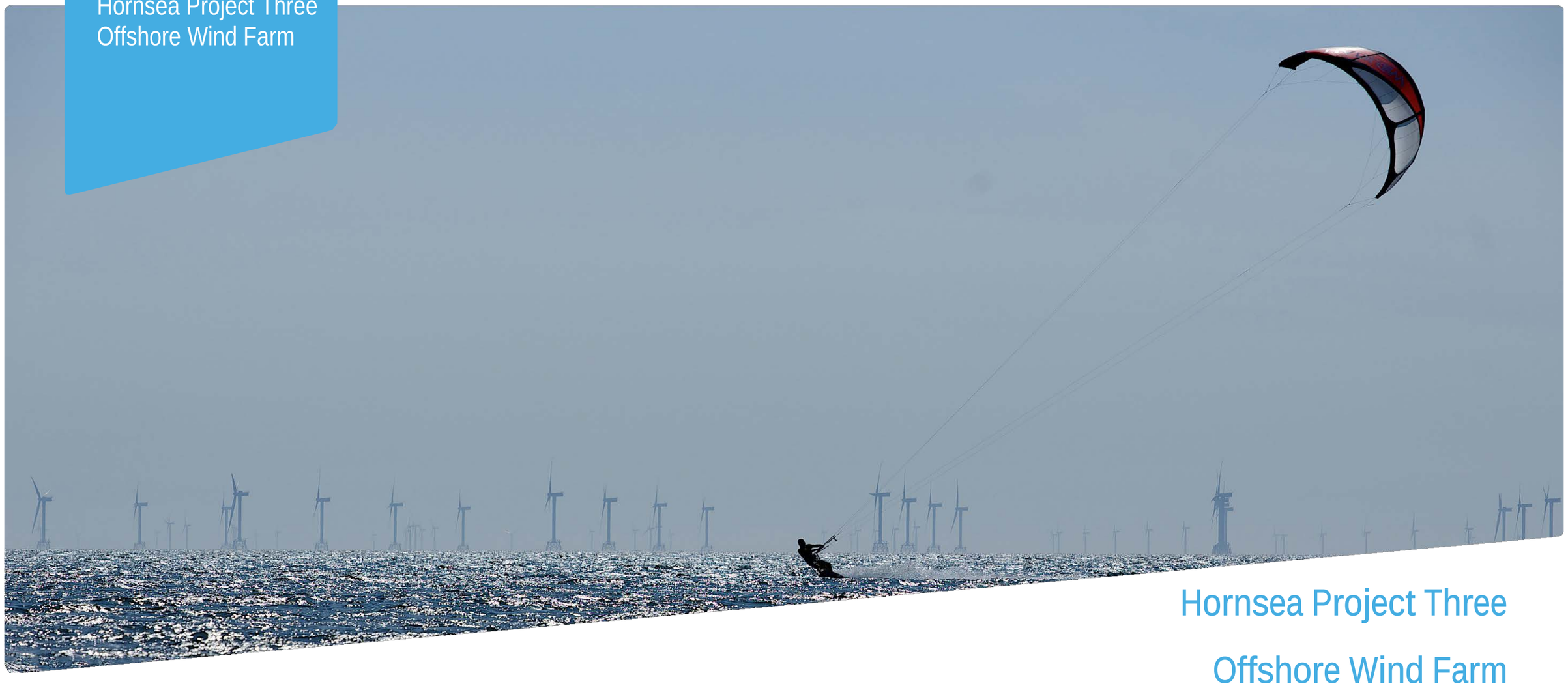
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Environmental Statement:
Volume 1, Chapter 4 – Site Selection and Consideration of Alternatives

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Hornsea 3
Offshore Wind Farm

Ørsted

Environmental Impact Assessment

Environmental Statement

Volume 1

Chapter 4 – Site Selection and Consideration of Alternatives

Report Number: A6.1.4

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This report is also downloadable from the Hornsea Project Three offshore wind farm website at:

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Table of Contents

List of Tables

List of Figures

Glossary

Term	Definition
Agreement for Lease (AfL)	An agreement for lease (AfL) is a non-binding agreement between a landlord and prospective tenant to grant and/or to accept a lease in the future. The AfL only gives the option to investigate a site for potential development. There is no obligation on the developer to execute a lease if they do not wish to.
Marine Resource System (MaRS)	Marine Resource System (MaRS) is The Crown Estates marine spatial planning system.
Maritime and Coastguard Agency (MCA)	The Maritime and Coastguard Agency (MCA) is an executive agency of the United Kingdom working to prevent the loss of lives at sea and is responsible for implementing British and international maritime law and safety policy.
National Grid Electricity Transmission	National Grid Electricity Transmission plc (formerly National Grid Company) is a British multinational electricity and gas utility company that owns and operates the National Grid high voltage electricity transmission network in England and Wales.
Offshore Energy Strategic Environmental Assessment (OESEA)	Strategic Environmental Assessment (SEA) is the process of appraisal through which environmental protection and sustainable development may be considered, and factored into national and local decisions regarding Government (and other) plans and programmes – such as offshore energy developments.
Secretary of State (SoS)	A Cabinet minister in charge of a government department (e.g. Housing, Communities and Local Government)
SMart Wind	Joint venture between Mainstream Renewable Power and Siemens Financial Services,
The Crown Estate (TCE)	The Crown Estate is an independent commercial business, created by Act of Parliament. They invest in and manage some of the UK's most important assets, aiming to create significant value beyond financial return.

Acronyms

Term	Definition
AC	Alternating Current
BEIS	Department for Business, Energy and Industrial Strategy.
CION	Connections and Infrastructure Options Note
CWS	County Wildlife Site
DBA	desk based assessment
DC	Direct Current
DCO	Development Consent Order
DECC	Department for Energy and Climate Change. (Please note that this department no longer exists as it has now been replaced by the Department for Business, Energy and Industrial Strategy (BEIS)).
EIA	Environmental Impact Assessment
EN -1	National Policy Statement for Energy
EN-3	National Policy Statement for Renewable Energy Infrastructure
GIS	Geographical Information System
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
LNR	Local Nature Reserve
MCA	Maritime and Coastguard Agency
MaRS	Marine Resource System
MCZ	Marine Conservation Zone
MHWS	Mean High Water Springs
NETS	National Electricity Transmission System
NGC	National Grid Company
NGET	National Grid Electricity Transmission Limited
NNR	National Nature Reserve
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
OESEA	Offshore Energy Strategic Environmental Assessment

Term	Definition
PEXA	(Military) Practice and Exercise Area
PRoW	Public Right of Way
REZ	Renewable Energy Zone
SAC	Special Area of Conservation
SoCC	Statement of Community Consultation
SoS	Secretary of State
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
s42	section 42
s47	section 47
TCE	The Crown Estate
TSS	Traffic Separation Systems
ZDA	Zone Development Agreement

Units

Unit	Description
GW	Gigawatt (power)
kV	Kilovolt (electrical potential)
kW	Kilowatt (power)
m	Metres (distance)

4. Site Selection and Consideration of Alternatives

4.1 Introduction

4.1.1.1 This chapter of the Environmental Statement provides a description of the site selection process and the approach undertaken by Hornsea Project Three Offshore Wind Farm (hereafter referred to as Hornsea Three), to identify the siting of specific elements and reasonable consideration of alternatives as Hornsea Three 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 2017 (the EIA Regulations), the main alternatives considered for the Hornsea Three 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) (Department for Energy and Climate Change (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 SoS in July 2013 and was granted a Development Consent Order (DCO) on 10th December 2014. Hornsea Project One commenced onshore construction in early 2016, and offshore construction in January 2018. Hornsea Project Two was the second project to be proposed within the former Hornsea Zone and was granted a DCO on 16 August 2016.

4.1.1.5 The approach taken to the development, including site selection, 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. Feedback received during the various rounds of statutory and non-statutory consultation is summarised in the Consultation Report submitted as part of the application for Development Consent (application document reference A5.1). This report includes details of how the project has had regard to feedback received as part of statutory consultation.

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 Environmental Statement (as presented in Volume 1, Chapter 3: Project Description) in order to assess, so far as possible at this stage, the potential environmental effects of Hornsea Three.

4.1.1.7 This chapter is also concerned with site selection and the main alternatives which have been considered for the location of Hornsea Three and its associated infrastructure options (including both onshore and offshore cables, onshore and offshore 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 Environmental Statement submission. 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 Assessment:
    - High level connection options;
    - National Grid Electricity Transmission (NGET) connection offer; and
    - Strategic landfall assessment.
- 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.A Consultation):
    - Landfall;
    - Offshore components; and
    - Onshore components.

- Stage 8 – Refinement of Hornsea Three from Preliminary Environmental Information Report (PEIR) to Phase 2.B and Phase 2.C Consultation i.e. further statutory consultation (Phase 2.B) and focussed statutory consultation (Phase 2.C), which were held following feedback received as part of the s42 and s47 consultation on the PEIR under Phase 2 (Phase 2.A) in July to September 2017:
    - Consideration of alternative route options;
    - Onshore cable route;
    - Onshore High Voltage Direct Current (HVDC) Converter/ High Voltage Alternating Current (HVAC) substation;
    - Onshore HVAC booster station;
    - Main and secondary construction compounds;
    - Temporary storage areas; and
    - Selection of access routes;
- Stage 9 - Submission of final preferred option(s) as part of the DCO application.

4.1.1.9 The chapter is supported by four separate Annexes which provide additional detail behind the development and iterative design stages of Hornsea Three. The Annexes can be found in Environmental Statement volume 4 as set out below:

- Annex 4.1: Grid Connection and Refinement of the Cable Landfall for Hornsea Project Three (Stages 3-4);
- Annex 4.2: Selection and Refinement of the Offshore Cable Corridor and HVAC Booster Station;
- Annex 4.3: Refinement of the Onshore Cable Corridor and Associated Infrastructure (Stages 5-7 Scoping tot PEIR); and
- Annex 4.4: Post PEIR Changes to Hornsea Project Three (Stages 8-9).

4.2 Legislation, planning policy and guidance

4.2.1 Legislation

4.2.1.1 Legislation requires that the information included in an Environmental Statement should include a description of the reasonable alternatives studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.

4.2.1.2 Furthermore under the Habitats Regulations and Offshore Habitats Regulations (i.e. the Conservation of Offshore Marine Habitats and Species Regulations 2017), 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 Environmental Statement 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 Environmental Statement.

4.2.2 National Policy Statements

4.2.2.1 From a policy perspective the National Policy Statement (NPS) 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 NPS 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 [SoS] to consider alternatives. These should also be identified in the Environmental Statement by the applicant."*

4.2.2.2 Requirements under the Habitats Regulations and the Offshore Habitats Regulations are addressed in the Report to Inform Appropriate Assessment, submitted as part of this Environmental Statement.

4.2.2.3 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 SoS 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 [SoS] 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 [SoS] 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 [SoS] thinks they are both important and relevant to [his] decision;*
- *as the [SoS] must decide an application in accordance with the relevant NPS (subject to the exceptions set out in the Planning Act 2008), if the [SoS] 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 [SoS'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 [SoS's] decision;*
- *alternative proposals which are vague or inchoate can be excluded on the grounds that they are not important and relevant to the [SoS'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 [SoS] 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 [SoS] may place the onus on the person proposing the alternative to provide the evidence for its suitability as such and the [SoS] should not necessarily expect the applicant to have assessed it."*

4.2.2.4 The NPS 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."*

4.2.3 Other relevant polices and guidance

The Horlock Rules

4.2.3.1 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 NGET in the 'Horlock Rules'. The Horlock Rules are a set of guidelines produced by NGET 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 NGET 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.

4.2.3.2 The principles embodied in the Horlock Rules are relevant to the infrastructure at the proposed onshore HVDC converter/HVAC substation and onshore HVAC booster station. The rules contain principles that have been relied upon over the years in route and site planning studies by NGET, and which have subsequently been endorsed in Ministerial decisions and at Public Inquiries.

4.2.3.3 In the Horlock Rules, NGET states that it will encourage generators to adopt the guidelines when working with NGET 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.

4.2.3.4 Section 4.2.3 below summarises the Horlock Rules, (National Grid, 2003), and how Hornsea Three has had regard to them.

4.3 Other considerations for site selection

4.3.1.1 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 have been inherently applied to the decision making process throughout, and these comprise:

- The shortest route to minimise impacts by minimising footprint for the offshore and onshore cable routes as well as minimising costs (hence ultimately reducing the cost of energy to the consumer) and transmission losses;
- Avoidance of key sensitive features where possible and where not, sought to mitigate impacts;
- Minimisation of disruption to populated areas thereby lowering effects; and
- For the accommodation of the range of connection technology sought within the design envelope, and exclude those options outwith the design 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 were 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 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 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 avoidance of ancient woodland, with historic hedgerows, surface and ground water sources and nature conservation areas protected as far as reasonably possible when considering sites for the onshore HVDC converter/HVAC substation and onshore 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 onshore HVAC booster station and onshore HVDC converter/HVAC substation siting exercise considered the availability of sites that benefit from existing screening, by looking at existing landscaping, landform, and existing built development. The onshore HVAC booster station is located close to existing woodlands and in local low point in the landscape so that it will be largely screened in views from the east, and seen with a woodland backdrop in views from the west. The view to the onshore HVDC converter/HVAC substation from surrounding areas would be partly screened by existing vegetation and visual mitigation such as the planting of supplementary trees and hedgerows would 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.
The land use effects of the proposal should be considered when planning the siting of substations or extensions.	The effects on land use, consultation feedback, 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. These selected sites had minimal effect on land use, agriculture and recreation, and planning policy, in the area (see volume 3, chapter 6: Land Use 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 from similar developments, an initial assessment of relevant information available from technology suppliers together with Ørsted's current expectations regarding land required for access, landscape works and other mitigation for the components required for a project of this scale. The design of the onshore HVAC booster station and onshore HVDC converter/HVAC substation has been developed iteratively throughout the progression of Hornsea Three, in response to consultation with stakeholders and as a consequence of 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.

4.4 Former Hornsea Zone and project site selection process

4.4.1.1 Further to the Government's confirmed policy (as discussed in volume 2, 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 DECC (now part of the Department for Business, Energy and Industrial Strategy (BEIS)), 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.

4.4.1.2 Ahead of the identification of specific areas for offshore wind farms as part of Round 3, the DECC 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*".

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

4.4.1.4 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 opposite (TCE 2012).

4.4.1.5 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 (TCE, 2012).

4.4.1.6 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 TCE. 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.

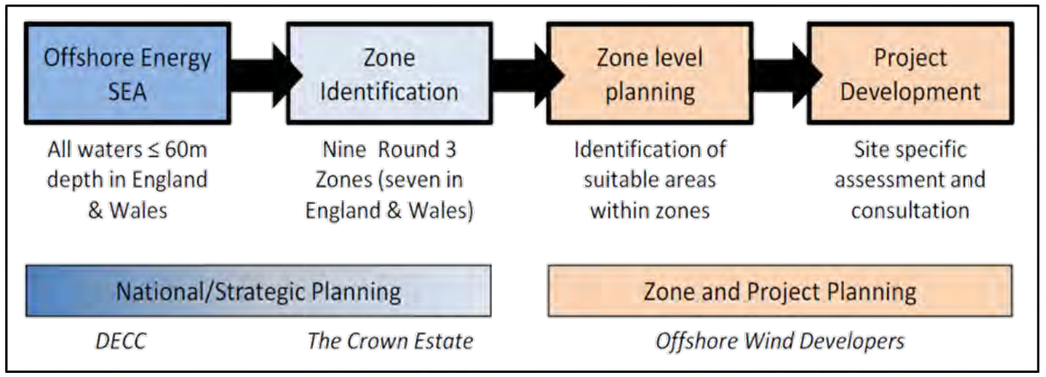

Figure 4.1: Two stage selection process of Round 3 offshore wind farms.

4.4.2 The role of The Crown Estate

4.4.2.1 TCE is not part of Government, and does not set renewable energy policy. However, TCE 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)[1]. 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.

[1] an area of the sea, beyond the United Kingdom's territorial sea, which may be exploited for energy production.

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

Organisation	Role	Responsibilities
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).
TCE	Identified the Round 3 zones. Was the Competent Authority for the Round 3 Plan – undertook Appropriate Assessment of the Plan (2009). Competitively tendered Round 3 zones and entered into Zone Development Agreements (ZDAs) with successful bidders (2009 and 2010).	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 TCE 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 SoS. 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 TCE. Provide advice in relation to Appropriate Assessment of the Round 3 plan.	Provide advice and guidance to project development via consultation with Government, 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 TCE.	Input to the Hornsea Three development process during consultation with developers.

4.5 Stage 1 – Identification of the former Hornsea Zone

4.5.1.1 The identification of the development zones to be tendered in Round 3 was undertaken by (TCE, 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) Geographical Information System (GIS) tool to undertake this analysis.

4.5.1.2 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 (TCE, 2012):

- *"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 (AfL) 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, NGET connections, Sensitive Bird Areas, and oil and gas licence blocks.*

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.

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.

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.

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."

4.5.1.3 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.

4.5.1.4 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 ZDA with a developer for each of these zones.

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

4.6.1.1 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 Ltd. and TCE established a target capacity of 4.0 GW of generating capacity within the former Hornsea Zone, which was to be met through the development of several offshore wind farms.

4.6.1.2 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 Zones. SMart Wind concluded ZAP to optimise the use of the former Hornsea Zone and ensure that all proposed works were delivered safely, efficiently and while minimising impacts for stakeholders and the environment.

4.6.1.3 The aim of ZAP was to:

- Optimise the development opportunity within the former Hornsea 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 former Hornsea Zone and in relation to other nearby offshore wind farm developments and marine activities.

4.6.1.4 The original offshore boundary to delineate the location of offshore wind turbines for offshore wind farm array areas 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 former Hornsea 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).

