking account of the same guiding principles as set out in section 4.4 and those constraints described above. Consideration was given as to the potential for any impediment to either search area (from zone 2 and 4) being able to support the construction elements as described above.

4.9.4.6 It was concluded that connecting from zone 2 or zone 4 landfall to Norwich Main Substation would be broadly similar, with none being particularly more, or less, technically challenging than the other, in terms of crossings of utilities/services. However, cable routing from zone 4 was considered to be potentially more challenging for other technical reasons. Marshy conditions in the area of the Norfolk Broads National Park were considered to present significant technical challenges for installation (in relation to access and installation techniques). In addition to this crossing the Norfolk Broads National Park was considered to present consenting risk to the project with the possibility of significant seasonal construction restrictions, increasing project costs and hence eventual costs to the consumer. Alternative options to avoid crossing the Norfolk Broads National Park if routing from zone 4 would result in a much more complex (longer) route which would in itself have significant commercial implications and also increase the potential for both further technical and consenting constraints encountered along the route.

4.9.4.7 In summary therefore, it was concluded that whilst there may be apparent technical ability to connect to the Norwich Main Substation from either landfall zone 2 or 4, the presence of the Norfolk Broads would strongly favour landfall zone 2 on both commercial, technical and consenting grounds.

4.9.5 Summary

4.9.5.1 Based on the high level appraisal of the offshore and onshore constraints associated with the two landfall options (zone 2 and 4) it is clear that whilst it may be technically feasible to connect from the Hornsea Three array area to the Norwich Main Substation via either landfall option, zone 2 offers considerably less overall risk from a technical, consenting and commercial perspective for both onshore and offshore elements of the project.

4.9.5.2 Landfall zone 2 was therefore, taken forward as the preferred option and connection routes from the array to this landfall and on to the Norwich Main Substation were then further explored in detail as described in Stage 4 of the site selection process.

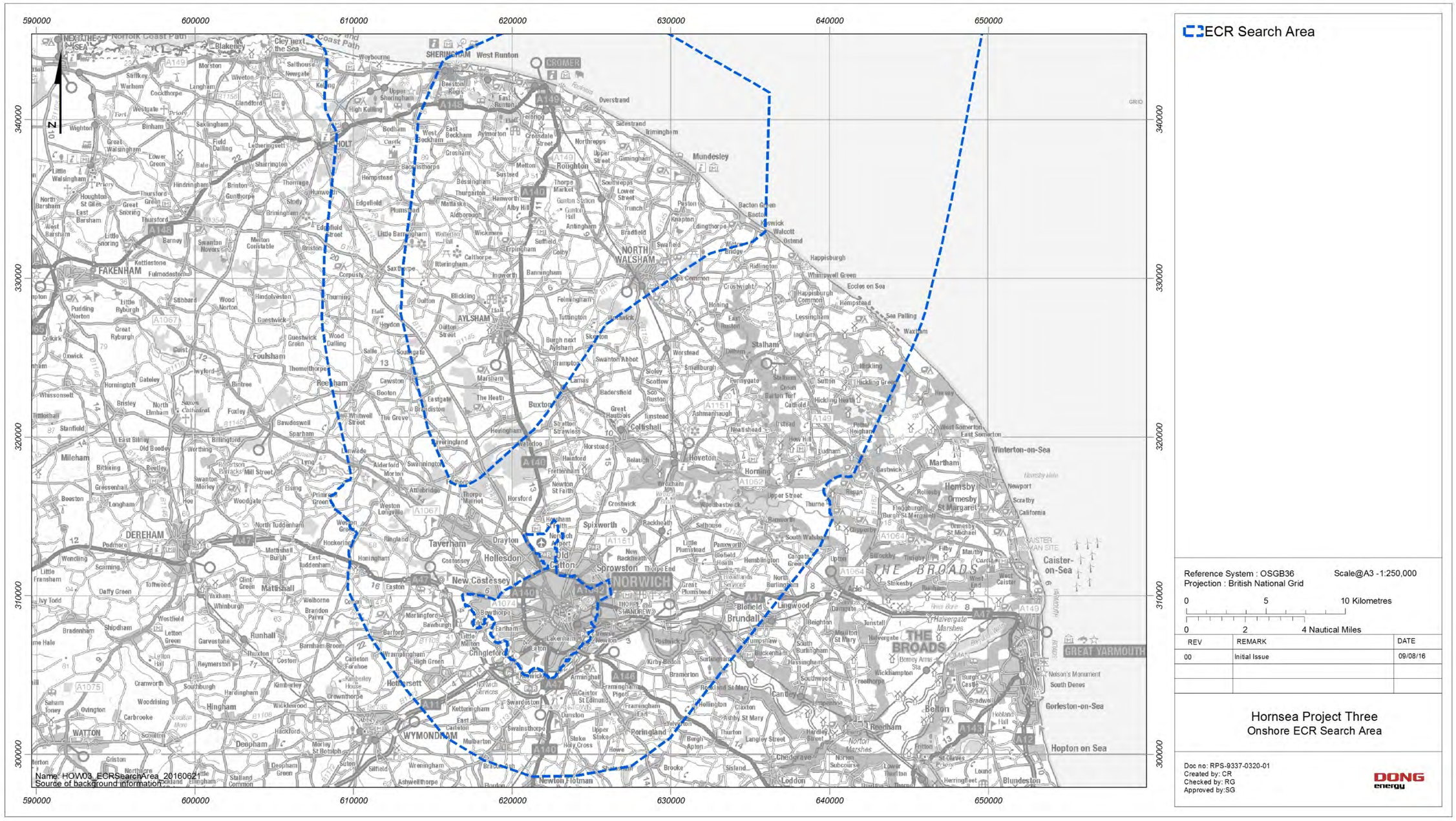

Figure 4.5: Onshore ECR search area.

4.10 Stage 5 - Identification of project for scoping, Statement of Community Consultation (SoCC) and Phase 1.A Consultation

4.10.1.1 Following the identification of a preferred landfall zone (as described under Stage 4) and initial consideration of offshore and onshore constraints, defined search areas (within which the future infrastructure would be cited) for each project component (offshore ECR (inclusive of offshore HVAC booster station search area), landfall, onshore ECR (inclusive of HVAC booster station and substation search areas)) were established for the purposes of formal and informal consultation with the public and relevant statutory and non-statutory stakeholders.

4.10.1.2 The search areas were selected for the Scoping, SoCC and Phase 1.A consultation exercises and built on the site selection refinement work described in Stage 4. The boundaries which were defined were considered to contain sufficient buffers to enable an iterative process (based on stakeholder feedback, further data acquisition and interrogation and, engineering optimisation work) for the evaluation of specific routes and infrastructure locations as the Project progressed through the pre-application phase.

4.10.1.3 For the offshore ECR search area a number of potential routes were developed (see Figure 4.6), aimed at satisfying the selection criteria (minimised the length, avoidance of hard constraints and minimising overlap with key constraints). These straight-line routes were subject to engineering review and route optimisation (e.g. crossing assets (cables and pipelines) at 90 degrees, avoid paralleling cables / pipelines). In recognition that these routes would require much refinement (as described above) before any could be considered suitable for progressing through the EIA process, a broad boundary was drawn around these initial route options for the purposes of Scoping. This provided a Scoping search area of approximately 10 km in width, within which the final preferred offshore ECR and offshore HVAC booster station search area would be identified.

4.10.1.4 For the onshore ECR search area (inclusive of the HVAC booster station and onshore HVDC converter/HVAC substation location) a 5 km wide corridor was established from landfall zone 2 to the Norwich Main Substation. This search area was developed on the basis of a desktop assessment using the preferred landfall zone identified above and commencing with a straight line to Norwich Main Substation. The straight line is the most efficient route that can be taken between the two locations and is therefore the starting point for the assessment. It was concluded early on that the onshore cable corridor could not be installed within roads, due to the individual, and combined, width of cable trenches that would be required (further information can be found on the width of cable trenches and land required in Volume 1 Chapter 3 Project Description) as well as impacts on transport networks locally; and the identification of onshore cable corridor options would, therefore, focus on open countryside as far as possible.

4.10.1.5 Where the straight line intercepted with residential areas or other ‘hard’ constraints, a deviation to the route was included to avoid these obstacles. In addition to obvious obstructions as identified on Ordnance Survey and satellite imagery, environmental constraints and consequent buffers were identified and avoided where feasible. Also, and as previously mentioned, the route deviated around the City of Norwich on the basis that the sufficient width of land would not be available to the project within the city boundary, any construction works within the city would cause significant disruption and the landownership and commercial considerations in that area would be too complex during all phases of the project

4.10.1.6 At this stage, no specific areas were identified for the HVAC booster stations or the onshore HVDC converter/HVAC substation within the onshore ECR search area, however it was established that the former would need to be as close to the coast as possible (although could be up to approximately 10 km from the coast) in order to minimise electrical losses and the latter cited as close to the existing National Grid substation as possible.

4.10.1.7 The onshore and offshore search areas as shown in Figure 4.7, for Hornsea Three represent the culmination of the site selection process up to Q3 2016 at which point a Project boundary was defined for the purposes of EIA Scoping in the summer of 2016. The scoping area was drawn to encompass an area within which all the required project components could potentially be accommodated, based on the status of the project design at that point, known infrastructure and environmental assets/constraints, and providing a spatial extent sufficient to accommodate potentially viable marine and terrestrial cable options, and providing space for further cable route development and refinement work, as the project design progressed and feedback from consultation was digested.

4.10.1.8 The final onshore scoping boundary was considered to include all realistic options for the development of the required onshore cable route corridor, onshore HVAC booster station and onshore HVDC converter/HVAC substation, along with the grid connection point at Norwich Main Substation.

4.10.1.9 Hornsea Three was satisfied that all reasonably foreseeable project options can could be accommodated in the final scoping area, based on all known technical, commercial and environmental criteria, and the project scoping boundary was therefore confirmed.

4.10.1.10 These areas were consulted on between September 2016 (as part of the SoCC), October and November 2016 (Phase 1.A consultation with the public) and December 2016 (as part of formal Scoping of the Project).

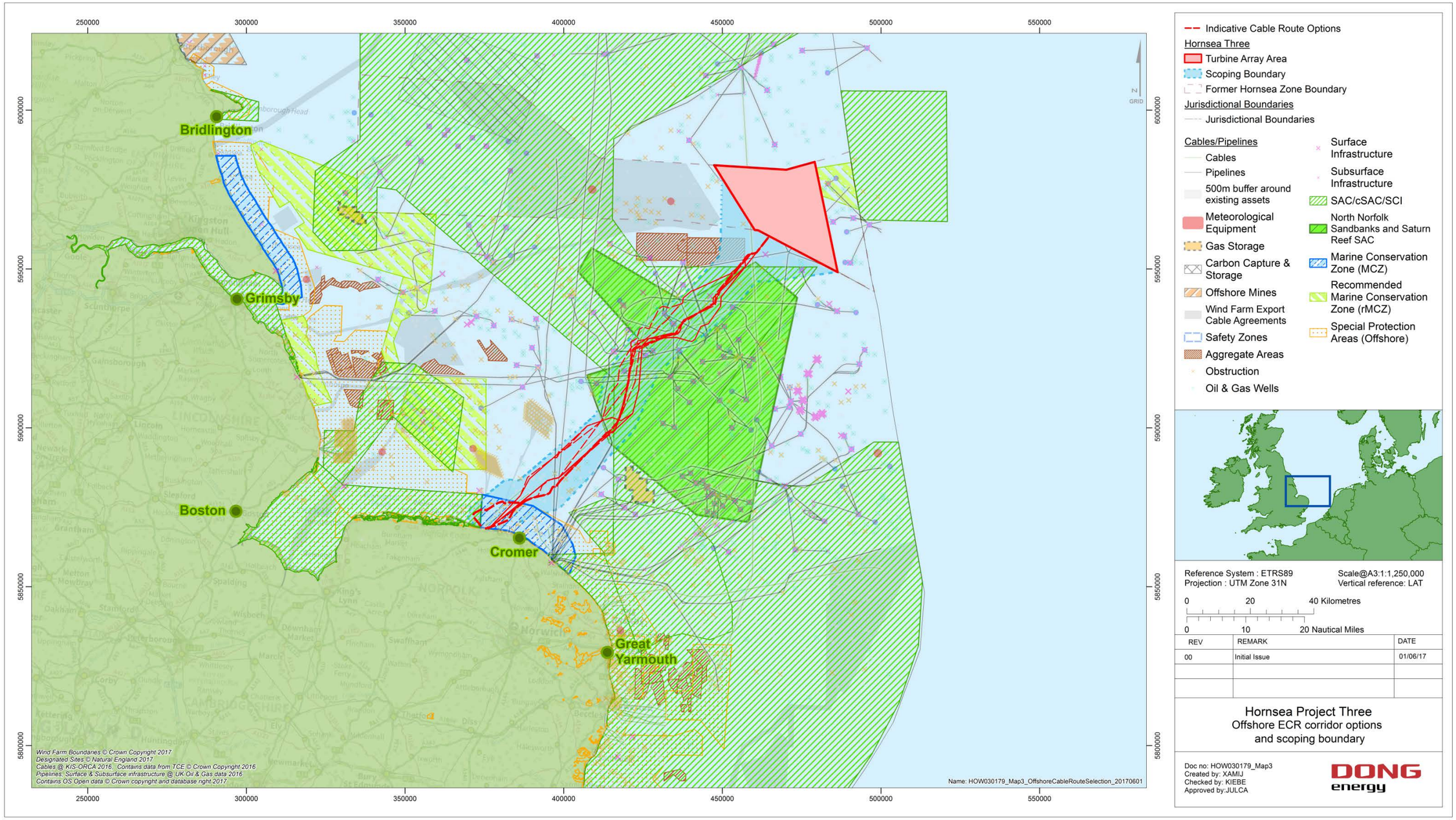

Figure 4.6: Offshore ECR corridor options and scoping boundary.

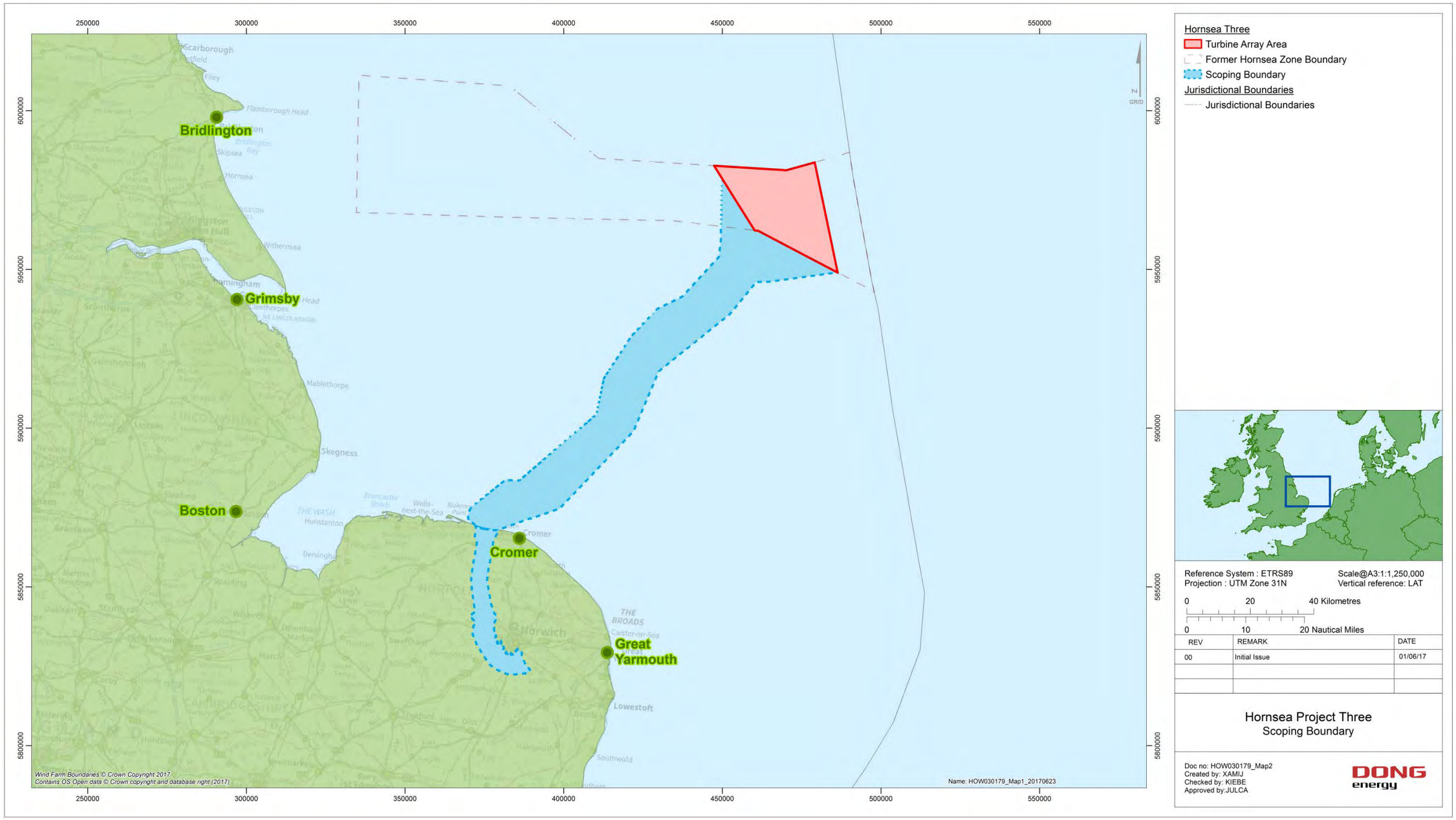

Figure 4.7: Scoping, SoCC and Phase 1 Consultation boundary.