4.6.1.5 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. Hornsea Project One comprises up to three offshore wind farms with a maximum combined generating capacity of 1.2 GW (although this has recently been amended to a maximum capacity of 1.218 GW). The project was taken forward for EIA and the SoS granted Development Consent for Hornsea Project One on 10 December 2014.

4.6.1.6 Hornsea Project Two, is an area of 462 km² located in the central part of the former Hornsea Zone to the north of Hornsea Project One. It comprises up to two offshore wind farms with a maximum combined generating capacity of 1.8 GW. The project was taken forward for EIA and the SoS granted Development Consent for Hornsea Project Two on 16 August 2016.

4.6.1.7 Ørsted (formerly DONG Energy) acquired the development rights to Hornsea Project One in February 2015 and, in August 2015, Ørsted 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 ZDA was terminated and the Hornsea Zone has therefore been dissolved (and hence is referred to as the former Hornsea Zone). Following this, 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 TCE.

4.6.1.8 After the former Hornsea Zone was divided into the four separate AfLs, two of these areas remained outside of the Hornsea Project One and Hornsea Project Two AfL areas. These two areas were investigated further by Ørsted 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 Hornsea Three was up to 1.6 GW and a grid connection at Walpole had been acquired, alongside the rights to the area, from SMart Wind. However, on further preliminary assessment of the AfL area of 696 km2 it was considered that the area could accommodate a greater generating capacity. In addition to this the grid connection timing needed to be adjusted. As a result it was necessary to review the pre-existing grid connection agreement as the original was no longer valid.

4.6.1.9 At this point Hornsea Three commenced the process to identify a suitable connection for the increased generation capacity with NGET (see also Stage 3 – Identification of grid connection location and strategic landfall assessment).

4.7 Stage 3 – Identification of grid connection location and strategic landfall assessment

4.7.1 Introduction

4.7.1.1 This grid connection stage comprised a sequence of steps associated with the site selection work preceding and immediately following on from confirmation of the point of connection to the main NGET infrastructure.

4.7.2 High level connection options

4.7.2.1 As explained in Stage 2, having identified the potential to accommodate a greater generating capacity, it was necessary to review the existing grid connection agreement. One early route considered for the Hornsea Three cable corridor would be to have used the existing cable route corridor that was used for Hornsea One and Hornsea Two, providing a landfall in the vicinity of Grimsby with a grid connection at Killingholme. However, at that initial stage NGET indicated that the 400kV substation at Killingholme and indeed locations north of Boston had no capacity within the timeframes required.

4.7.2.2 Ørsted began discussions with NGET in 2016, with the objective of identifying a potential grid connection location for Hornsea Three's increased generating capacity. A number of potential grid connection locations (see Figure 4.2) were considered by NGET 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 were:

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

4.7.2.3 These locations and indicative connection routes are shown on Figure 4.2. Note that these routes are shown for illustration by indicative straight routes to the coast and then to the potential connection points and do not reflect any environmental constraint analysis.

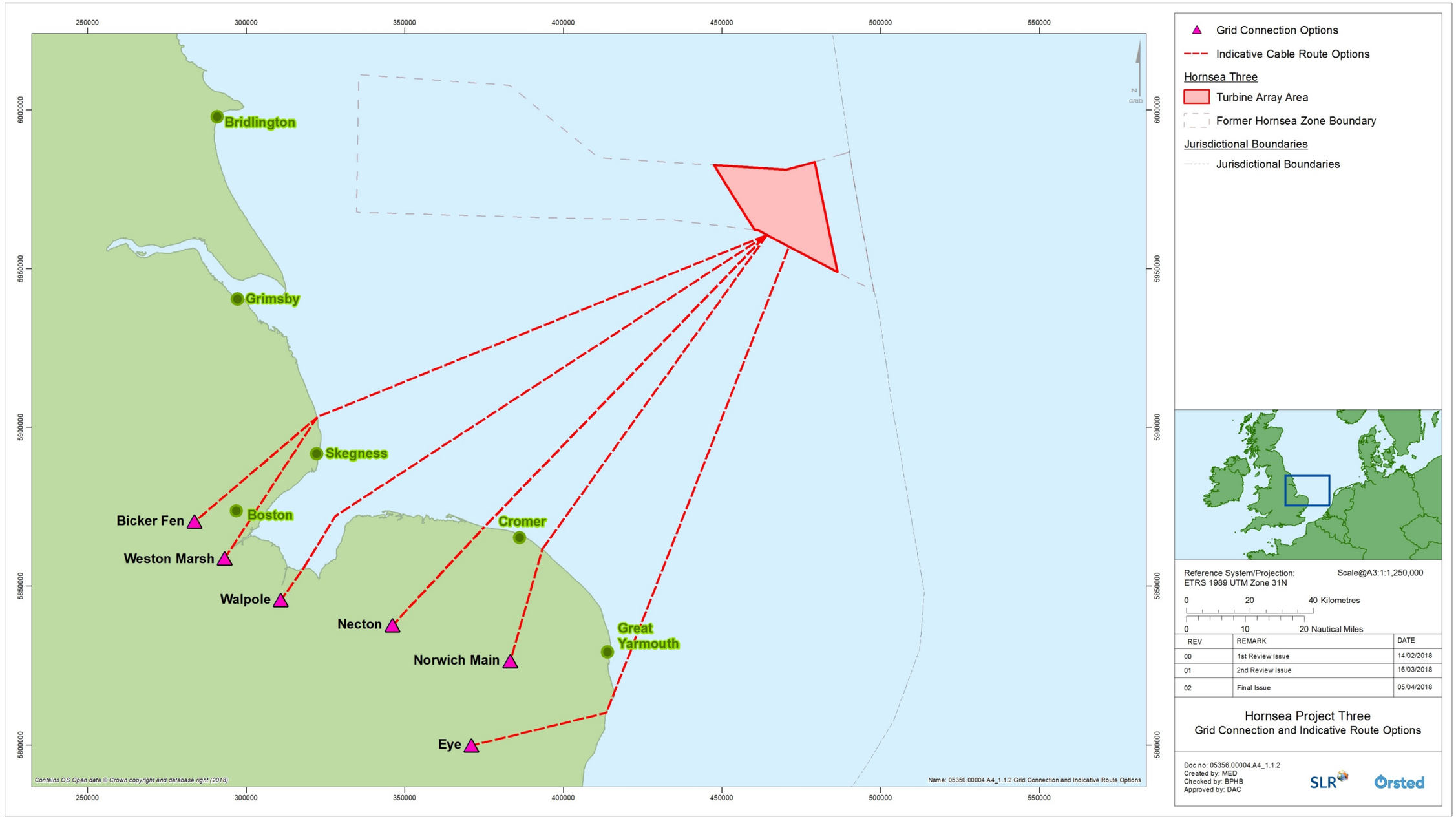

Figure 4.2: High level NGET connection mapping.

4.7.3 National Grid Electricity Transmission connection offer

4.7.3.1 NGET's decision making on connection offers takes into account technical, commercial, regulatory, environmental and socio-economic aspects. Early in the process the Necton option was removed from consideration after a third party accepted an earlier connection offer from NGET meaning that no spare connection capacity was available at Necton.

4.7.3.2 NGET concluded that the preferred connection option representing the most optimal design (economic, efficient and co-ordinated) considering all criteria (i.e. technical, cost, environmental and deliverability) was Norwich Main Substation and on 14 July 2016, Hornsea Three was formally offered a grid connection to that substation which was signed on 24 October 2016.

4.7.3.3 Further studies were then focussed on establishing the optimum route connection between the Hornsea Three offshore substation and the Norwich Main substation. These studies considered the effects arising from the possible combinations of the route of the onshore cable corridor, offshore cable corridor and landfall.

4.7.4 Strategic landfall (intertidal area) assessment

4.7.4.1 Following on from the NGET connection offer, an initial desk based assessment (DBA) of potential landfall options on the North Norfolk coast was undertaken. A landfall study area was defined within which potential landfall zones were identified with initial strategic assessment to establish which zone(s) should be taken forward for detailed study. This is set out in detail in volume 4, Annex 4.1: Grid Connection and Refinement of the Cable Landfall for Hornsea Project Three (Stages 3-4) and outlined below.

4.7.4.2 The landfall study area was defined, by applying those principles set out in section 4.3 of this chapter, to define an area that encompassed a number of potentially viable landfall locations. This area extended from Kings Lynn in the west around the North Norfolk Coast to Great Yarmouth in the East (approximately 85 km). To aid selection within this area, five landfall search zones were defined by excluding areas of greatest constraint where the likely deliverability of a viable connection was considered to be substantially less (i.e. areas of very high cliffs or built up areas). Volume 4, Annex 4.1: Grid Connection and Refinement of the Cable Landfall for Hornsea Project Three (Stages 3-4), section 1.2.3 and 1.2.4, sets out the criteria which were considered using professional judgement. The criteria included consideration of a range of technical, environmental, deliverability and socio-economic considerations to be avoided, minimised or specific requirements to be met.

4.7.4.3 This appraisal process resulted in the identification of five zones for further detailed investigation in Stage 4 (see Figure 4.3) where landfall could be feasible whilst minimising overlap with the key constraints:

- Zone 1 – Titchwell to Holkham;
- Zone 2 – Salthouse to Cromer;
- Zone 3 – Cromer to Mundesley (previously referred to as Overstrand to Sidestrand);
- Zone 4 – Broomholm to Waxham (previously referred to as Happisburgh to Waxham); and
- Zone 5 – Heacham to Hunstanton.

4.7.4.4 The main reasons for excluding areas between or beyond these zones were as set out below:

- South of Zone 4 – Offshore route constraints (windfarms and aggregate areas) necessitating extensive route diversion with increased level of effects and costs compared with other options;
- Between Zones 3 and 4 – Onshore built development providing little opportunity for a suitable landfall;
- Between Zones 2 and 3 – Onshore built development providing little opportunity for a suitable landfall;
- Between Zones 1 and 2 – An extensive assemblage of environmental designations, saltmarshes and geomorphological features leading to the conclusion that no acceptable installation technique could be identified;
- Between Zones 1 and 5 – An extensive assemblage of environmental designations, saltmarshes and geomorphological features in combination with a distribution of scattered properties leading to the conclusion that no acceptable installation technique could be identified; and
- West of Zone 5 – Additional length of cable route and additional challenges of cable installation in the Wash leading to increased effects and costs compared with other options.

4.8 Stage 4 – Identification and Refinement of Coastal Landfall options

4.8.1.1 Subsequent to the confirmation and acceptance of the 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:

- Refinement and selection of one or more preferred landfall zones to be taken forward;
- Defining one (or more) broad offshore export cable corridor search areas (encompassing potential future HVAC booster station locations) between preferred landfall zone and offshore substation location; and
- Defining one (or more) broad onshore export cable corridor search areas (encompassing potential future HVAC booster station and onshore substation / Convertor Station locations) between preferred landfall zones and offshore substation location.

Figure 4.3: Strategic landfall assessment.

4.8.1.2 There are a range of transmission system designs that can be used to transport the power from the wind farm to the UK National Grid. These fall under two primary transmission types defined by how the current is delivered to the export cables; HVAC or HVDC. Both transmission types have a range of relative benefits and drawbacks in terms of stage of technological development, costs and impacts. Offshore wind farms have traditionally used HVAC connections; however HVDC connections become more viable at far from shore projects and are used on a number of projects in Germany. At this stage of project development, it had been determined that both HVAC and HVDC transmission technologies would be taken forwards for development. Both technologies and details of the associated envelope were presented within the eventual Scoping Report that was produced at the end of this stage.

4.8.1.3 The intention of this stage was to establish alternatives with 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 zone). Further detail is provided volume 4, Annex 4.1: Grid Connection and Refinement of the Cable Landfall for Hornsea Project Three (Stages 3-4), section 1.3.

4.8.2 Refinement of coastal landfall options

4.8.2.1 All five of the landfall zones (described in Stage 3, section 4.7 of this chapter above) were visited by a multi-disciplinary team of environmental and consenting specialists, construction and installation engineers and commercial managers. In addition to the principles and constraints considered in the previous strategic assessment of landfall zones as referred to in section 4.7.3, the following technical, consenting and cost implications were also considered in more detail:

- Technical constraints:
  - Nearshore and beach profile & coastal geology and geomorphology;
  - Proximity to existing infrastructure;
  - Suitability of 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.

4.8.2.2 A strategic assessment of landfall zones is set out in detail in volume 4, Annex 4.1: Grid Connection and Refinement of the Cable Landfall for Hornsea Project Three (Stages 3-4), section 1.3. This concluded that no technically viable landfall zone was available in Zone 3 due to the high cliffs. As such this zone was discounted from further consideration.

4.8.2.3 Areas within each of the other zones had the potential to provide a landfall location but all presented different combinations and levels of technical, consenting and commercial risk. Areas within Zones 1 and 5 were identified as being significantly more technically challenging than those areas in Zones 2 and 4 due to limited foreshore access and highly variable nearshore shallow bathymetry, requiring long and complex intertidal works. Using either Zones 1 and 5 would also substantially increase the overall cable corridor length and therefore reduce the economic efficiency of both these alternatives compared with areas within Zones 2 and 4. Areas within Zones 2 and 4 also face a number of constraints but none were considered to prevent consideration of the zones through more detailed study.

4.8.2.4 It was therefore recommended that landfall areas within Zones 1 and 5 were discounted from further consideration and that landfall areas within Zones 2 and 4 were taken forward for further detailed consideration. Final selection being made in light of the combination of effects arising from both onshore and offshore cable corridors, in combination with effects associated with Landfall Zones 2 and 4 as described in sections 4.8.3 to 4.8.5.

4.8.3 Appraisal of offshore cable corridor search areas

4.8.3.1 Volume 4, Annex 4.2: Selection and Refinement of the Offshore Cable Corridor and HVAC Booster Station describes strategic consideration of offshore cable corridor options to connect to Landfall Zones 2 and 4. Having refined the number of landfall zones (from five to two), a number of early offshore cable corridor 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:

- A screening of physical and environmental constraints and opportunities within the High Level study area which was defined primarily by the Hornsea Three AfL and straight line Offshore cable corridor options from the array area to landfall (See Figure 3 in volume 4. Annex 4.2: Selection and Refinement of the Offshore Cable Corridor and HVAC Booster Station; and
- Identification of potential offshore cable corridor options.

4.8.3.2 Using the guiding principles (as set out in section 4.3 above), several 1.5 km wide indicative options were developed within the study area, initially along a straight-line approach. These were then modified taking account of key physical and environmental constraints as set out in volume 4, Annex 4.2: Selection and Refinement of the Offshore Cable Corridor and HVAC Booster Station, section 5. The key driver to offshore cable corridor development was the minimisation of the offshore cable corridor length and avoidance of, or minimising overlap with hard constraints, where possible. Figure 4.4 presents several of the high-level offshore cable corridor options that were developed from the Hornsea Three AfL to landfall Zone 2 and Zone 4.

4.8.3.3 It was established that routeing to either Zone 2 or 4 would result in interaction with designated sites (as would 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 routeing to landfall Zone 2. (The locations of Zones 2 and 4 are shown on Figure 4.3).

4.8.3.4 Routeing 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 increased when considering landfall at Zone 4, for which the number of crossings that would be required close to shore (associated with the multiple spread of assets connecting into Bacton gas terminal) would create a significant challenge both technically and commercially. Furthermore, Hornsea Three became aware of Bacton to Walcott 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. Further detail in relation to the technical and consenting challenges is provided within volume 4, Annex 4.1: Grid Connection and Refinement of the Cable Landfall for Hornsea Project Three (Stages 3-4).

4.8.3.5 In respect of Stage 4 it was concluded that both landfall Zones 2 and 4 provide viable onshore connections. However, with the complexities surrounding Bacton Gas Terminal, both in terms of the number of cable/pipeline crossings required close to shore, and the proposed Bacton to Walcott Sandscaping Scheme associated with the Coastal Management Scheme in the same area, obtaining landfall at Zone 4 was a significantly greater challenge both technically and commercially. It was acknowledged that other offshore cable corridors (e.g. those from Sheringham Shoal and Dudgeon Offshore Windfarms), did have the potential to impact upon landfall Zone 2, however it was also considered that they did not create such a pinch point of physical constraints to not be viable. In addition, the presence of this existing infrastructure and cable landing points also confirmed it was potentially technically viable. As such, there was clear evidence to support a preference for proceeding with an offshore cable corridor connecting to landfall Zone 2.

4.8.4 Appraisal of onshore cable corridor options and infrastructure

4.8.4.1 Alongside the appraisal of potential offshore cable corridors for landfall Zones 2 and 4, a similar exercise was undertaken for the onshore cable corridor and associated infrastructure to explore whether there were any key influencing factors from an onshore perspective on the selection of the landfall zone. The proposed cable corridor connection would require a new onshore HVDC converter/HVAC substation and potentially an onshore HVAC booster station. The location of the onshore HVDC converter/HVAC substation would need to be in close proximity to the NGET substation and as such, the siting of this would be influenced by local factors around the NGET substation. Similarly, whilst an onshore HVAC booster station close to the landfall may potentially be needed there was considered to be sufficient flexibility for the location of this site to benefit from existing landform and vegetation screening to allow this to be determined after identification of the preferred corridor. Neither of these infrastructure requirements were therefore considered to be a determining factor for landfall / cable routeing considerations at this strategic stage.

4.8.4.2 The onshore search areas (Figure 4.5) were developed on the basis of making landfall at either Zone 2 or Zone 4 and then an onshore cable corridor to a grid connection at Norwich Main substation. The purpose of this stage of consideration was not to establish a specific route but to establish that within a general corridor there were no insurmountable barriers to cable installation to allow comparison of strategic options. For this purpose, based on past experience on other projects, a general corridor of approximately 5km wide was considered sufficient to allow for routeing around the majority of constraints, although some modifications to this were made as noted below. To establish the general corridors the main considerations were to identify the most direct route possible and to avoid developed areas (housing, commercial land etc) where possible. On this basis, the connection from Landfall Zone 2 would be routed to the west of Norwich. A route from Zone 2 passing to the east of Norwich would add substantially to the cable distance, require routeing through the Norfolk Broads National Park and therefore generally increase the level of environmental effects and construction costs. As there were no insurmountable routeing considerations for a route to the west, the route from Zone 2 to the east of Norwich was discounted from further consideration. Applying the same approach to the connection from Landfall Zone 4 would tend to imply a route to the south of Norwich should be taken forward however in this case the need for such a route to unavoidably cross the Norfolk Broads National Park suggested that a longer and more costly route may potentially be justified when balanced against the potential effects on the National Park and therefore routeing either to the north or south of Norwich from Zone 4 should be considered.

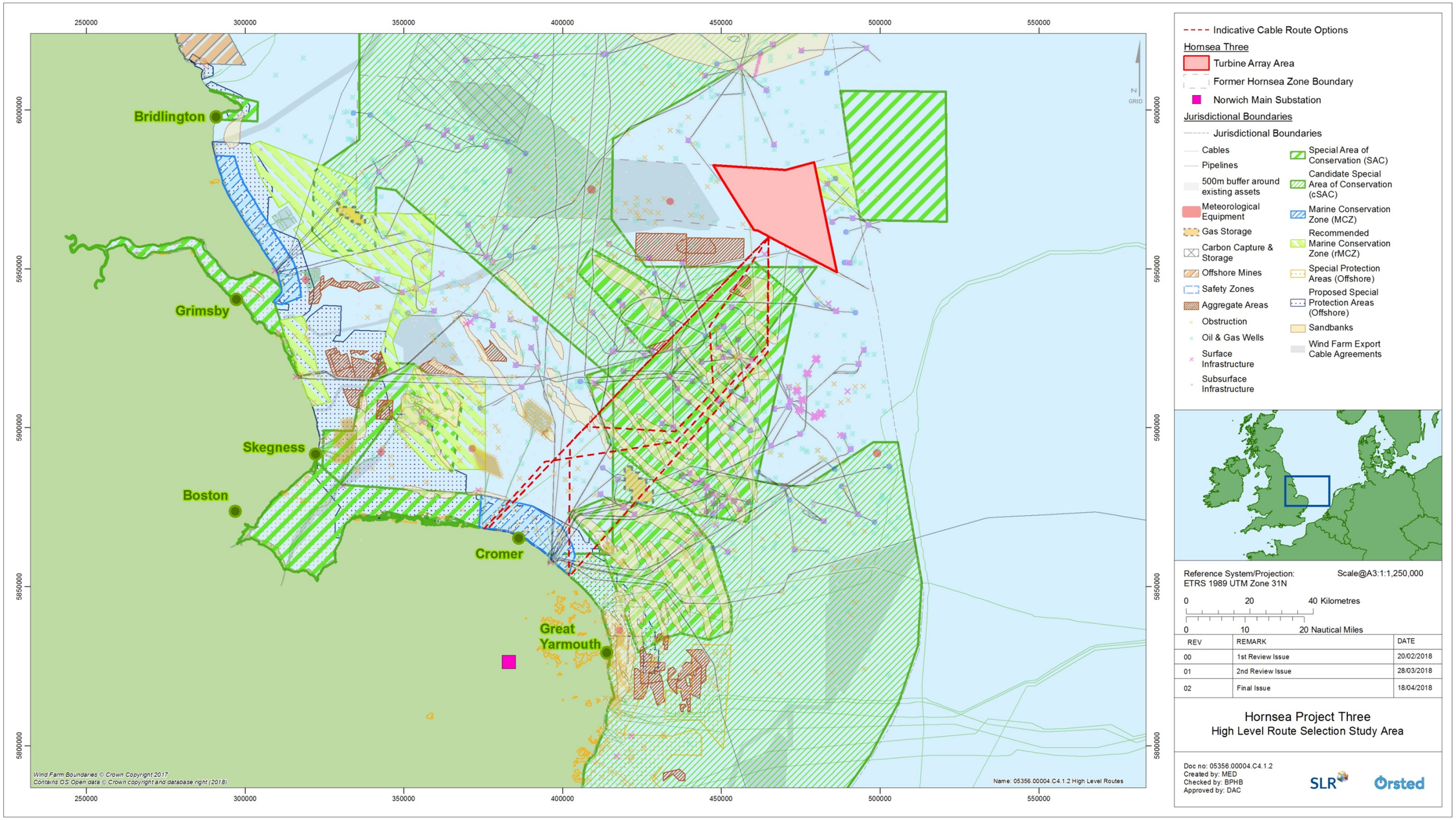

Figure 4.4: Hornsea Three high-level offshore cable corridor options to landfall Zones 2 and 4.

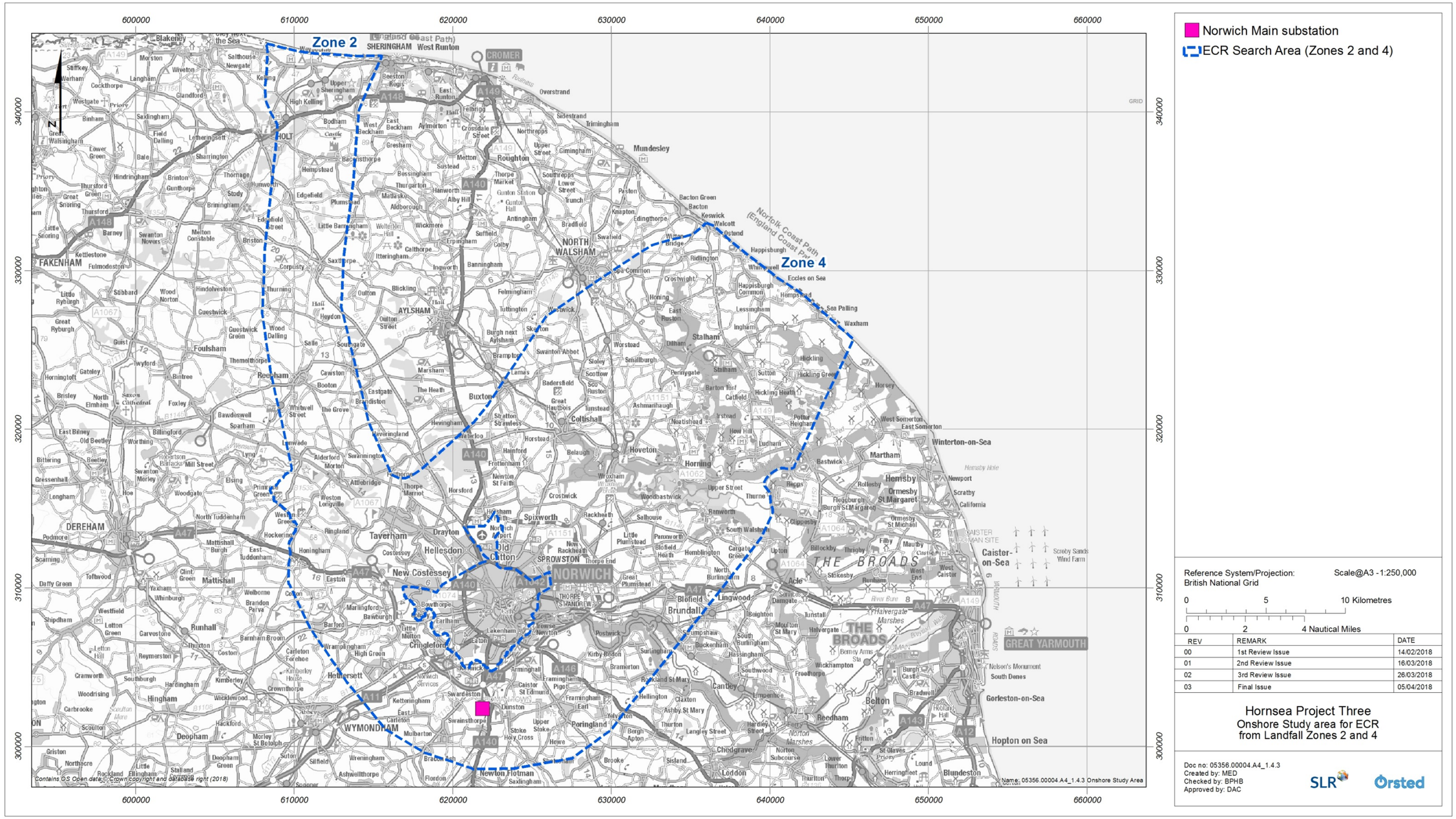

Figure 4.5: Onshore cable corridor search area.

4.8.4.3 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 conurbation was excluded from the search area on the basis that sufficient width of land would not be available for the Hornsea Three cable corridor within the city boundary, any construction works within the city would cause high levels of disruption and the landownership and commercial considerations in that area would be too complex during all phases of Hornsea Three. The general corridors were also widened from Zone 4 to give additional flexibility to potentially route around the Norfolk Broads National Park and substantial National Nature Reserves and also around all sides of Norwich in light of the additional concentration of infrastructure and built development that was present.

4.8.4.4 After all of the considerations taken into account within paragraph 4.8.4.3, the main constraints to onshore cable routeing were considered to be: 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).

4.8.4.5 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 4.3 above 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.

4.8.4.6 A detailed assessment of the Zone 2 and Zone 4 search areas is presented in volume 4, Annex 4.1: Grid Connection and Refinement of the Cable Landfall for Hornsea Project Three (Stages 3-4). This assessment concluded that connecting from Zone 4 south of Norwich to Norwich Main substation was the poorest performing alternative. Whilst it had potential to be the shortest connection it was likely to be the most challenging in technical and environmental terms principally due to the interaction with the Norfolk Broads National Park and need to cross extensive marshy areas where there would be the potential for greater construction stage environmental effects and construction risks. The risks and impacts associated with this option were considered too great and for these reasons this alternative was discounted.

4.8.4.7 Of the other corridor alternatives either from Zone 2 or from Zone 4 landfall north and west of Norwich to the Norwich Main Substation, the corridors on many criteria perform broadly similar, with none being particularly more, or less, technically challenging than the other.

4.8.4.8 However, cable routeing from Zone 4 is potentially more challenging without additional diversion to avoid the Norfolk Broads National Park. Direct routeing would present significant technical challenges for installation (in relation to access and installation techniques) due to the additional marshy conditions in the area of the Norfolk Broads National Park which in addition to potential environmental effects, could also bring additional seasonal restrictions on construction increasing project costs and hence eventual costs to the consumer. Diversion of the route to avoid the National Park and thus avoid these adverse effects means that the route from Zone 4 to pass to the north and west of Norwich is a much more complex (longer) route which would in itself have significant commercial implications and generally increase adverse effects.

4.8.4.9 On this basis 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 close to Zone 4 and consequent reduction in connection length associated with Zone 2 and therefore generally reduced environmental effects, strongly favoured a connection from landfall Zone 2 on both commercial, technical and consenting grounds.

4.8.5 Summary

4.8.5.1 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 Hornsea Three.

4.8.5.2 Landfall Zone 2 was therefore, taken forward as the preferred option and connection routes from the Hornsea Three array area to this landfall and on to the Norwich Main substation. Zone 2 is hereafter referred to as the preferred landfall zone.

4.9 Stage 5 – Identification of project for SOCC, Scoping and Phase 1.A Consultation

4.9.1.1 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 sited) for each project component (offshore cable corridor (inclusive of offshore HVAC booster station search area), landfall, onshore cable corridor (inclusive of onshore HVAC booster station and onshore HVDC converter/HVAC substation search areas) were established for the purposes of formal and informal consultation with the public and relevant statutory and non-statutory stakeholders.

4.9.1.2 The search areas were selected for the SoCC, Scoping 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 design refinement process (based on stakeholder feedback, further data acquisition and interrogation and, engineering optimisation work) for the evaluation of specific routes and infrastructure locations as Hornsea Three progressed through the pre-application phase.

4.9.1.3 For the offshore cable corridor search area, a number of potential routes were developed (see Figure 4.6), aimed at satisfying the selection criteria (minimising the length, avoiding 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 the Hornsea Three offshore cable corridor scoping search area. This provided a Scoping search area of approximately 10 km in width from the array area to the landfall zone, within which the final preferred offshore cable corridor and offshore HVAC booster station search area would be identified (see volume 4, Annex 4.2: Selection and Refinement of the Offshore Cable Corridor and HVAC Booster Station for additional detail).

4.9.1.4 For the onshore cable corridor search area (inclusive of the onshore 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 as stated in section 4.8.4.2 above. 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.

4.9.1.5 The straight line is the most efficient route that can be taken between the two locations and is therefore the starting point for the route identification. The 5 km width provided a high degree of confidence that a viable onshore cable corridor could be identified. 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 (i.e. approximately 80 m width including working areas) 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. Further information on the width of cable trenches and land required is provided in volume 1, chapter 3: Project Description

4.9.1.6 Where the straight line intercepted with residential areas or other constraints, a deviation to the route was included to avoid these. In addition to obvious obstructions as identified on Ordnance Survey and satellite imagery, desk based mapping of environmental constraints enabled the identification of appropriate buffers to avoid 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 Hornsea Three within the city boundary, any construction works within the city would cause high levels of disruption and the landownership and commercial considerations in that area would be too complex during all phases of development.

4.9.1.7 At this stage, no specific areas were identified for the onshore HVAC booster station or the onshore HVDC converter/HVAC substation within the onshore cable corridor scoping 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 that the latter should be sited as close to the existing NGET substation as possible.

4.9.1.8 The Hornsea Three cable corridor scoping search area was drawn to encompass an area within which all the required project Hornsea Three components could potentially be accommodated, based on the status of the Hornsea Three design at that point, known infrastructure and environmental assets/constraints, and providing a spatial extent sufficient to accommodate potentially viable offshore and terrestrial cable options, whilst allowing sufficient space for further cable route development and refinement work, as the Hornsea Three design progressed and feedback from consultation was digested. The final scoping boundary was considered to include all realistic options for the development of the required cable corridor, offshore and onshore HVAC booster station options, and onshore HVDC converter/HVAC substation, along with the grid connection point at Norwich Main Substation.

4.9.1.9 The onshore and offshore cable corridor scoping search areas as shown in Figure 4.7, for Hornsea Three represent the culmination of the site selection process, and shows the boundary which was defined in summer 2016 and ultimately consulted on in quarter 3 of 2016 (i.e. as part of the SoCC in September 2016, Phase 1.A consultation with the public in October to November 2016, and as part of the formal Scoping Opinion which was requested in October 2016 and received in December 2016).

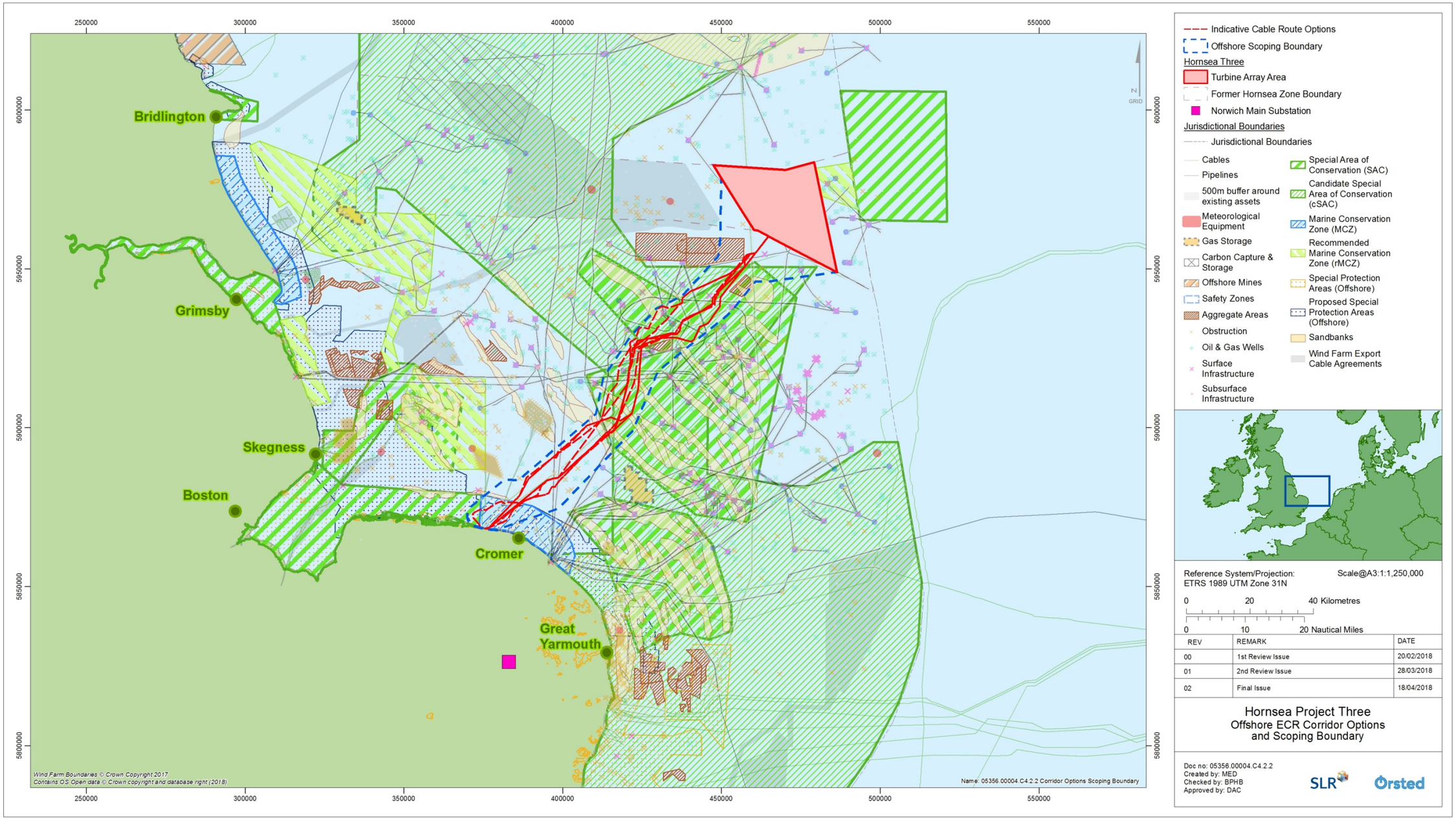

Figure 4.6: Offshore cable corridor options and offshore cable corridor scoping boundary search area.