4.11 Stage 6 - Refinement of project for Phase 1.B community consultation events and EIA preparation

4.11.1.1 Following on from the consultation described under Stage 5 of the site selection process further refinement was carried out on these search areas. Specifically, the following activities were undertaken:

- Identification of a refined 1.5 km wide offshore ECR;
- Identification of an offshore HVAC booster station search area;
- Identification of the onshore ECR corridor from 5 km to a 200 m wide corridor with a 100 m technical buffer either side of the corridor;
- Identification of three onshore HVAC booster station location options (and associated cable corridors); and
- Identification of potential onshore HVDC converter/HVAC substation locations.

4.11.1.2 This section of the site selection chapter describes the process of how the above refinements were carried out.

4.11.2 Refinement of the Offshore ECR corridor

4.11.2.1 The indicative routes for the offshore ECR (as identified in Figure 4.6) were further developed following Scoping. Specific aims during this phase were to identify a route that the Project had sufficient confidence in to commission site specific surveys on and then take through the EIA process, whilst retaining sufficient flexibility to enable refinement following receipt of the survey outputs and stakeholder feedback through the iterative EIA process. Accordingly, a 1.5 km width route was sought (in line with the principles in section 4.4 and those set out in Stage 4) that aimed to:

- Minimise overlap with the key features of the North Norfolk Sandbank and Saturn Reef SCI (in particular the sandbank features);
- Minimise overlap with the key (chalk) features of the Cromer Shoal MCZ based on available information at the time of writing; and
- Minimise the number of crossings and ensure that crossings occurred at 90 degrees.

4.11.2.2 This process culminated in the identification of the route as presented in Figure 4.8.

4.11.2.3 Routeing in the area of the North Norfolk Sandbank and Saturn Reef SCI was primarily constrained by the need to cross various oil and gas assets at angles as close to 90° as possible as well as the need to avoid the larger sandbanks charted in the area. For commercial and technical reasons, it is best practice to aim to cross existing cables and pipelines at 90°. Routeing cables over large sandbank features can be technically challenging due to potential for sediments to move during the life of the project (potentially leaving cables exposed). In addition, it was recognised that as a site which is designated for 'sandbanks which are slightly covered by seawater all the time' these features should be avoided in order to minimise any potential impacts on these features of the SCI.

4.11.2.4 In the nearshore area, the proposed routeing gave due consideration to the potential to overlap with the key (chalk) features of the Cromer Shoal MCZ, based on available information at the time of route selection, whilst also considering a number of other constraints in the area and the overarching principles set out in section 4.4. The route proposed seeks to minimise interaction with the chalk which occurs predominantly to the east of the offshore ECR (based on publicly available data, Defra, 2015). In addition, alternative routeing options to avoid the MCZ further offshore, to the north west were considered but were not deemed feasible. This was because the Sheringham Shoal and Pollard Bank bathymetric features were considered to pose potential technical constraints and were avoided, particularly where alternatives would have meant crossing existing cables in close proximity to these. Alternative options to avoid these features entirely would have significantly increased the total length of the offshore ECR and hence would not have been in line with the overarching principles laid out in section 4.4.

4.11.3 Identification of offshore HVAC booster station search area

4.11.3.1 As explained in volume 1 chapter 3: Project Description, an offshore HVAC booster station would potentially be required in the event that an AC electrical system is developed, in order to mitigate transmission losses over the entire cable route.

4.11.3.2 If a DC electrical system is developed then neither onshore or offshore HVAC booster stations would be required.

4.11.3.3 An area starting at approximately 40% of the total cable route length (offshore and onshore) continuing to approximately 60% of the total cable route length, was identified as the offshore HVAC booster station search area (Figure 4.8). This area was chosen based on preliminary electrical design studies which indicated that this location may be electrically optimal. In defining this area, consideration was also given to the results of marine traffic surveys undertaken in support of the assessment of impacts on shipping and navigation (volume 2, chapter 7: Shipping and Navigation) which indicated a high level of vessel traffic to the south west of the offshore HVAC booster station search area. The southernmost limit of the offshore HVAC booster station search area is therefore located 1 nm from the edge of the 90th percentile of the identified main route in line with Marine Guidance Note 543 (MCA, 2016).

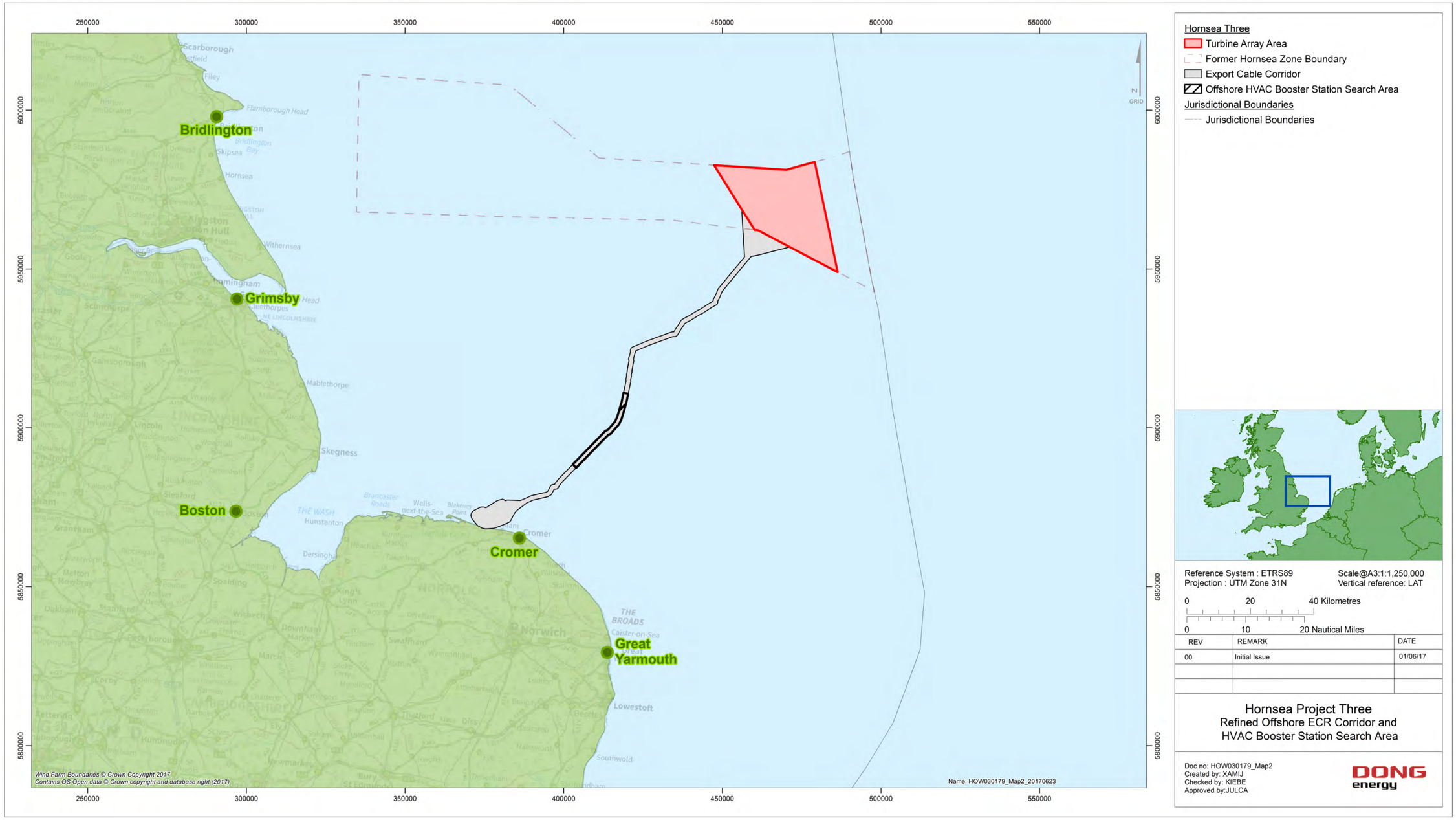

Figure 4.8: Refined offshore ECR corridor and offshore HVAC booster station search area.

4.11.4 Refinement of the landfall zone

4.11.4.1 Following Phase 1.A consultation and consultation on the Scoping Report the landfall area was further refined. This process was iterative, taking account of refinements to the offshore and onshore cable corridor search areas (or equally the potential need to refine each) to ensure that options were aligned at the landfall. Particular consideration was given at the landfall to a number of technical, commercial and consenting constraints which were informed by constraints mapping and previous site visits conducted in Summer 2016. The eastern part of the landfall zone was technically constrained by cliffs, which increased in height from Weybourne eastwards, as well as the town of Sheringham. The western part of the zone was technically constrained by the migrating barrier beach which was considered to present a challenge for cable installation and operation. Commercial considerations for the refinement process included future proximity and crossing options for existing offshore wind farm and telecoms cables either offshore or onshore and the need to do so at an angle as close to 90 degrees as possible. Environmental constraints at the landfall which were avoided through the refinement process included, but were not limited to, landward extents of The Wash and North Norfolk Coast SAC, the North Norfolk Coast SSSI and the North Norfolk Coast SPA to the west of the landfall zone.