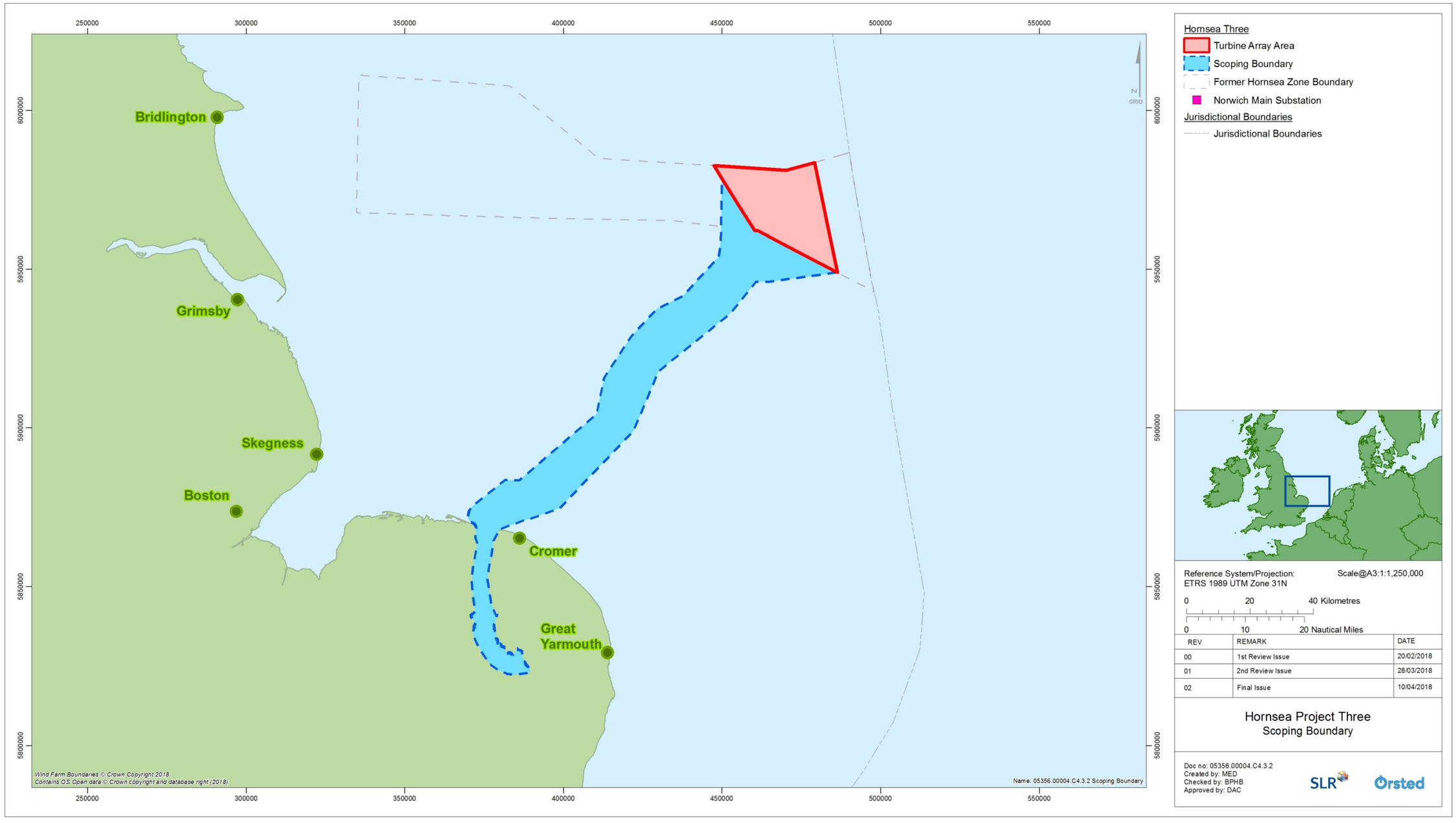

Figure 4.7: Scoping, SoCC and Phase 1.A Consultation boundary.

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

4.10.1.1 Following on from the Phase 1.A consultation further refinement was carried out on the Hornsea Three cable corridor scoping search areas. Specifically, the following activities were undertaken:

- Identification of a refined 1.5 km wide offshore cable corridor;
- Identification of an offshore HVAC booster station search area;
- Identification of a refined landfall zone;
- Identification of a refined onshore cable 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 constraint heat maps for the identification of potential onshore HVDC converter/HVAC substation locations.

4.10.1.2 This section of the site selection chapter describes the process of how the above refinements were carried out including the key responses to the previous round of consultation that fed into these refinements.

4.10.2 Phase 1.A Consultation Feedback

4.10.2.1 Shortly after publishing the Scoping Report, Ørsted held its first round of community consultation events (Phase 1.A). These provided stakeholders with access to further information on Hornsea Three and provided a platform to engage directly with the Hornsea Three team at a similar time. From a project perspective this was an opportunity to gather feedback on Hornsea Three early in the development process. A summary of the topics raised is set out within the Consultation Report, submitted as part of this application for Development Consent (document reference number A5.1). However, in relation to site selection the following key issues were raised:

- Support for cable burial rather than using overhead lines;
- Concern regarding the potential impact on the local environment and wildlife and the need for the project to leave the natural environment in a better position;
- Concern about the visual impact and also ecological features to avoid when routeing the cable corridor;
- Concern regarding the potential noise generated from, and the visual intrusiveness of the onshore HVDC Converter/HVAC substation, noting that the rural area around Norwich is meant to be protected;
- Consider the impact on farming communities;
- Suitability of the local road network, specifically around Kelling and Weybourne;
- Potential impact on areas that rely on tourism in the summer months; and
- Consider the cumulative effect of other similar developments such as the Northern Distributor Route Western link and Norfolk Vanguard.

4.10.3 Refinement of the offshore cable corridor

4.10.3.1 The indicative routes for the offshore cable corridor (as identified in Figure 4.6) were further developed following receipt of the Scoping Opinion and closure of the associated s42 statutory consultation. Specific aims during this phase were to identify a route that would give Hornsea Three sufficient confidence 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. In accordance with the principles outlined within section 8.2 of volume 4, Annex 4.2: Selection and Refinement of the Offshore Cable Corridor and HVAC Booster Station, a 1.5 km wide route corridor was established which sought to minimise conflict with environmentally sensitive features (such as sandbanks and chalk beds) and minimise the number of cable/pipeline crossings. This process culminated in the identification of the Hornsea Three Preliminary Environmental Information Report (PEIR) offshore cable corridor search area as presented in Figure 4.8.

4.10.3.2 Routeing in the area of the North Norfolk Sandbank and Saturn Reef Special Area of Conservation (SAC) was primarily constrained by the need to avoid the larger sandbanks charted in the area (see Figure 4.8). It was recognised that the SAC is designated for 'sandbanks which are slightly covered by seawater all the time' and that these features should be avoided in order to minimise any potential impacts on these important features of the SAC. Beyond that, the other key constraint was the need to cross various oil and gas assets. For commercial and technical reasons, it is best practice to aim to cross such assets at 90° to minimise design risks and cable length. Routeing cables over large sandbank features can also be technically challenging due to potential for sediments to move during the life of the wind farm (potentially leaving cables exposed).

4.10.3.3 In the nearshore area, the proposed routeing gave due consideration to the potential to overlap with the key (chalk) features of the Cromer Shoal and Chalk Beds Marine Conservation Zone (MCZ), based on available information at the time of route selection (see Figure 4.8), whilst also considering a number of other constraints in the area and the overarching principles set out in section 4.4. The route corridor proposed seeks to minimise interaction with the chalk which occurs predominantly to the east of the offshore cable corridor (based on publicly available data, Defra, 2015). In addition, alternative routeing options to avoid the Cromer Shoal and Chalk Beds MCZ further offshore, to the north west were considered but were not deemed feasible 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 (see Figure 4.8). Alternative options to avoid these features entirely would have significantly increased the total length of the offshore cable corridor and hence would not have been in line with the overarching principles laid out in section 4.3. Additional information on the routeing decisions for the offshore cable corridor options is provided in volume 4, Annex 4.2: Selection and Refinement of the Offshore Cable Corridor and HVAC Booster Station.

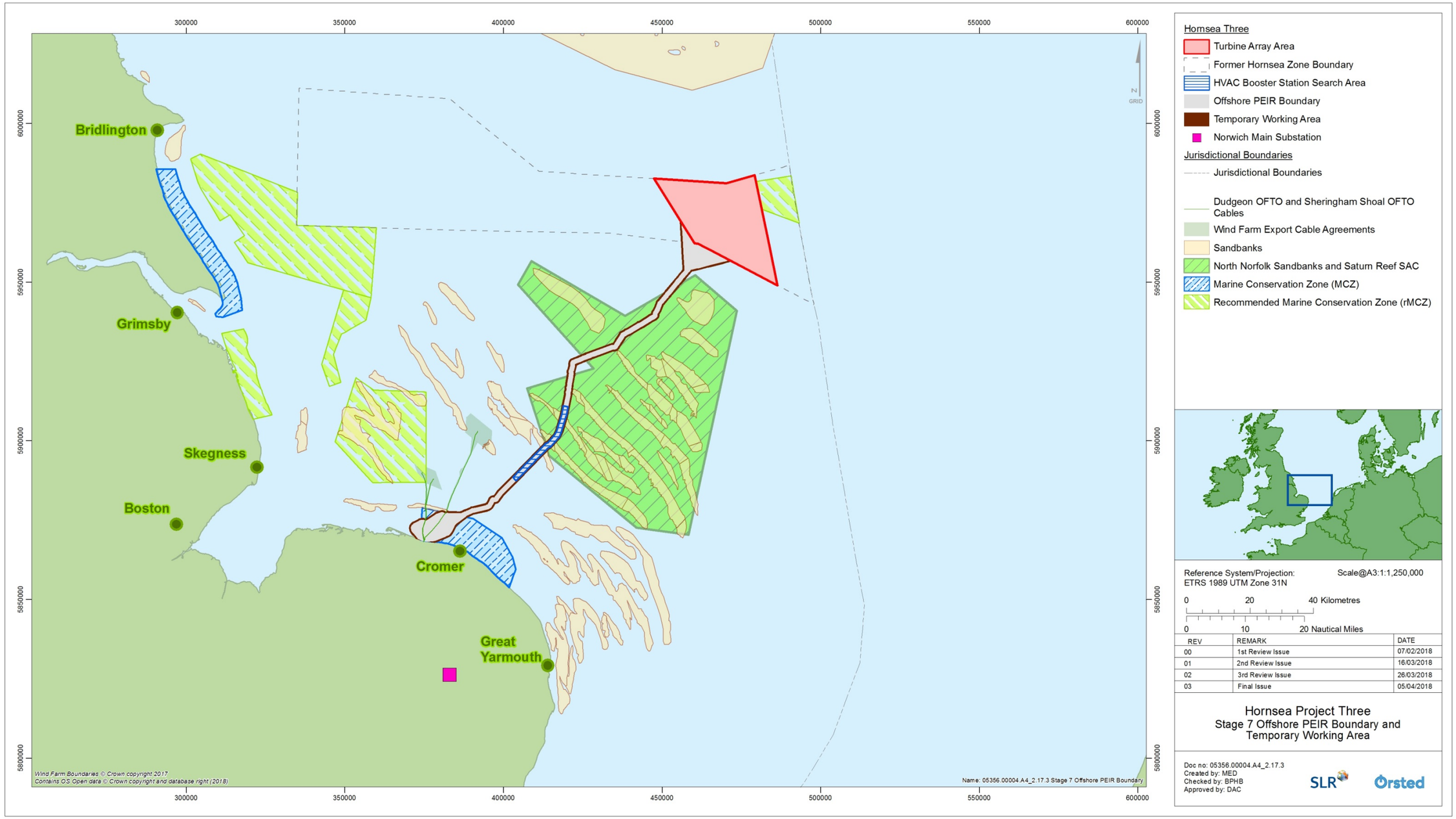

Figure 4.8: Refined offshore cable corridor and offshore HVAC booster station search area.

4.10.4 Identification of an offshore HVAC booster station search area

4.10.4.1 As explained in volume 1, chapter 3: Project Description, an offshore HVAC booster station (and/or 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 corridor.

4.10.4.2 If a HVDC electrical system is developed then neither onshore nor offshore HVAC booster stations would be required.

An area starting at approximately 40% of the total cable route corridor length (offshore and onshore) continuing to approximately 60% of the total cable route corridor 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 general area was electrically optimal for minimising transmission losses. 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 (Maritime and Coastguard Agency (MCA), 2016). Further details can be found in volume 4, Annex 4.2: Selection and Refinement of the Offshore Cable Corridor and HVAC Booster Station).

4.10.5 Refinement of the landfall zone

4.10.5.1 Following Phase 1.A consultation and consultation on the Scoping Report the landfall area was further refined prior to submission of the PEIR (Figure 4.9). 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 (see volume 4, Annex 4.3: Refinement of the Onshore Cable Corridor and Associated Infrastructure (Stages 5-7 Scoping to PEIR) 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 (WNNC) SAC, the North Norfolk Coast SSSI and the North Norfolk Coast SPA to the west of the landfall zone.

4.10.5.2 A 1.2 km wide stretch of coastline near to Weybourne presented a location which offers the onshore cable corridor an appropriate landfall zone that minimises any impact on environmental designations whilst potentially limiting engineering complexity through the use of open cut construction rather than Horizontal Directional Drilling (HDD).

4.10.6 Refinement of the onshore cable corridor

4.10.6.1 Identification of an onshore cable corridor within the Hornsea Three onshore cable corridor 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.

4.10.6.2 The onshore cable corridor route 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 previous stages of routeing did not 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 (see section 4.10.7). As a result, it was possible to progress this initial route identification work without knowing the exact location of the onshore HVDC converter/HVAC substation whilst still ensuring that any routes would reach the region of the connection point.

4.10.6.3 Volume 4, Annex 4.3: Refinement of the Onshore Cable Corridor and Associated Infrastructure (Stages 5-7 Scoping to PEIR), section 3.3.2, describes a range of engineering and environmental principles that were applied to develop the onshore cable corridor search area. These include (but are not restricted to) selection of the most direct route possible, avoiding hard constraints (housing, commercial, allocated land), minimising major asset crossings, and excluding environmentally sensitive areas within the original search area as far as possible (noting there may be some circumstances where they could not be completely avoided).

4.10.6.4 Following the development of the initial route cable corridor, this was then refined to take account of the identification of potential onshore HVAC booster station locations (as described below in section 4.10.7). Three onshore cable corridors were defined to provide an onshore cable corridor option to each potential onshore HVAC booster station option, taking account of the same routeing constraints as outlined above. These routes then all re-joined the main onshore route cable corridor to the south of the most easterly onshore HVAC booster station option (Figure 4.10). With reference to Figure 4.10 it should be noted that the Phase 1.B consultations did not specifically show two options for the onshore substation as they had not been fully considered at that point, but Hornsea Three did indicate through the heat mapping exercise the areas within a 3 km search area that were least constrained and therefore likely to be more preferable (as shown in Figure 4.15 and volume 4, annex 4.3: Refinement of the Onshore Cable Corridor and Associated Infrastructure (Stages 5-7 Scoping to PEIR)).

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

4.10.7.1 Alongside the Hornsea Three onshore cable corridor search area 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 onshore HVAC booster station site

4.10.7.2 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 corridor.

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

4.10.7.4 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 an onshore 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.

4.10.7.5 In addition to the Horlock Rules which are discussed above, the onshore HVAC booster station search area was also established using the following guiding principles:

- Within approximately10 km of the preferred landfall zones (to maximise electrical efficiency/ minimise electrical losses);
- Located within the Hornsea Three onshore cable corridor search area if possible (to minimise deviations/cable route length between onshore cable corridor options identified and the onshore HVAC booster station); and
- Suitable to accommodate an approximately 2.5 ha onshore HVAC booster station and associated working area.

4.10.7.6 In accordance with the guiding principles adopted for Hornsea Three described above in section 4.10.7.5, potential onshore HVAC booster station sites were identified within the search areas, initially using constraints based heat mapping to identify the least constrained locations.

4.10.7.7 This was then followed by more detailed constraints mapping in order to confirm exclusion areas, and to identify sites offering some potential, in the potentially least constrained locations. Volume 4, Annex 4.3: Refinement of the Onshore Cable Corridor and Associated Infrastructure (Stages 5-7 Scoping to PEIR), section 3.4.3, sets out the selection criteria listing a range of constraints that were excluded from consideration and/or indicate the least environmentally constrained locations within the search area. In particular the presence of the Area of Outstanding Natural Beauty (AONB) at and near the coast was seen to be a constraint to what is considered optimal siting - as close to the coast as possible - and hence this area was ruled out despite being preferable from a technical perspective.

4.10.7.8 Once these exclusions were applied, a desk based search was carried out to identify potential site locations for further investigation within the onshore 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 onshore 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.

4.10.7.9 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 cable corridor options to each of these potential onshore HVAC booster station locations were also established (as outlined above). An overview of these sites is presented in Figure 4.11 and the detail for each option presented on Figure 4.12, Figure 4.13 and Figure 4.14 below. In each case, the areas shown for temporary works were indicative only at this stage.

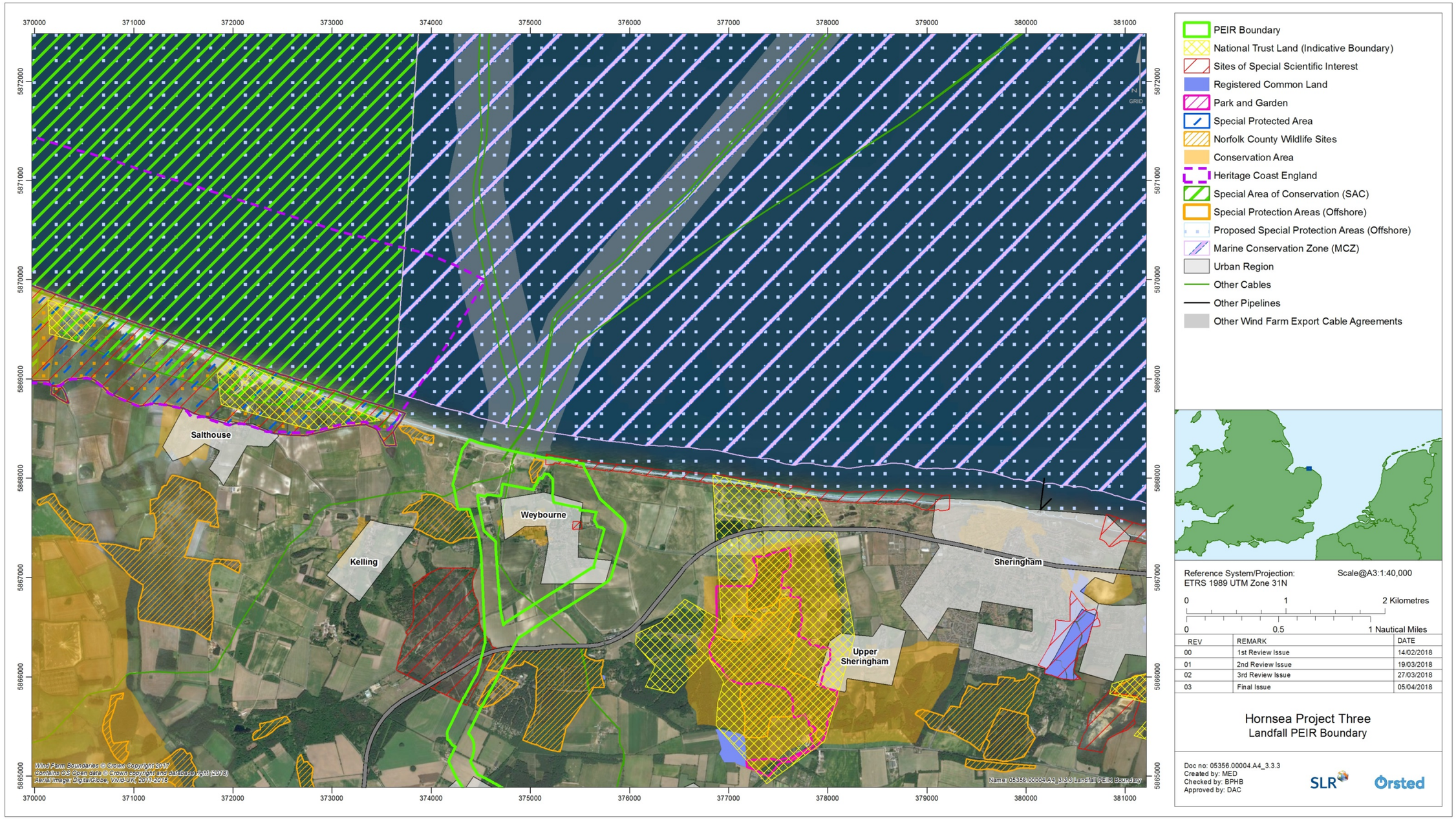

Figure 4.9: Refined landfall area for PEIR submission.

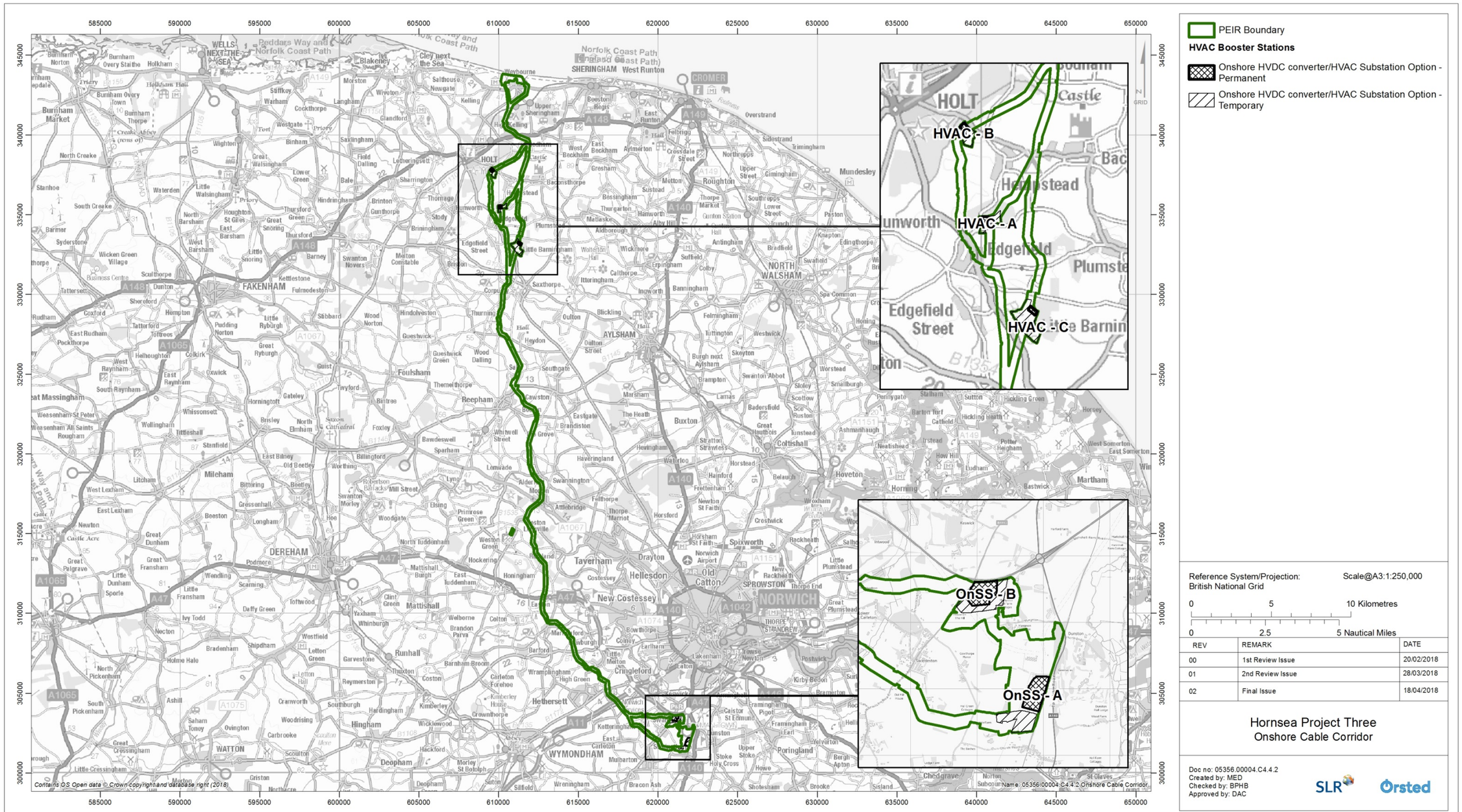

Figure 4.10: Refined Hornsea Three onshore cable corridor search area.

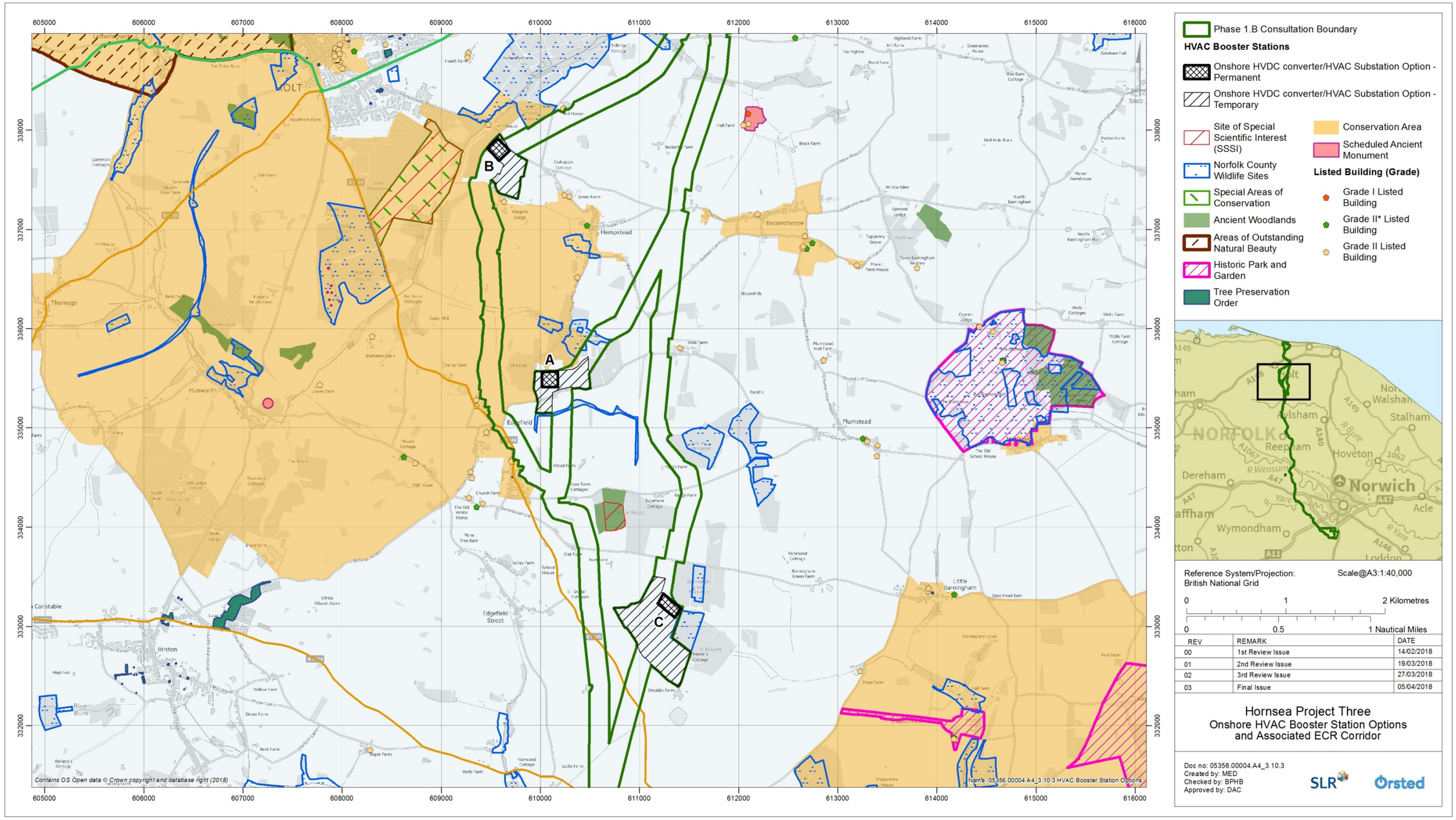

Figure 4.11: Onshore HVAC booster station overview.

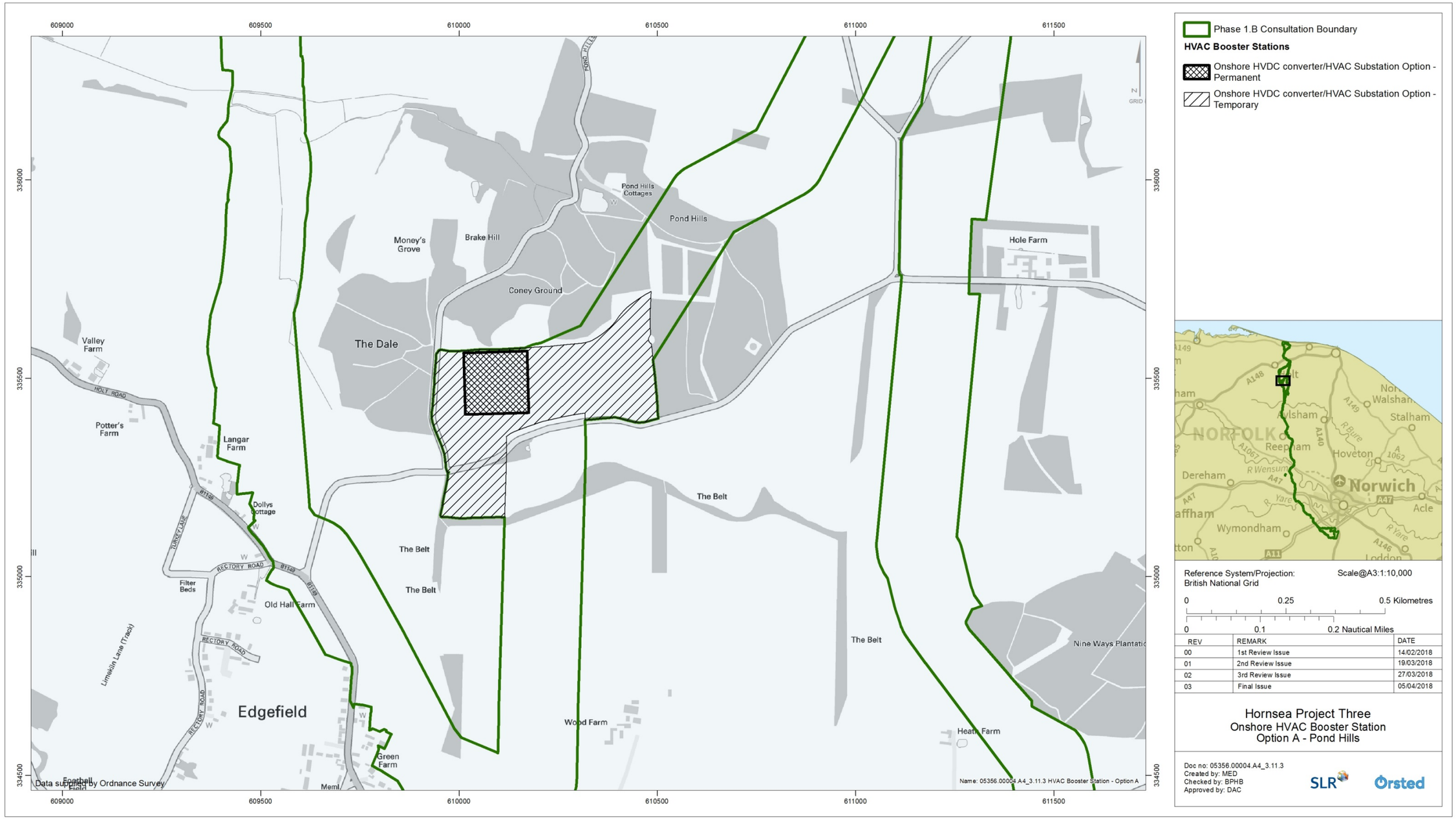

Figure 4.12: Onshore HVAC booster station option A, "Pond Hills".