4.11.5 Refinement of the onshore ECR Corridor

4.11.5.1 Identification of an onshore ECR corridor within the Scoping search area was informed through consideration of the main constraints to onshore cable routeing; ecology, nature conservation designations, landscape designations, tourism and recreation, cultural heritage assets, the presence of 'fixed' assets such as infrastructure (roads, railways, rivers). The objective was to avoid these features, where feasible. Land uses (settlements, commercial development, housing, surface water bodies, woodland) were also considered.

4.11.5.2 The onshore ECR was further developed on a desk top basis only. At this stage, further investigation of specific engineering challenges, (including complex terrestrial crossings, landowner information, and cost benefit analysis), was not included but it was recognised that this would be required for the next stage in order to define preferred options. The initial routing didn't give detailed consideration to potential sites for the development of an onshore HVAC booster station or specific sites for the onshore HVDC converter/HVAC substation. Sites for the onshore HVDC converter/HVAC substation were initially explored in close proximity (<3 km) to the existing substation (paragraph 4.11.6.12). As a result, it was possible to progress this initial route identification work without knowing the exact location of the onshore HVDC converter /HVAC subsation whilst still ensuring that any routes would reach the region of the connection point.

4.11.5.3 To develop the onshore cable corridor search area, the following criteria were used:

- Most direct route possible;
- Avoid developed areas (housing, commercial, land allocated) where possible;
- Keep cable turns under 90 degrees;
- Minimise major asset crossings (roads, rail lines, rivers) and close proximities to other assets (utilities, drainage networks, etc.); and
- Opportunities for HDD compounds to be present at both ends of any HDD to ensure option is technically feasible (assuming that at this stage there would be sufficient space within the identified candidate 500 m wide cable corridors); and
- The following areas were excluded within the original search area with the objective that candidate onshore cable corridor options within the search area would avoid these features, as far as possible (noting there may be some circumstances where they could not be completely avoided):
    - Sites of Nature Conservation Interest (SNCI)/designated sites (Special Area of Conservation (SAC)/Special Protection Area (SPA)/Site of Special Scientific Interest (SSSI)/Ramsar/National Nature Reserve (NNR)/Local Nature Reserve (LNR)/County Wildlife Site (CWS)/Royal Society for the Protection of Birds (RSPB) Reserves);
    - Settlements and residential development;
    - Historic Parks and Gardens;
    - Sites allocated for development in the relevant Development Plans;
    - Scheduled Ancient Monuments and Listed Buildings;
    - Substantial Wooded Areas;
    - Ancient Woodland;
    - Active landfill areas;
    - Surface water features;
    - Airfield locations;
    - Designated open space; and
    - National Trust and Forestry Commission Land.

4.11.5.4 Following the development of the initial route, this was then refined to take account of the identification of potential onshore HVAC booster station locations (further detail below). The onshore ECR was split into three to provide an ECR option to each potential onshore HVAC booster station option, taking account of the same routing constraints as outlined above. These routes then all rejoined the main onshore route to the south of the most easterly onshore HVAC booster station option (Figure 4.9).

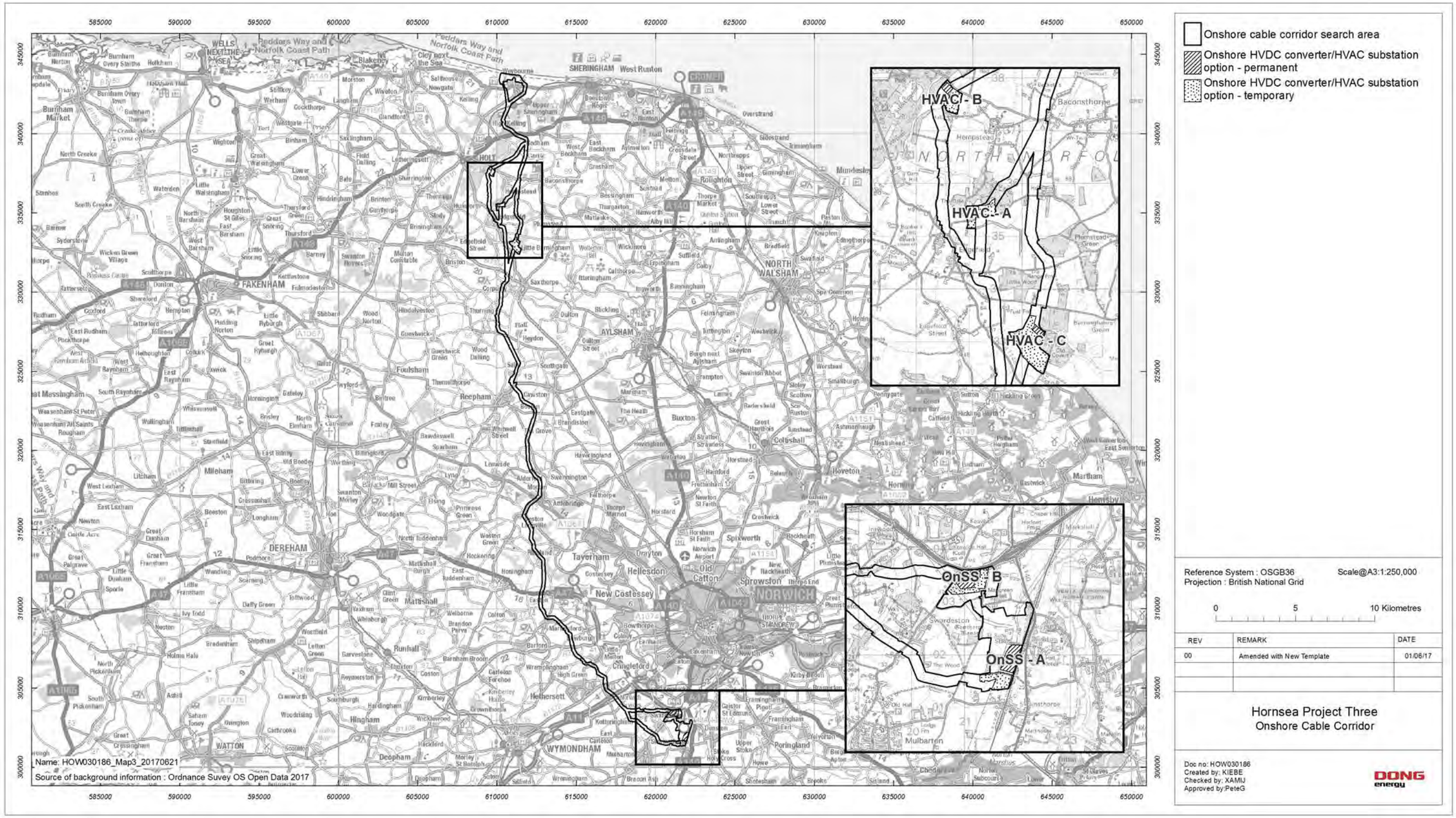

Figure 4.9: Refined onshore ECR corridor.

4.11.6 Identification of potential onshore HVAC booster station and HVAC/HVDC substation locations

4.11.6.1 Alongside the onshore ECR corridor identification process consideration was given to potentially feasible site options for the above ground onshore infrastructure, namely:

- The onshore HVAC Booster Station (if required); and
- The onshore HVDC converter/HVAC substation.

Identification of Potential HVAC Booster Stations

4.11.6.2 As explained in Volume 1 Chapter 3: Project Description, an onshore HVAC booster station would potentially be required in the event that an AC electrical system is developed, in order to mitigate transmission losses over the entire cable route.

4.11.6.3 If a DC electrical system is developed then neither onshore or offshore HVAC booster stations would be required.

4.11.6.4 The site requirements for the onshore HVAC Booster Station are set out in Volume 1, Chapter 3: Project Description. In order to find a potentially suitable site for a HVAC booster station, Hornsea Three developed a set of guiding principles to first establish an onshore HVAC booster station search area, and then further guiding principles to identify potentially suitable sites within the search area it for further investigation.

4.11.6.5 The HVAC Booster Station search area was established on the following basis:

- Within approximately 10 km of the preferred landfall zones (to maximise electrical efficiency/minimise electrical losses);
- Located within the onshore cable corridor search area if possible (to minimise deviations/cable route length between onshore cable corridor options identified and the HVAC booster station); and
- Suitable to accommodate a 2.5 ha onshore HVAC booster station and associated working area.

4.11.6.6 In accordance with the guiding principles adopted for Hornsea Three described above, overarching search methodology, potential onshore HVAC Booster Station sites were identified within the search areas, initially using constraints based heat mapping to identify the potentially least constrained locations.

4.11.6.7 Once the overarching search area was established (as detailed above), more detailed constraints mapping was prepared in order to confirm exclusion areas within the search area and, to identify sites offering potential.in the potentially least constrained locations.