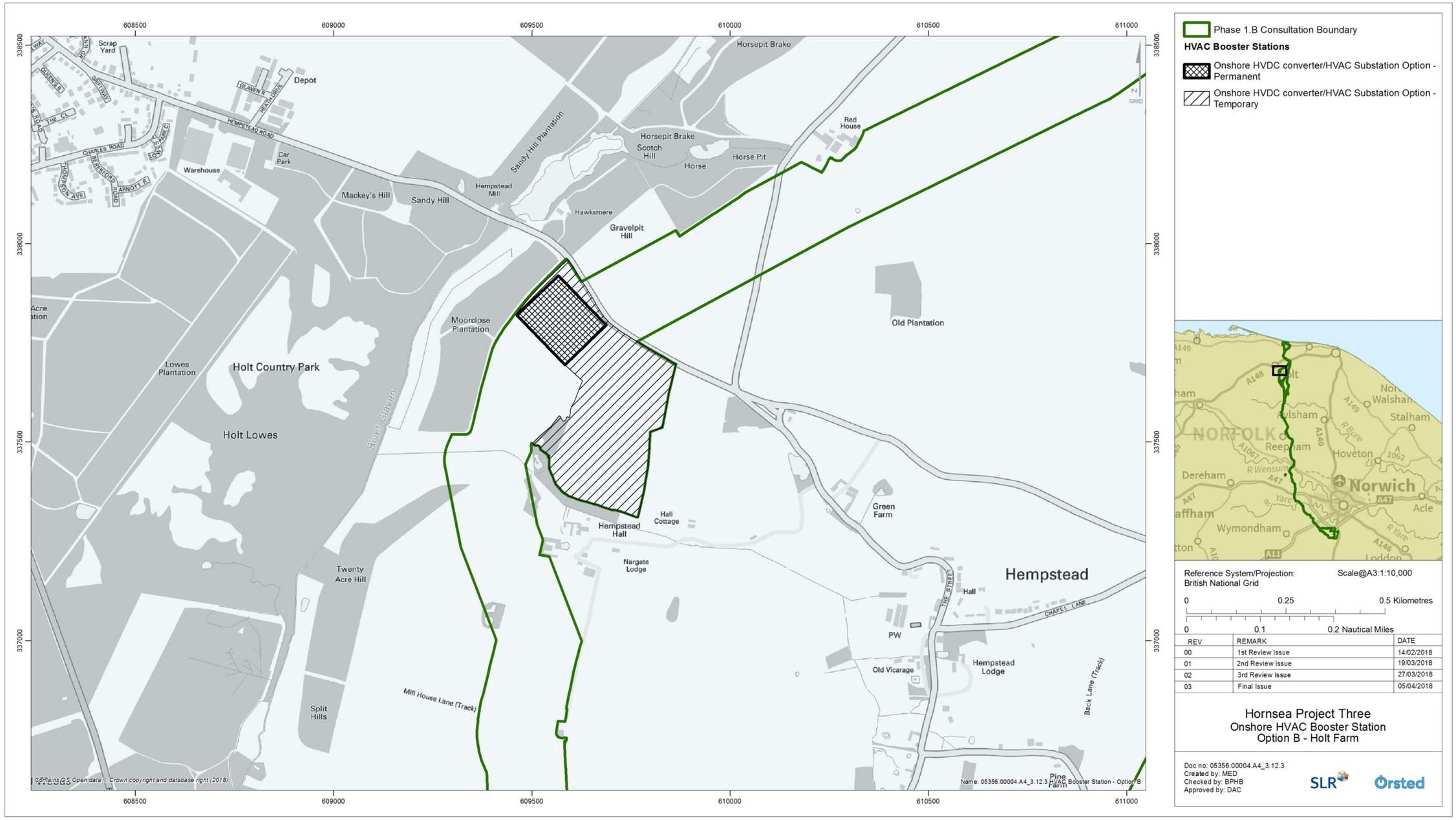

Figure 4.13: Onshore HVAC booster station option B, "Holt Farm".

Figure 4.14: Onshore HVAC booster station option C, "Little Barningham".

Identification of potential HVDC converter/HVAC substation sites

4.10.7.10 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 HVDC converter/HVAC substation Hornsea Three again developed a set of guiding principles (in addition to the Horlock Rules), to first establish an onshore HVDC converter/HVAC substation search area, and then further guiding principles to identify potentially suitable sites within it for further investigation.

4.10.7.11 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 the onshore cable corridor and the new onshore HVDC converter/HVAC substation, and onward connection to the NGET network).

4.10.7.12 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.

4.10.7.13 Volume 4, Annex 4.3: Refinement of the Onshore Cable Corridor and Associated Infrastructure (Stages 5-7 Scoping to PEIR), section 3.2.3, sets out the selection criteria listing a range of constraints that were excluded from consideration and/or indicate the least environmentally constrained locations within the search area.

4.10.7.14 The outputs of the constraints mapping exercise described are presented in Figure 4.15Figure 4.15. This indicates a clear preference for the western 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 NGET Norwich Main substation. This is in the context that the preferred onshore cable route is around the west of Norwich.

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

- Generally flat;
- Benefitting from some existing landscape screening/landscape framework;
- Unconstrained by existing services and utilities; and
- Accessible for construction/delivery of abnormal loads.

4.10.7.16 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 (Option A and Option B), were identified for further investigation. Both options were seen to be positioned positively in relation to the onshore cable corridor search area however it was established that Option A's proximity to the railway line directly to the east and the Norwich Main substation to the north made it physically more constrained than Option B. Furthermore, Option B was significantly less constrained in terms of both access and existing services and utilities, as well as possessing a greater availability of land for potential mitigation to be implemented. The site options are presented on 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.

4.10.8 Summary

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

- A preferred indicative 1.5 km wide offshore export cable corridor (See Figure 4.8);
- A preferred landfall zone (in the vicinity of Weybourne) (See Figure 4.9);
- A preferred indicative 200 m onshore export cable corridor search area, with 100 m technical buffer either side for technical considerations (See Figure 4.10);
- Three potential sites (and associated cable corridors) (See Figure 4.11) being considered by Hornsea Three 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 (See Figure 4.15) 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.

4.10.8.2 Exhibition banners and foam board maps (to allow attendees to mark local features using pins and notes) 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 HVDC converter/HVAC substation.

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

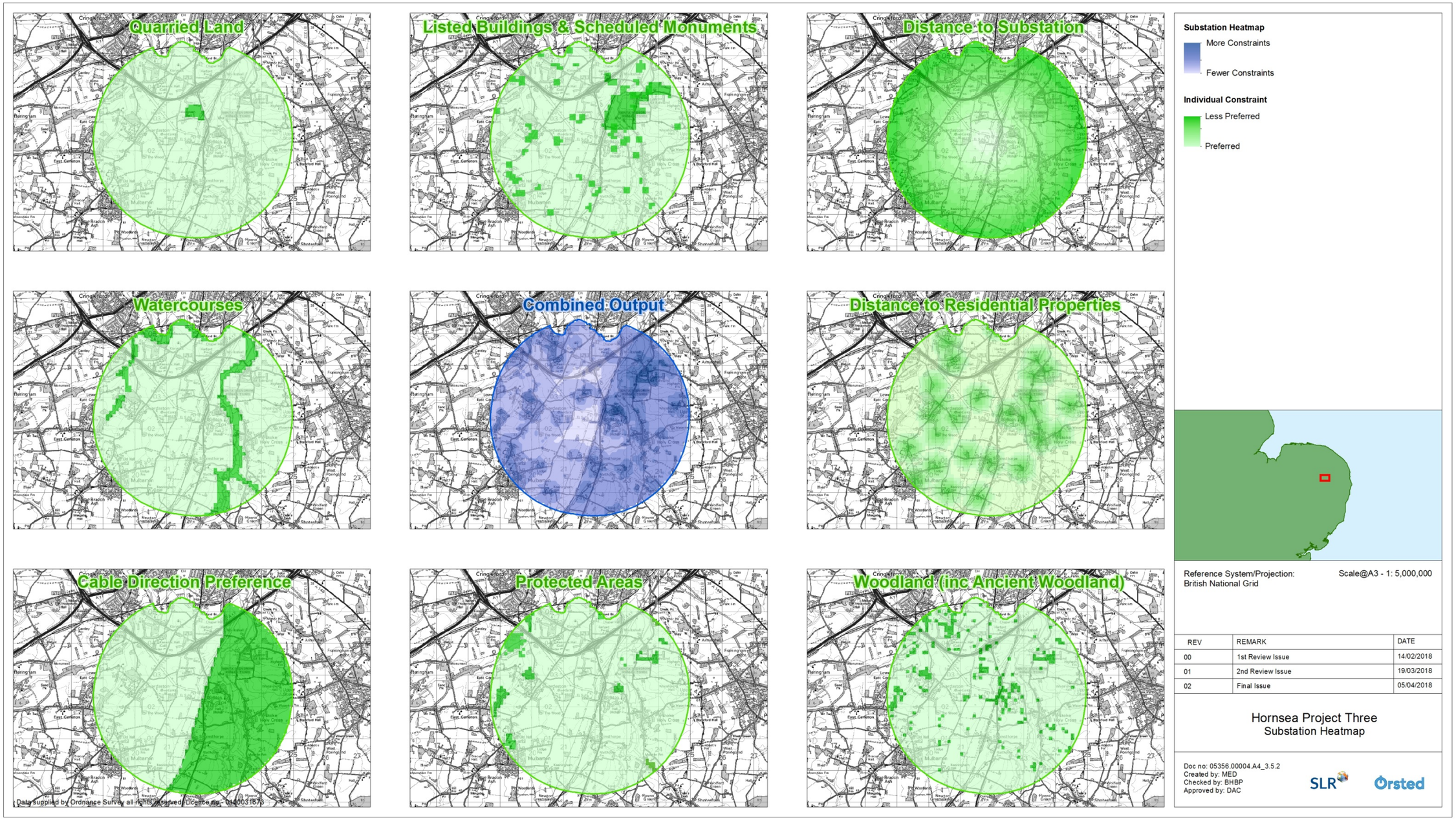

Figure 4.15: Constraints mapping of onshore HVDC converter/HVAC substation search area.

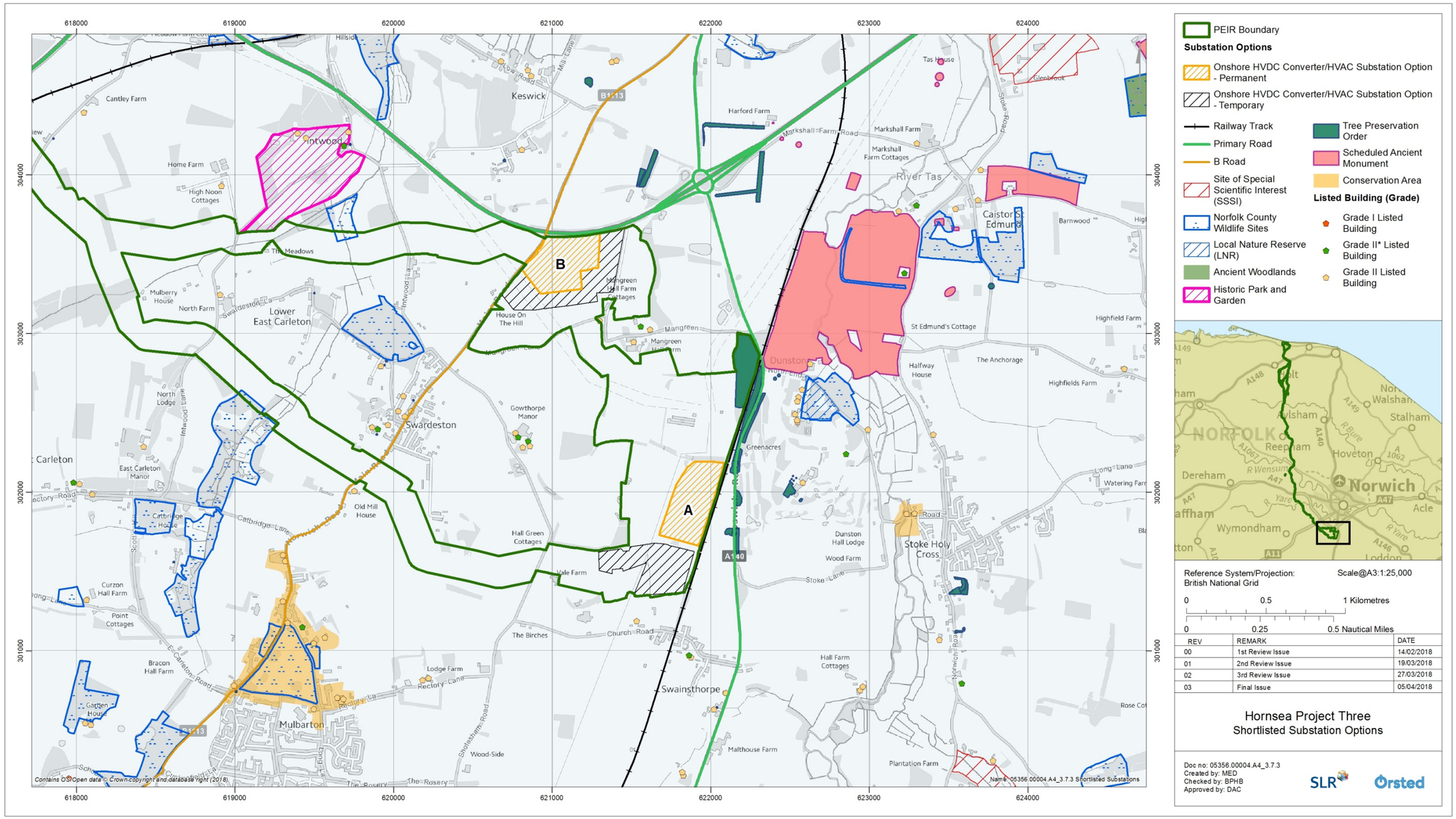

Figure 4.16: Overview of onshore HVDC converter/HVAC substation options.

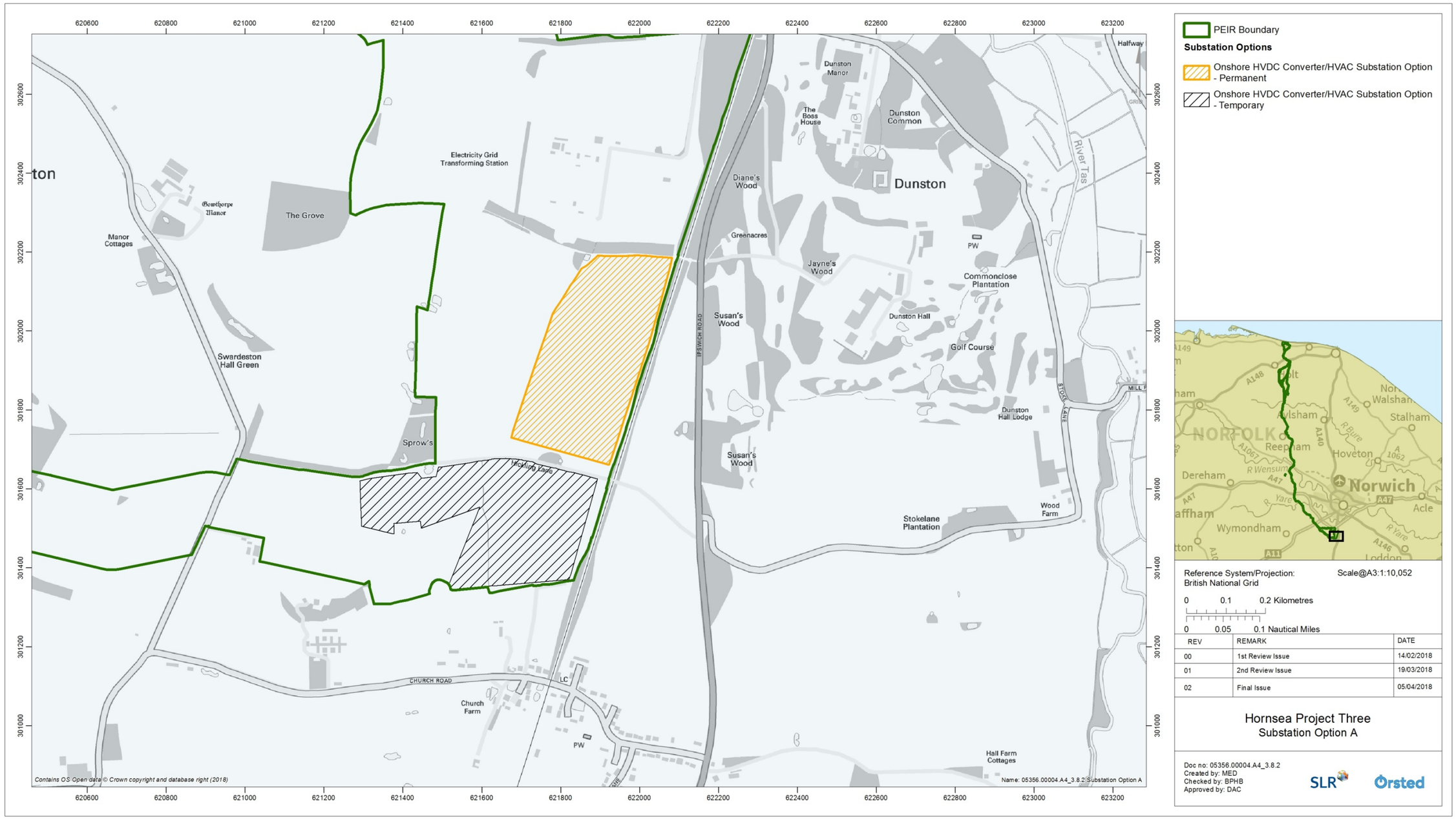

Figure 4.17: Onshore HVDC converter/HVAC substation option A.

Figure 4.18: Onshore HVDC converter/HVAC substation option B.

4.11 Stage 7 – Refinement for PEIR and Phase 2.A Consultation

4.11.1.1 Hornsea Three 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.A 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.

4.11.1.2 The following text describes those refinements made and the rationale supporting the decision making process for each refinement. In addition, reference is made to the key responses to the previous round of consultation that fed into these refinements.

4.11.2 Phase 1.B Consultation Feedback

4.11.2.1 A summary of the topics raised along with Ørsted's response is set out within the Consultation Report that is submitted as part of the application for Development Consent (document reference number A5.1). However, in relation to site selection the following key issues were raised:

- Offshore – Potential impact from the offshore cable corridor on the Cromer Chalk Reef and its associated Marine Conservation Zone (MCZ);
- Intertidal Area – potential impact on the cliffs in relation to nesting birds, the coastal footpath and tourism;
- Landfall Zone – objections to the use of the area to the east of Weybourne, noting its proximity to Pine Walk and residential properties;
- Onshore Cable Corridor – potential impact on the River Glaven, proximity to residential properties;
- Onshore Booster Station – community expressed strong concerns about Option A being an area that is renowned for its natural beauty and diverse wildlife, and Option B's proximity to residential properties and the River Glaven; and
- Onshore HVDC converter/HVAC Substation – concern about the proximity to residential properties, request to avoid common land including Dunston Common and the neighbouring woodland.

4.11.3 Refinement of the offshore cable corridor and landfall zone

4.11.3.1 Between the refinements made for Phase 1.B Community Consultation Events and PEIR, there was comparatively minimal refinement of the offshore cable corridor search area 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 would be 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 offshore cable corridor 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 cable corridor.