4.11.6.8 The following features were excluded from the search area:

- Areas designated for landscape importance (Areas of Outstanding Natural Beauty (AONB));
- SNCI/designated sites (SAC/SPA/SSSI/Ramsar/NNR/LNR/CWS/RSPB Reserves);
- Flood risk zone 1 areas;
- Settlements and residential development;
- Historic Parks and Gardens;
- Sites allocated for development in the relevant Development Plans;
- Scheduled Ancient Monuments and Listed Buildings;
- Substantial Wooded Areas;
- Ancient Woodland;
- Conservation Areas;
- Active landfill areas;
- Surface water features;
- National Trust and Forestry Commission Land;
- Common Land;
- Approximate airfield locations; and
- Designated open space.

4.11.6.9 Once the exclusions above had been applied, a desk based search was carried out to identify potential site locations for further investigation within the HVAC Booster Station search area. This also took account of information gathered in previous site visits conducted in Summer 2016. That search looked for sites that met the following criteria:

- Suitable to accommodate a 2.5 ha HVAC Booster Station and associated working areas (further information can be found in volume 1, chapter 3: Project Description);
- Generally flat;
- Benefitting from some existing landscape screening/landscape framework;
- Unconstrained by existing services and utilities; and
- Accessible for construction/delivery of abnormal loads.

4.11.6.10 This process resulted in the identification of three potential sites for further investigation; Option A, also referred to as “Pond Hills”, Option B also referred to as “Holt Farm” and Option C also referred to as “Little Barningham”. Onshore ECR corridor options to each of these potential HVAC Booster Station locations were also established (as outlined above). An overview of these sites is presented in Figure 4.10 and the detail for each option presented on Figure 4.11, Figure 4.12 and Figure 4.13 below.

Figure 4.10: Onshore HVAC booster station overview.

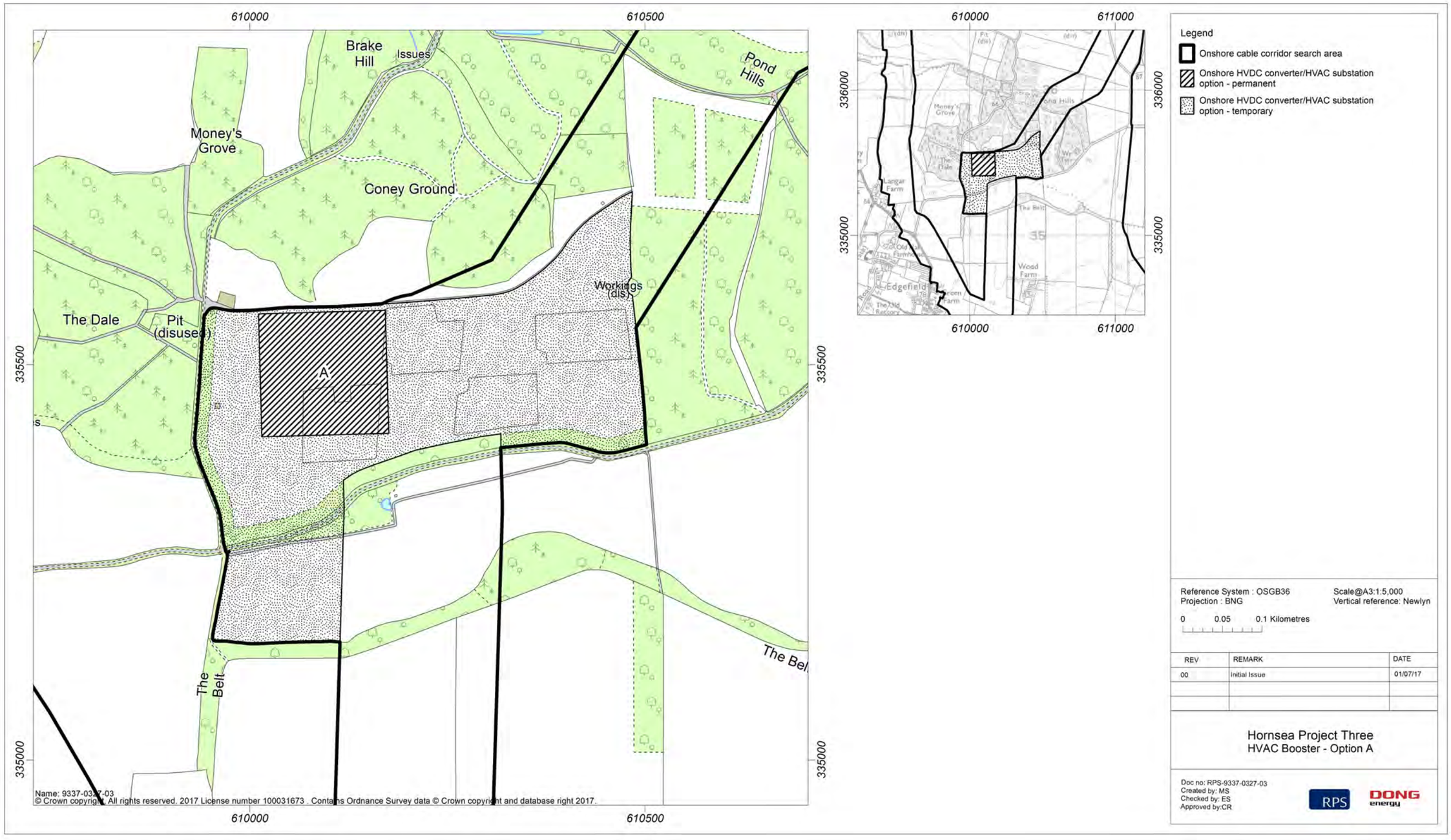

Figure 4.11: Onshore HVAC booster station option A, “Pond Hills”.

Figure 4.12: Onshore HVAC booster station option B, "Holt Farm".

Figure 4.13: Onshore HVAC booster station option C, “Little Barningham”.

Identification of potential HVAC substation/HVDC converter station sites

4.11.6.11 The site requirements for the onshore HVDC converter/HVAC substation are set out in Volume 1, Chapter 3: Project Description. In order to find a potentially suitable site for an onshore HVAC/HVDC substation Hornsea Three again developed a set of guiding principles to first establish an onshore HVAC/HVDC substation search area, and then further guiding principles to identify potentially suitable sites within it for further investigation.

4.11.6.12 The onshore HVDC converter/HVAC substation search area was established on the following basis:

- Within 3 km of Norwich Main Substation (to minimise the distance of the 400 kV AC connection between the new substation and the grid connection point, and to mitigate transmission losses);
- Suitable to accommodate 12.8 ha permanent land take to accommodate onshore HVDC converter/HVAC substation, associated working areas and visual mitigation; and
- Located within the onshore cable corridor search area if possible (to minimise deviations/cable route length between onshore cable corridor and the new onshore HVDC converter/HVAC substation, and onward connection to the National Grid).

4.11.6.13 As with the onshore HVAC booster station search exercise, potential onshore HVDC converter/HVAC substation sites were identified using constraints-based heat mapping initially to identify the potentially least constrained locations.

4.11.6.14 The following areas were excluded from the search area:

- Areas designated for landscape importance (AONB);
- SNCI/designated sites (SAC/SPA/SSSI/Ramsar/NNR/LNR/CWS/RSPB Reserves);
- Flood risk zone 1 areas;
- Settlements and residential development;
- Historic Parks and Gardens;
- Sites allocated for development in the relevant Development Plans;
- Scheduled Ancient Monuments and Listed Buildings;
- Substantial Wooded Areas;
- Ancient Woodland;
- Conservation Areas;
- Active landfill areas;
- Surface water features;
- National Trust and Forestry Commission Land;
- Common Land;
- Approximate airfield locations; and
- Designated open space.

4.11.6.15 The outputs of the constraints mapping exercise described are presented in Figure 4.14. This indicates a clear preference for the east half of the 3 km search area. This was primarily due to the railway line intersecting the area which is considered to present both a technical and commercial constraint for routeing of cables to the onshore HVDC converter/HVAC substation and back to the National Grid Norwich Main substation.

4.11.6.16 A more focused search on this area looked for sites that met the following criteria:

- Suitable to accommodate up to 12.8 ha permanent land take to accommodate onshore HVDC converter/HVAC substation, associated working areas and visual mitigation ;
- Generally flat;
- Benefitting from some existing landscape screening/landscape framework;
- Unconstrained by existing services and utilities; and
- Accessible for construction/delivery of abnormal loads.

4.11.6.17 Following the initial constraints mapping exercise, as well as consideration of technical constraints and information gathered at previous site visits in Summer 2016, two sites were identified for further investigation. The site options are presented on Figure 4.15, Figure 4.16 and Figure 4.17. Due to the early stage of technical investigation at the point of the Phase 1.B consultation events, the specific sites presented in Figure 4.15 were not shown at the consultation events as work was ongoing to determine whether each was considered to be technically feasible. However, the heat mapping exercise was presented to demonstrate the process that Hornsea Three was using to try to identify potential sites.