4.11.3.2 The Hornsea Three PEIR offshore cable corridor search area was 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) was located between 40% to 60% of the way along the length of the Hornsea Three PEIR offshore cable corridor search area (see Figure 4.8).

4.11.4 Refinement of the onshore cable corridor search area and onshore HVAC booster station locations

4.11.4.1 The three shortlisted sites for the onshore HVAC booster station (and their associated cable route corridors) 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 development of the scoping boundary, the sites had been the subject of desk top heritage assessment and phase 1 ecology surveys, and this information was also considered.

4.11.4.2 A summary comparison is presented in Table 4.3 (red representing high level of constraint to successful development relative to other issues, orange a moderate constraint relative to other issues and probably surmountable, and green is perceived to be a limited constraint).

4.11.4.3 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 Hornsea Three, and a short Phase1.B Consultation Summary Report was prepared and published on the Hornsea Three website (now located at www.hornseaproject3.co.uk) on the 22 June 2017 summarising the views expressed at that stage. Respondents 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. Respondents were also concerned about the proximity of Option A (Pond Hills) and Option B (Holt Farm), (and their associated cable corridors,) to areas of conservation, including the Glaven Conservation Area. Respondents noted that of the three options, Option C, (Little Barningham) has the most direct cable corridor and was furthest from public footpaths.

Table 4.3: Onshore HVAC booster station sites summary assessment.

Criteria		Candidate Sites		
		A - Pond Hills	B - Holt Farm	C - Little Barningham
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

4.11.4.4 Based on the site assessment 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 (Little Barningham) 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 (Pond Hills) and B (Holt Farm) were therefore removed from the onshore cable corridor.

4.11.4.5 No further refinements to the onshore cable corridor were made for the PEIR consultation phase to that presented at Phase 1.B Community Consultation. However, Hornsea Three did also present some alternative options for the cable corridor within the Statutory Consultation Plans that were consulted on alongside the PEIR, as feedback on these route options was considered necessary at that stage.

4.11.5 Refinement of the onshore HVDC converter/HVAC substation

4.11.5.1 The two substation site options 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.

4.11.5.2 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 provided a greater availability of land for potential mitigation to be implemented. Option A was comparatively constrained by the railway line directly to the east and by the Norwich Main NGET 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.

4.11.5.3 A summary comparison is presented in Table 4.4 (red representing high level of constraint to successful development relative to other issues, orange a moderate constraint relative to other issues and probably surmountable, and green is perceived to be a limited constraint).

Table 4.4: Onshore HVDC converter/HVAC 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

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

4.11.6 Identification of potential main compound sites

4.11.6.1 Construction activities will need to be supported by one main compound approximately half way along the route close to the cable corridor of up to 4.5 ha in area. Further development of the onshore cable route corridor search area allowed for the identification of three potential locations within Broadland District Council for a main compound site. These areas are shown on Figure 4.19. A fourth site at Oulton Airfield was also included in the statutory consultation plans.

4.11.6.2 No information on these sites was available at the PEIR stage. These compound options were then also subjected to further review in the post PEIR phase of Hornsea Three (see section 4.12.6.2 later in this chapter).

4.11.7 Summary

4.11.7.1 The further site selection work (as informed through stakeholder engagement, landowner discussions and technical studies) enabled the refinement of Hornsea Three to the point of PEIR submission and commencement of Phase 2.A (s42, s47 and s48) consultation accordingly:

- A single preferred offshore cable corridor search area of 1.5 km in width (See Figure 4.8);
- An offshore HVAC booster station search area (See Figure 4.8);
- A refined landfall at Weybourne (See Figure 4.9);
- A single preferred onshore cable corridor search area of 200 m in width (See Figure 4.10);
- A single preferred onshore HVAC booster station site (See Figure 4.14); and
- A single preferred onshore HVDC converter/ HVAC substation site (See Figure 4.18).

4.11.7.2 Hornsea Three considered that these options and refinements were sufficiently justified and narrowed down to enable stakeholders (through the consultation process) to meaningfully comment on the proposed scheme and its potential effects on the receiving environment. The boundary used throughout within the PEIR can be seen in Figure 4.20.

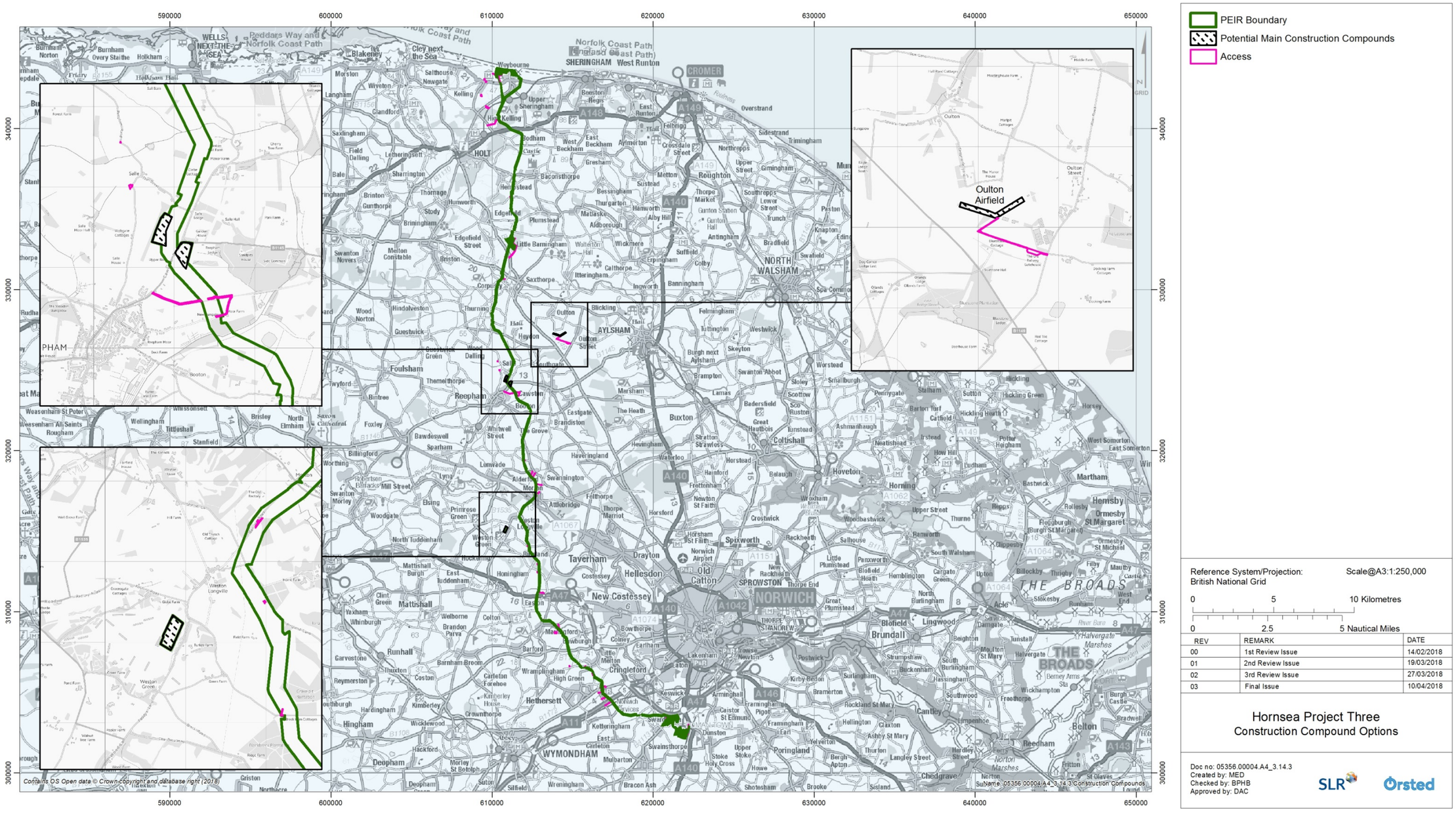

Figure 4.19: Hornsea Three onshore cable corridor search area and construction compounds.

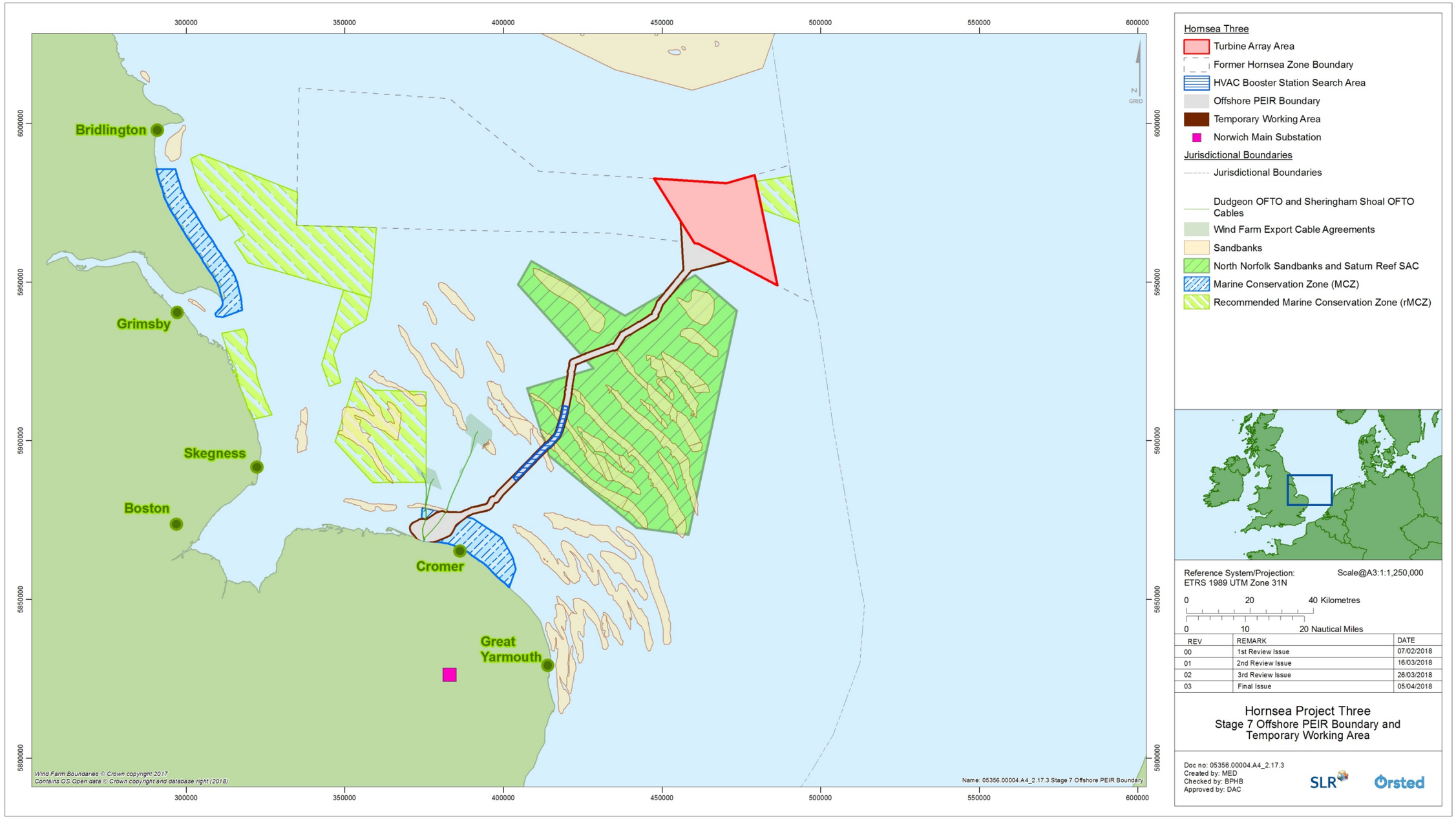

Figure 4.20: Project boundary considered within PEIR.

4.12 Stage 8 – Refinement of Hornsea Three Post PEIR including to Phase 2.B and Phase 2.C consultation

4.12.1.1 Following submission of the PEIR, a number of modifications were made to Hornsea Three as a result of further design refinements and engineering design optimisation, taking on board Section 42 consultee and stakeholder feedback, informal consultation with landowners, responding to findings from site specific additional environmental assessments and also to further reduce and offset the potential environmental effects. These include:

- A reduction in the number of turbines from 342 to 300;
- Removal of floating foundations as an option for the turbine foundations;
- Refinement of the offshore HVAC booster station due to potential impacts on the NNSSR SAC and potential impacts on shipping and navigation;
- Reduction in offshore cable protection within designated sites;
- Reduced number of phases in the construction programme and the associated period over which construction could occur; and
- The use of HDD rather than open cut trenching at over seventy points along the onshore cable corridor.

4.12.1.2 Some of these alterations (which had not been consulted on at PEIR or within the Statutory Consultation Plans), required the proposed cable route corridor to fall outside of the PEIR corridor. Further statutory consultations (Phase 2.B) and focused statutory consultations (Phase 2.C) were therefore held to consult on these changes and to inform the public and stakeholders of the proposed alternative route options and design adjustments.

4.12.1.3 Further consultation related to the following:

- Potential re-routes for sections of the offshore cable corridor;
- A single preferred onshore cable corridor search area of 200 m in width, with six alternative route cable corridors around design constraints or as a consequence of s42 feedback;
- Refinements to the onshore HVDC converter/HVAC substation and onshore HVAC booster station sites;
- Some potential construction compounds and storage areas; and
- Currently identified construction access routes.

4.12.1.4 Further information can be found in volume 4, Annex 4.3: Refinement of the Onshore Cable Corridor and Associated Infrastructure (Stages 5-7 Scoping tot PEIR), and Annex 4.4: Post PEIR Changes to Hornsea Project Three (Stages 8-9).

4.12.1.5 A number of consultation responses received in response to PEIR requested that the project drop the option for an HVAC transmission system and maintain just HVDC. Whilst there is a certain level of confidence in the UK wind industry that HVDC technology will become more mature before Hornsea Three connects, there is currently no certainty of this. As detailed in paragraph 4.8.1.2 there are currently uncertainties associated with both technologies.

4.12.1.6 In relation to HVDC, to date, this technology has more commonly been used to transmit electricity from one grid to another in the form of an interconnector and has yet to be applied to any UK offshore wind farms. Although there is some experience of using HVDC for offshore wind farms in Germany, the structure of the market is quite different to the UK (in that offshore transmission connections are centrally planned and delivered by the onshore utility) and the use of DC technology for offshore wind farms is still maturing. For an interconnector from one country to another, there is no marine infrastructure other than the cabling itself and therefore interfaces with other systems/marine platforms is absent. At present the increased complexity of offshore HVDC systems compared to those used for interconnectors as well as less experience in the technology has led to transmission reliability issues meaning that less energy can be transmitted to the grid.

4.12.1.7 Aside from technological maturity, there are currently very few suppliers in the world with the capability of producing and supplying the HVDC transmission technology that would be needed for a project of this size. As a result, delivery lead times can be considerably longer than for equivalent HVAC systems.

4.12.1.8 Due to these uncertainties, a decision on which transmission system (HVDC or HVAC) to adopt will not be made until post consent after extensive engagement with potential systems suppliers has taken place. For this reason, both technologies were maintained within the design envelope for which Hornsea Three is seeking consent.

4.12.2 Potential offshore alternative routes

4.12.2.1 Following feedback received during Section 42 statutory consultation at PEIR, the Hornsea Three PEIR offshore cable corridor search area was reviewed specifically in relation to the Cromer Shoal Chalk Beds MCZ and North Norfolk Sandbank and Saturn Reef SAC where stakeholders requested that re-routes should be considered. The following text summarises the works undertaken, with further detail provided within section 10 of volume 4, Annex 4.2: Selection and Refinement of the Offshore Cable Corridor and HVAC Booster Station. A supplementary information document was issued for further Section 42 consultation (November 2017) which provided information on two ‘potential offshore alternative routes’ - one close to the offshore array area (known as the ‘seaward potential alternative route’), and the other closer to landfall (known as the ‘near shore potential alternative route’) (see Figure 4.21).

4.12.2.2 Following careful consideration of stakeholder feedback the seaward potential alternative route has been taken forward. Although extending the length of the offshore cable corridor, this reduces the direct impact of cable laying activities on the North Norfolk Sandbanks and Saturn Reef (NNSSR) SAC and is supported by Natural England and other stakeholders.

4.12.2.3 Although the near shore potential alternative route was seen to reduce the direct impact of cable laying activities on the Cromer Shoal Chalk Beds MCZ, following stakeholder feedback, further consideration was given to its greater potential impact upon the WNNC SAC. It was determined that the near shore potential alternative route reduces the total length of cable passing through both the WNNC SAC and the MCZ combined by almost half. Similarly, the maximum area of seabed within designated sites which may be affected by cable protection (including crossings) would be approximately one quarter of that using the original route. Furthermore, the potential nearshore alternative route would move construction activities further away from the more intense areas of fishing activity.

4.12.2.4 A Report to Inform Appropriate Assessment (RIAA) has been completed that gives full consideration of the cable installation, operation and maintenance, and decommissioning activities within the SACs. The RIAA is provided in Hornsea Project Three application document reference number A5.2.

4.12.3 Alternative onshore cable corridor options

4.12.3.1 While volume 4, Annex 4.4: Post PEIR Changes to Hornsea Project Three (Stages 8-9), (section 1.3.2), documents the approach and principles used in decision making as well as a detailed description of the alternative route options, the following text, along with Figure 4.22, provides a summary of the proposed refinements along with reasons for doing so:

- A refined landfall location and western re-route around Kelling:
  - Avoiding cliffs and coastal geomorphological Sites of Scientific Interest (SSSI's);
  - Avoiding the technically challenging engineering design that would be required to HDD under a heritage railway in the original proposed location;
  - Avoidance of the Kelling Heath SSSI and County Wildlife Site (CWS);
  - Following feedback received from the local community and landowners in the area of Weybourne and Kelling relating to proximity to residential properties (see Hornsea Project Three Consultation Report, DCO document reference number A5.1 for more information);
- A potential re-route around Salle:
  - Minimising the loss of good quality land take;
  - Siting further from existing heritage assets;
  - Avoiding ecologically sensitive ponds;
  - Avoiding potential archaeological remains;
  - Avoiding a wider section of a tributary of the River Wensum; and
  - Reducing the requirement to cross Public Rights of Way (PRoW).
- Avoiding a special category pipeline to the east of Hethersett that was found to be an abandoned Ministry of Defence (MOD) pipeline.