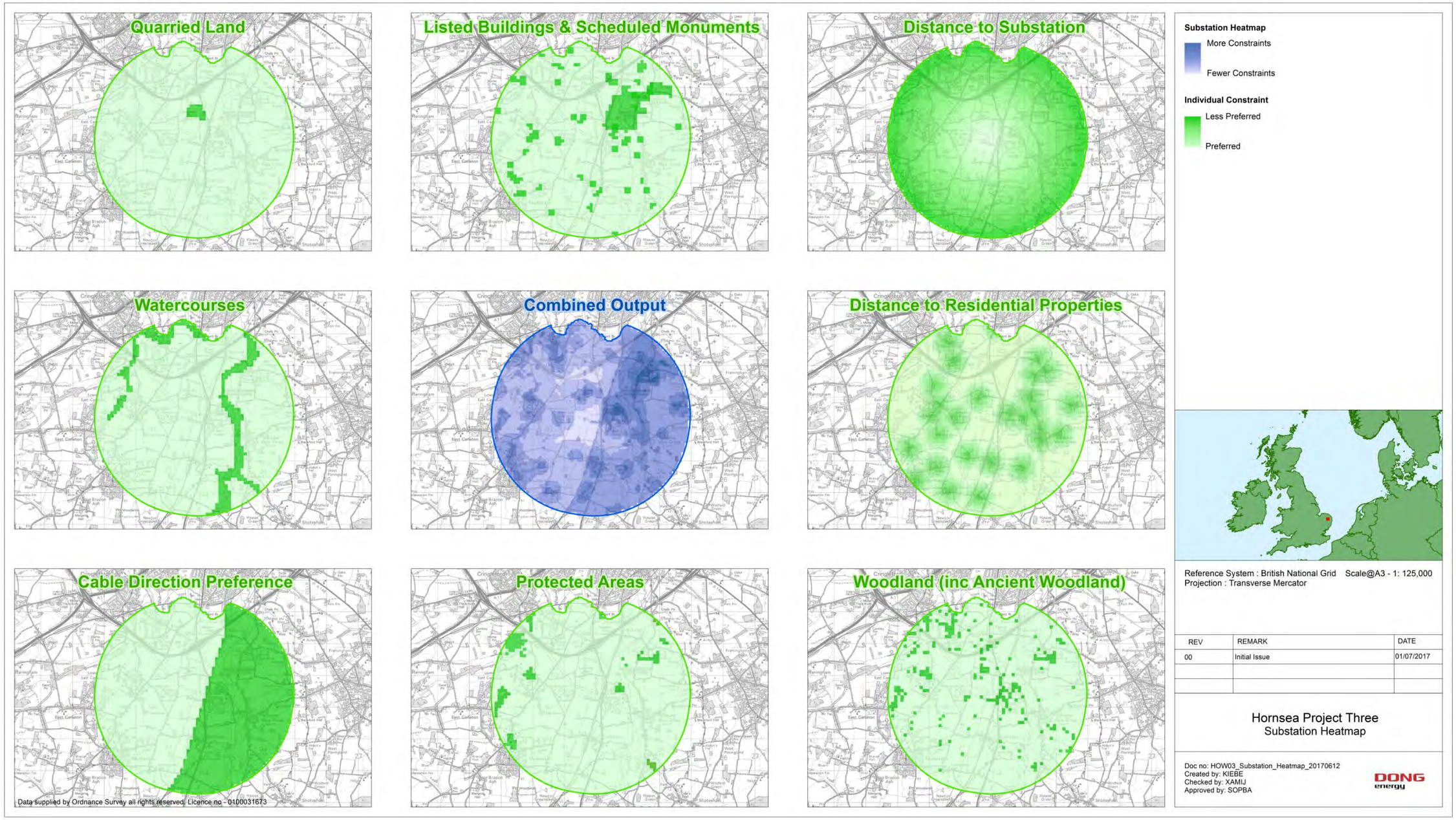

Figure 4.14: Constraints mapping of substation search area.

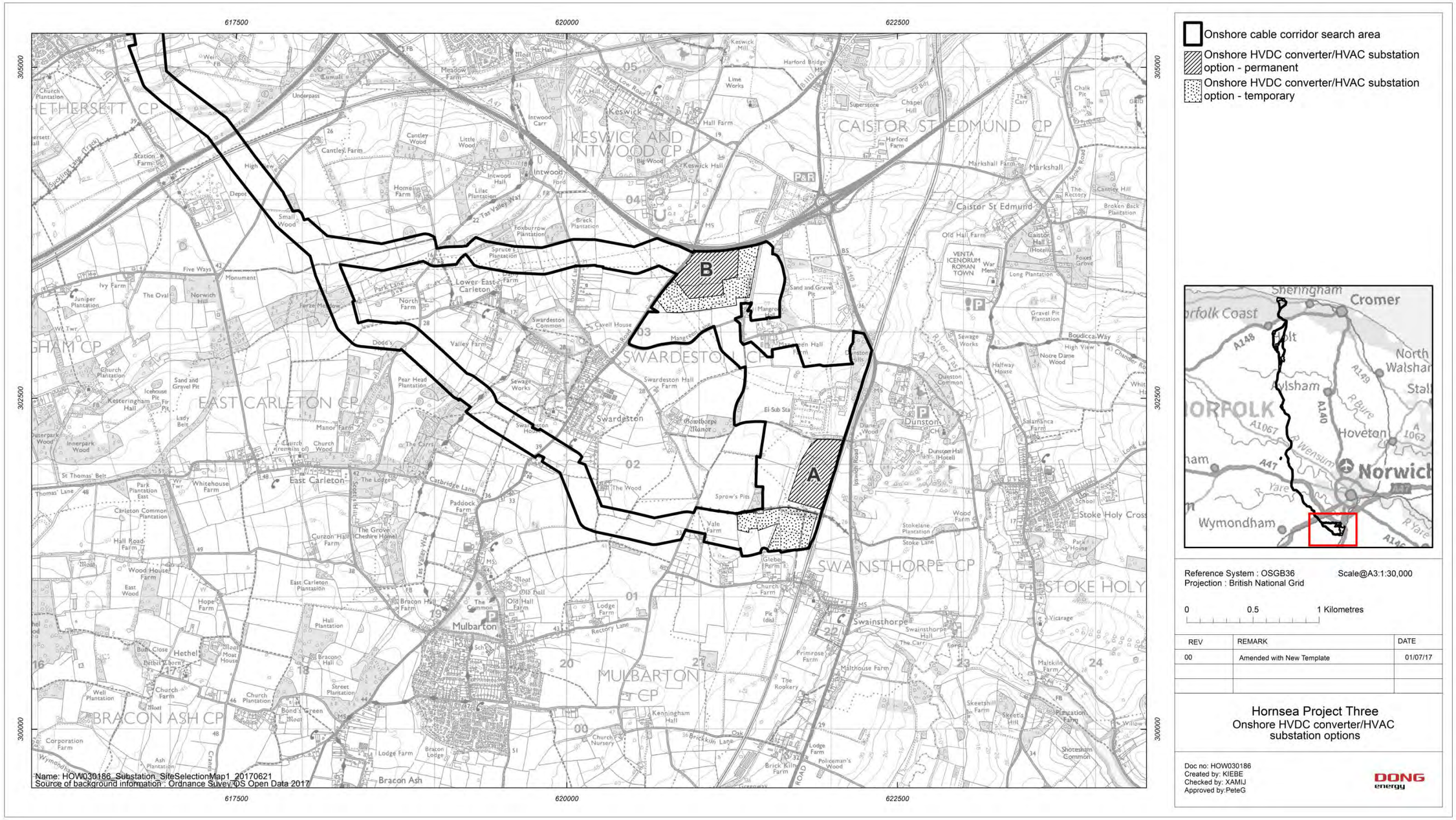

Figure 4.15: Overview of substation options.

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Figure 4.16: Onshore HVDC converter/HVAC substation option A.

Figure 4.17: HVAC/HVDC substation option B.

4.11.7 Summary

4.11.7.1 The refinements discussed within this section formed the basis of the proposed Project that was presented to and discussed with stakeholders between Scoping and PEIR and in March 2017, was presented at the community consultation events (Phase 1.B), where the project presented and sought feedback on:

- A preferred indicative 1.5 km wide offshore export cable corridor;
- A preferred landfall zone (in the vicinity of Weybourne);
- A preferred indicative 200 m onshore export cable corridor, with 100 m technical buffer either side for technical considerations;
- Three potential sites (and associated cable corridors) for being considered by the project for locating the onshore HVAC booster station, within the original 10 km search area; and
- The output of the heat mapping exercise showing areas identified as being least constrained within the onshore HVDC converter/HVAC substation search area, and therefore more preferable in terms of siting the onshore HVDC converter/HVAC substation.

4.11.7.2 Exhibition banners and foam board maps were used to display project information, and attendees were asked to consider the information and provide feedback on the preferred indicative export cable corridor, the three site options for locating the onshore HVAC Booster Station and the search area (with constraints applied) for locating the onshore onshore HVDC converter/HVAC substation.

4.11.7.3 A Phase 1.B Community Consultation Event Overview document was available and published on the Hornsea Three website (www.dongenergy.co.uk/hornseaproject3), along with an online feedback form, for interested parties unable to attend the events in person.

4.12 Stage 7 - Refinement for PEIR and Phase 2 Consultation

4.12.1.1 The Project boundaries were subject to further refinement between the consultation described above (under Stage 6 of the site selection process) and submission of the PEIR and Phase 2 consultation. These refinements were based on a number of factors comprising:

- Response to stakeholder feedback on existing proposals;
- Responses to informal consultation with landowners;
- Response to findings from site specific and desk based studies and preliminary EIA outputs; and
- Ongoing engineering design optimisation.

4.12.1.2 The following text describes those refinements made and the rationale supporting the decision making process for each refinement.

4.12.2 Refinement of the offshore ECR corridor and landfall zone

4.12.2.1 Between the refinements made for Phase 1.B Community Consultation Events and PEIR there has been comparatively minimal refinement of the offshore ECR and landfall zone. The only significant variation to the proposed boundary being the inclusion of a 600 m temporary working area either side of the 1.5 km route. The purpose of this temporary working area is to ensure that any vessels associated with the installation of the export cables and/or the offshore HVAC booster station, could operate within close proximity to the main ECR boundary without risk of their anchors or even jack-up legs being outwith the consented order limits whilst allowing the cables to be installed up to the boundary of the offshore ECR.

4.12.2.2 The offshore ECR corridor is considered to represent the optimal route, balancing environmental, technical, commercial and consenting risks. The offshore HVAC booster station search area for the potential offshore HVAC booster station(s) (if required) is located between 40% to 60% of the way along the marine ECR length. The HVAC Search Area may be subject to further refinement (reduction in area) following the S42 consultation.

4.12.3 Refinement of the onshore ECR corridor and HVAC booster station locations

4.12.3.1 The three shortlisted sites for the HVAC booster station (and their associated cable routes) were considered, relative to one another, to determine a preferred option, supported by previous site visits of the wider area conducted in the Summer of 2016. During the site, inspections further consideration was given to matters like topography, access, landscape framework/screening, hydrology and ground conditions, to supplement the desk top work that was carried out. As part of the wider scoping boundary, the sites had been the subject of desk top heritage assessment and phase 1 ecology surveys, and this information was also considered.

4.12.3.2 A summary comparison is presented in Table 4.4 below.

4.12.3.3 This further evaluation work was coupled with the feedback from the Phase 1.B Community Consultation process from which a significant amount of feedback both at and after the March 2017 community consultation events, was received. All the feedback was considered by the project, and a short Phase 1.B Consultation Summary Report was prepared and published on the Hornsea Three website (www.dongenergy.co.uk/hornseaproject3) on the 22nd June 2017 summarising the views expressed at that stage. Respondants expressed strong concerns regarding the proposed Option A, Pond Hills, highlighting that this particular site is valued by local communities and visitors to the area. Respondants were also concerned about the proximity of Options A & B, Pond Hills and Holt Farm, (and their associated cable corridors) to areas of conservation, including the Glaven Conservation Area. Respondants noted that of the three options, Option C, Little Barningham has the most direct cable corridor and was furthest from public footpaths.

Table 4.4: HVAC booster station sites summary assessment.

Criteria		Candidate Sites		
		A	B	C
Commercial	Availability			
	Mitigation and Access			
Environmental and Planning	Planning Policies			
	Landscape			
	Ecology			
	Hydrology			
	Historic Environment			
Engineering/technical	Area available			
	Services/Utilities			
	Ground conditions			
	Access			
	Relationship to Onshore cable corridor search area			
Ranking		3	2	1

4.12.3.4 Based on the site assessment presented in Table 4.4 including technical constraints and taking account of consultation with both Statutory Stakeholders and the local community. it was concluded that onshore HVAC booster station option C was the preferred option for Hornsea Three and would be taken forwards for assessment at PEIR. The cable corridors associated with onshore HVAC booster station options A and B were therefore removed from the onshore ECR.

4.12.3.5 No further refinements to the onshore ECR have been made for the PEIR consultation phase to that presented at Phase 1.B Community Consultation.

4.12.4 Refinement of the HVAC/HVDC substation

4.12.4.1 The two substation sites were considered, relative to one another, to determine a preferred option, supported by site visits in the summer of 2016. During the site inspections, further consideration was given to matters such as topography, access, landscape framework/screening, hydrology and ground conditions, to supplement the desk top work that was carried out. Furthermore, the sites had been subject of desk top heritage assessment and phase 1 ecology surveys (as part of the early EIA process) since their initial identification and shortlisting, and this information was also considered.

4.12.4.2 The constraints on the physical availability of the land at the two substation options fed into the assessment of “Mitigation and Access” (Table 4.5). It was determined that Option B provides a greater availability of land for potential mitigation to be implemented. Option A is comparatively constrained by the railway line directly to the east and by the Norwich Main National Grid substation to the north. In addition an assessment of the potential access to Option B identified that this was significantly less constrained and would involve less highway works and the associated construction disruption.

4.12.4.3 A summary comparison is presented in Table 4.5 below (red representing High constraint, orange a Moderate constraint, and green a limited constraint).

Table 4.5: HVAC/HVDC substation sites summary assessment.

Criteria		Candidate Sites	
		A	B
Commercial	Availability		
	Mitigation and Access		
Environmental and Planning	Planning Policies		
	Landscape		
	Ecology		
	Hydrology		
	Historic Environment		
Engineering/technical	Area available		
	Services/Utilities		
	Ground conditions		
	Access		
	Relationship to Onshore cable corridor search area		
Ranking		2	1

4.12.4.4 It was concluded that onshore HVDC converter/HVAC subtation option B was the preferred option for Hornsea Three, subject to further on site investigation, technical design work, and feedback from public consultation at the PEIR stage.

4.12.5 Identification of potential Main Compound Sites

4.12.5.1 Futher development of the onshore cable route allowed for the identification of three potential locations within Broadland District Council for a main compound site. These areas are shown on Figure 4.18. Construction activities will likely need to be supported by one main compound approximately half way along the route close to the cable corridor of upto 4.5 ha in area. Compound options will contimue to be reviewed as the compound strategy is developed as a next step post PEIR.

4.12.6 Summary

4.12.6.1 The further site selection work (as informed through stakeholder engagement, landowner discussions and technical studies) has enabled the refinement of the Project to the point of PEIR submission and commencement of Phase 2 (S42, S47 and S48) consultation accordingly:

- A single preferred offshore ECR of 1.5 km in width;
- An offshore HVAC booster station search area
- A refined landfall at Weybourne;
- A single preferred onshore ECR search area of 200 m in width;
- A single preferred onshore HVAC Booster Station; and
- A single preferred onshore HVDC converter/ HVAC substation.

4.12.6.2 The Project considers that these options and refinements are sufficiently justified and narrowed down to enable stakeholders (through the Phase 2 consultation process) to meaningfully comment on the proposed scheme and its potential effects on the receiving environment. The boundary use throughout this PEIR can be seen in Figure 4.19.

4.13 Next stages of process – refining the project between PEIR and EIAr/DCO application submission (Stages 8 to 9)

4.13.1.1 Hornsea Three will continue to develop and refine the project as it progresses towards a final application for Development Consent and beyond this as it moves towards construction. The following paragraphs provide a summary of the ongoing activities and the work that will continue in refining the project options ahead of the final application.

4.13.1.2 Hornsea Three is currently at Stage 7 in the site selection process (Further formal Consultation Phase, PEIR). The next key project milestone is the consultation on the PEIR. Up to this point Hornsea Three has engaged with a range of stakeholders with regard to the progress of the project and emerging project design matters. These stakeholders include:

- The Planning Inspectorate;
- North Norfolk District Council;
- Broadland District Council;
- South Norfolk District Council;
- Norfolk County Council;
- Norwich City Council;
- Norfolk Broads National Park Authority;
- The Environment Agency;
- Natural England;
- The Marine Management Organisation;
- The Wildlife Trust;
- Cefas;
- Trinity House;
- Oil and Gas Operators;
- Utility Providers;
- Landowners;
- Parish Councils; and
- Members of the public through consultation events (through Scoping and Phase 1.A and 1.B Consultation).

4.13.1.3 As the project progresses past the PEIR stage, Hornsea Three will continue to engage with and keep these stakeholders (and any others that may become apparent) informed about project design and the selection process for preferred options, through Stages 8 and to 9 of this process, in response to further consultation feedback, and ongoing engineering, commercial and environmental investigations.

4.13.1.4 It is anticipated that the following refinements will be made following responses on the Phase 2 consultation:

- Refinement of the Onshore ECR to a final corridor of 80 m width;
- Refinement of location and size of key onshore construction compounds; and
- Identification of onshore access for construction.

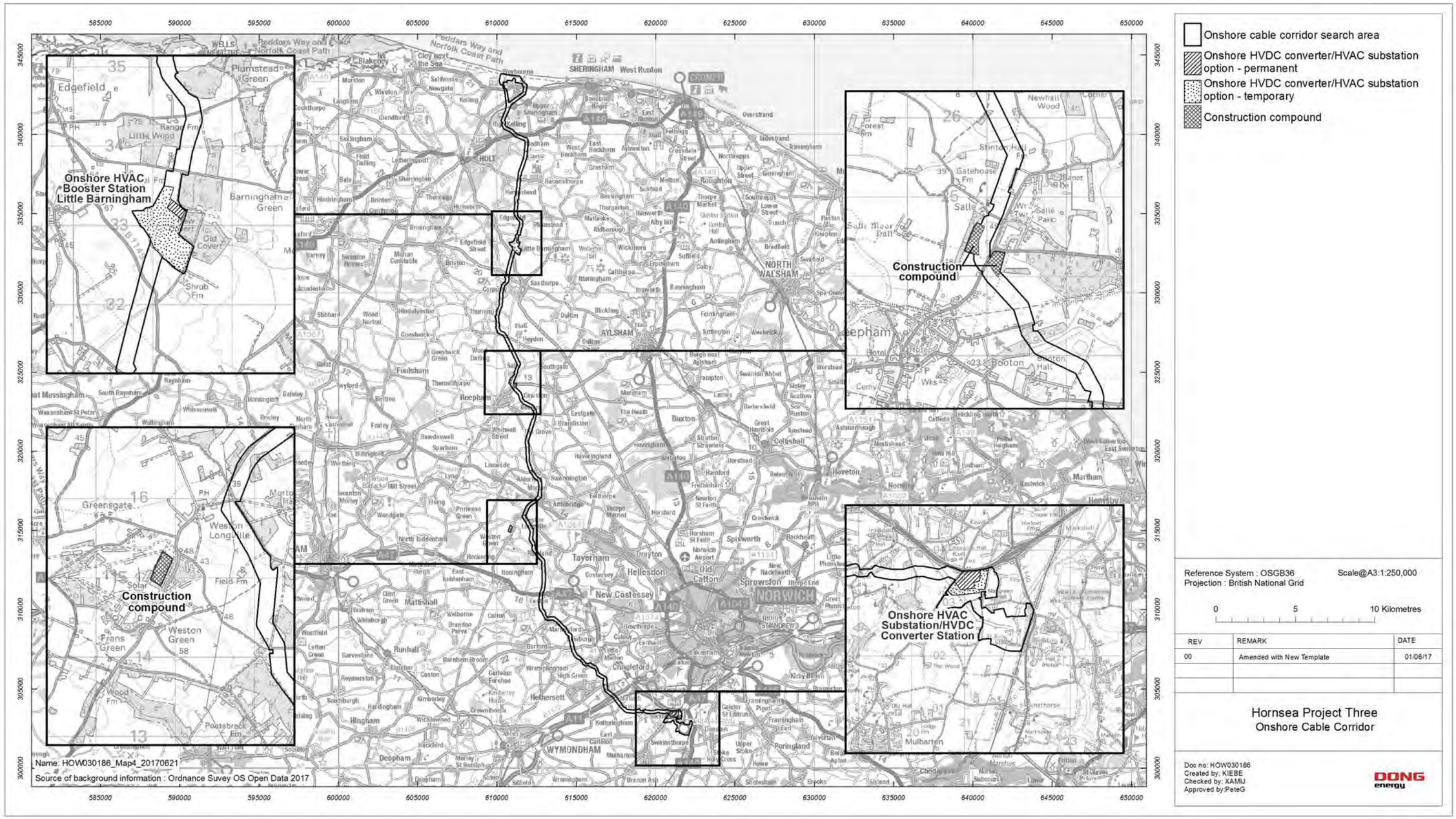

Figure 4.18: Hornsea Three onshore cable corridor search area and construction compounds.

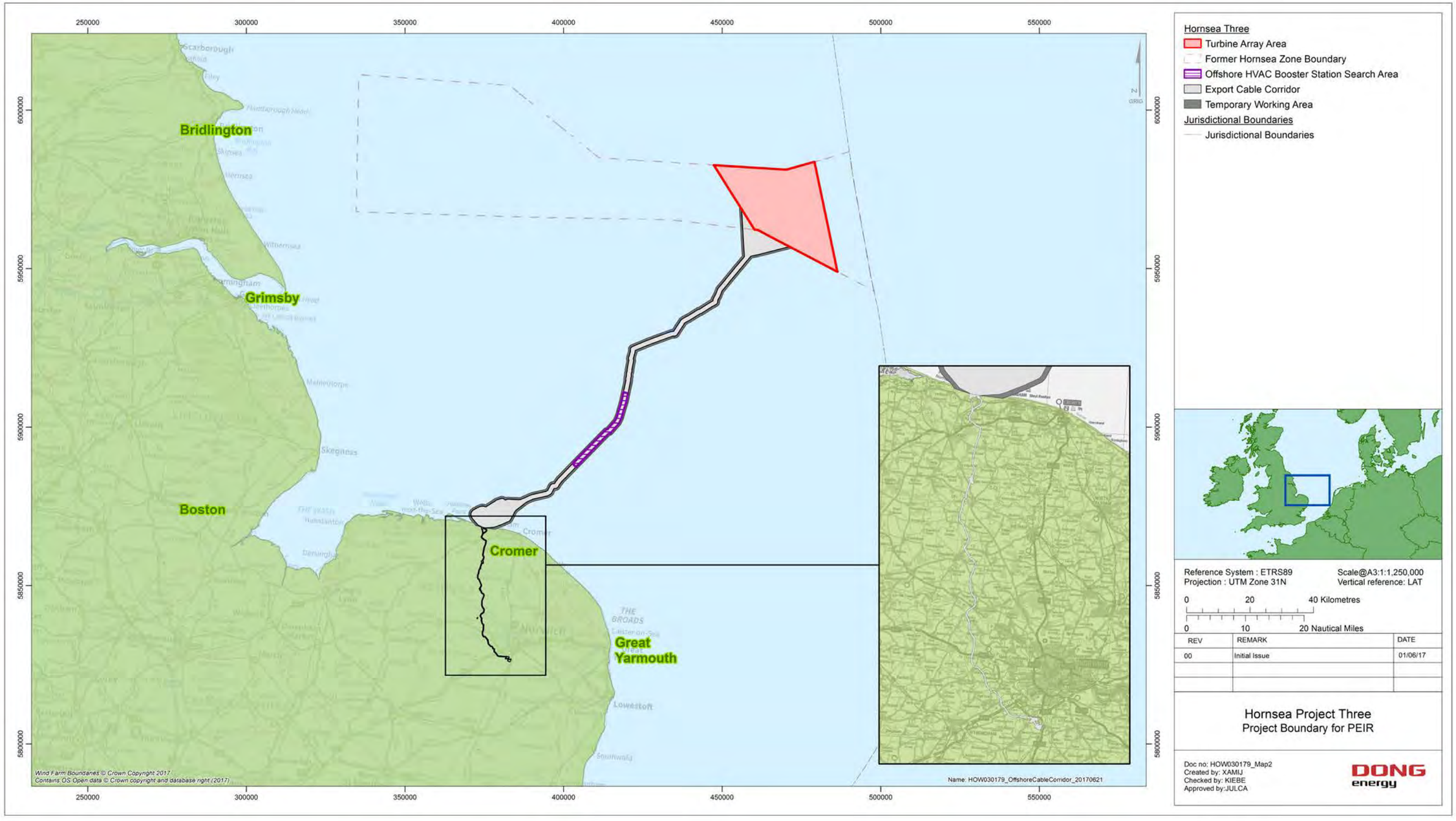

Figure 4.19: Project boundary for PEIR.

4.14 References

The Crown Estate (TCE) (2012). Round 3 Offshore Wind Site Selection at National and Project Levels. [Internet, available: < https://www.thecrownestate.co.uk/media/5644/ei-km-in-pc-planning-062013-round-3-offshore-wind-site-selection-at-national-and-project-levels.pdf >, accessed May 2017].

Department for Energy and Climate Change (DECC) (2009). UK Offshore Energy Strategic Environmental Assessment. January 2009. [Internet, available: < https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/194328/OES_Environmental_Report.pdf >, accessed May 2017].

Department for Energy and Climate Change (DECC) (2011). Overarching National Policy Statement for Energy (EN-1). Presented to Parliament pursuant to Section 5(9) of The Planning Act 2008. July 2011. London: The Stationery Office. [Internet, available: < https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf >, accessed 18 January 2017].

Department for Energy and Climate Change (DECC) (2011a). UK Offshore Energy Strategic Environmental Assessment. February 2011. [Internet, available: < https://www.gov.uk/government/publications/uk-offshore-energy-strategic-environmental-assessment-2-environmental-report >, Accessed May 2017].

National Grid (2003): NGC Substations and the Environment – Guidelines on Siting and Design. [Internet, available: < http://www.nationalgrid.com/NR/rdonlyres/74542DA5-7923-48AB-97AB-77B1F3ED3492/45808/horlock_rules.pdf >, accessed May 2017].

MCA (2016). Marine Guidance Notice 543 (Merchant and Fishing), Safety of Navigation Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues. Southampton: MCA.