4.12.4 Final onshore cable corridor refinements

4.12.4.1 Taking on board additional consultee feedback, the entire onshore cable corridor search area was the subject of an internal 'change control' review process with a multidisciplinary Ørsted team as the refinement process commenced, assessing every request for a change to the route corridor. Any changes were made in response to an iterative discussion which sought to identify the best/preferred option when considering the balance of all constraints and potential environmental effects. The following summarises why those modifications were implemented, with further discussion provided in the subsequent text and in detail in volume 4, Annex 4.4: Post PEIR Changes to Hornsea Project Three (Stages 8-9):

- The need for further refinement of the landfall following the identification of additional technical and environmental hurdles, as discussed in section 4.12.3.1 above;
- The need to define a final onshore cable route corridor, and reduce the broad 200 m corridor down to a final approximately 80 m route corridor (60 m for the cable width, plus working area);
- Responding to consultation feedback and requests. This has influenced many of the post PEIR onshore route cable corridor refinements;
- The need to future proof Hornsea Three by identification of new environmental designations and planning applications/allocations;
- The requirement for construction compounds and cable construction access routes corridors;
- Design refinements to the onshore HVDC converter/HVAC substation and onshore HVAC booster station sites; and
- Proactive changes to the onshore cable corridor route using the results of detailed ecological and archaeological surveys to inform the detailed route selection.

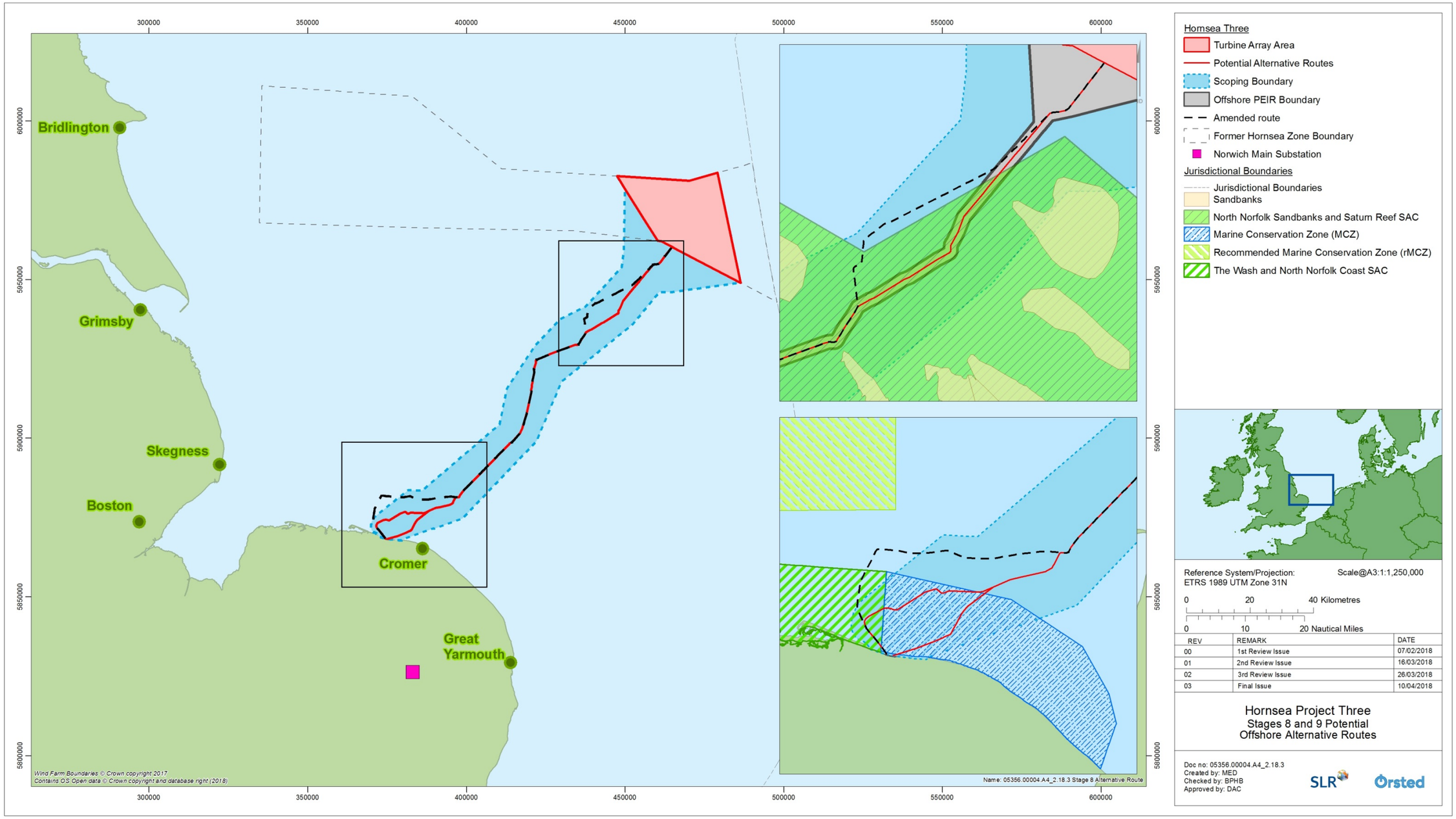

Figure 4.21: Potential offshore alternative routes.

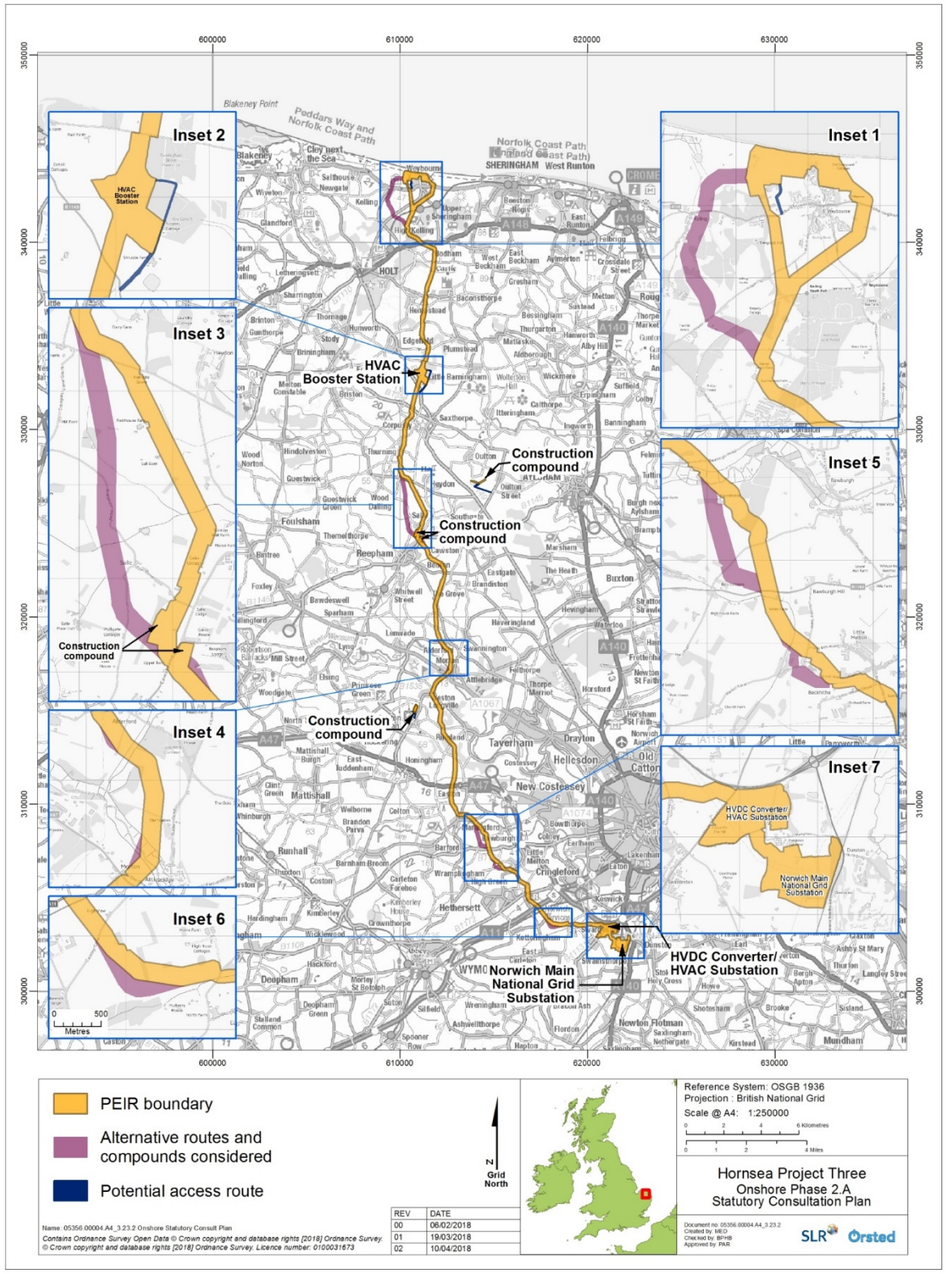

Figure 4.22: Onshore Phase 2.A Statutory Consultation Plan.

4.12.5 Refinements to the onshore HVDC converter/HVAC substation and onshore HVAC booster station with associated compounds

4.12.5.1 Following detailed electrical substation design the footprint of the onshore HVDC converter/HVAC substation increased slightly, with the footprint for the temporary construction compound reducing in size (see Figure 4.23). The final alignment of the substation compound was chosen in order to place it directly adjacent to the permanent footprint of the substation and as far away from residential receptors as possible. A thin strip of land to the south of the substation was also identified to enable the planting of a strategic landscape screening corridor.

4.12.5.2 With regards to the onshore HVAC booster station, its footprint and associated compound have been substantially reduced in extent from the larger search areas identified at PEIR. The area has been reduced by over 30 ha as illustrated in Figure 4.24. The alignment of the onshore HVAC booster station was adjusted slightly to take further advantage of an existing belt of trees that lies immediately to the north, and to site the building onto the lowest lying, flat land, in order to reduce the overall visual effect. The relocation also allowed the avoidance of hedgerows and trees and restricted the number of agricultural fields that would be affected. A strategic landscaping corridor was also identified to allow for additional tree planting and visual screening, in addition to that provided by the existing woodland around the site.

4.12.6 Additional construction compounds and storage areas

Landfall temporary construction compound

4.12.6.1 A construction compound will be temporarily installed in the same broad location as the Transition Joint Bay in order to support the landfall works. This location was determined by the technical, environmental, and commercial decision making of the final cable landfall.

Main construction compound

4.12.6.2 A main construction compound would operate as a central logistics base for the onshore construction works. In order to maintain a range of flexible options for the construction phase, three potential sites were identified and assessed within the PEIR, whilst an additional site was identified during the Phase 2.B and Phase 2.C consultation period. One site (Site 1: Weston Longville) was discounted on the basis of not possessing the required level of access for heavy goods vehicles (HGV), with another two (Sites 2 and 3, near Cawston Road, south of Salle), considered less suitable due to their separation from the strategic road network or being located on agricultural land that would need converting to hardstanding. Further details of these sites and their locations can be found in volume 4, Annex 4.4: Post PEIR Changes to Hornsea Project Three (Stages 8-9).

4.12.6.3 The preferred site, at Oulton Airfield, located off the B1149 near Oulton Street (see Figure 4.25), was deemed suitable due to it already comprising hard standing for the temporary placement of site facilities and storage of plant and materials, and would therefore reduce environmental impacts and require minimal reinstatement. The site is approximately at the mid-way point along the route and is well placed to serve deliveries to the construction route. The site has previously been used as a construction compound for other construction projects, and has direct access from the B1149, a route that does not require traffic to pass through any large settlements and therefore would have minimal impact on sensitive residential receptors.

Secondary construction compounds

4.12.6.4 Following the identification of the main construction compound, five secondary compound sites were identified within the final red line boundary for the application for Development Consent (see Figure 4.27). These sites are typically in agricultural use. They were selected on the basis that they provide logical locations, equally spaced along the Hornsea Three onshore cable corridor. Wherever possible they have been sited to avoid environmental constraints, are located away from sensitive receptors and closer to the more complex works such as HDD sites, Hornsea Three onshore cable corridor pinch points or restricted working areas. Where viable they have been located to fit into areas of land that might be temporarily severed or agriculturally redundant during the cable construction works (e.g. the corners of fields).

4.12.7 Temporary storage areas

4.12.7.1 There is a potential requirement for storage areas at locations along the Hornsea Three onshore cable route corridor, in addition to land provided within the 80 m (approximate) corridor. The sites that have been identified (see Figure 4.27) are generally in agricultural use and would be located in areas that could not be used by the farmer because the cable installation works would have temporarily restricted access to these locations. It is envisaged that each storage location would be in place for periods of up to one month (per phase) and the sites restored to their original condition when the work front had passed.

4.12.8 Access Routes

4.12.8.1 Following PEIR submission, onshore a number of potential construction site access routes were consulted on as part of a further round of statutory consultation (Phase 2.B) in late 2017, which was undertaken to gather feedback on locations outside of the previous consultation boundary. Since then, the routes have been subject to further detailed adjustments with a key principle being to keep to existing access routes and roads wherever viable in order to minimise environmental and social impacts.

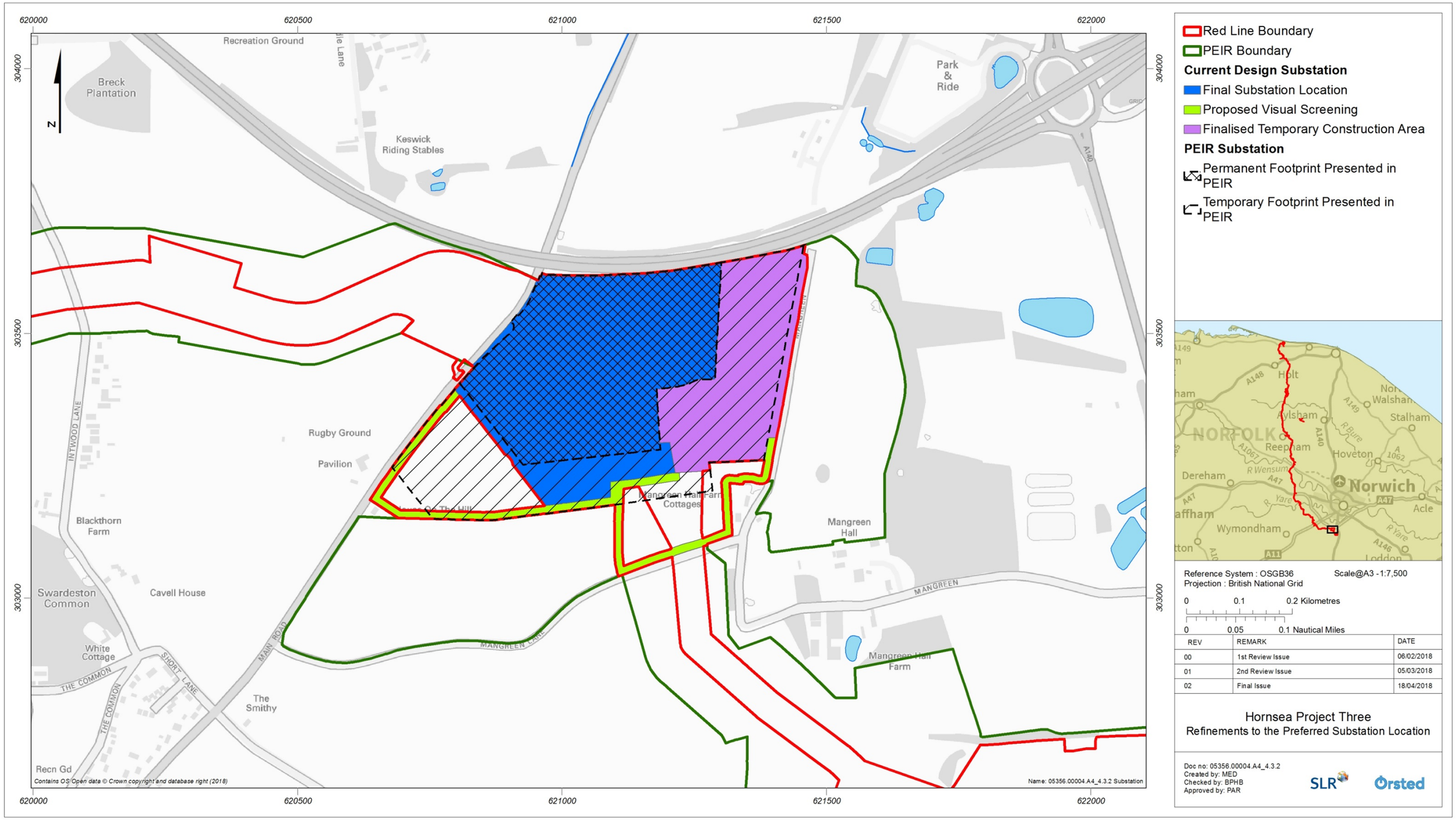

Figure 4.23: Refinements to the preferred onshore HVDC converter/HVAC substation location.

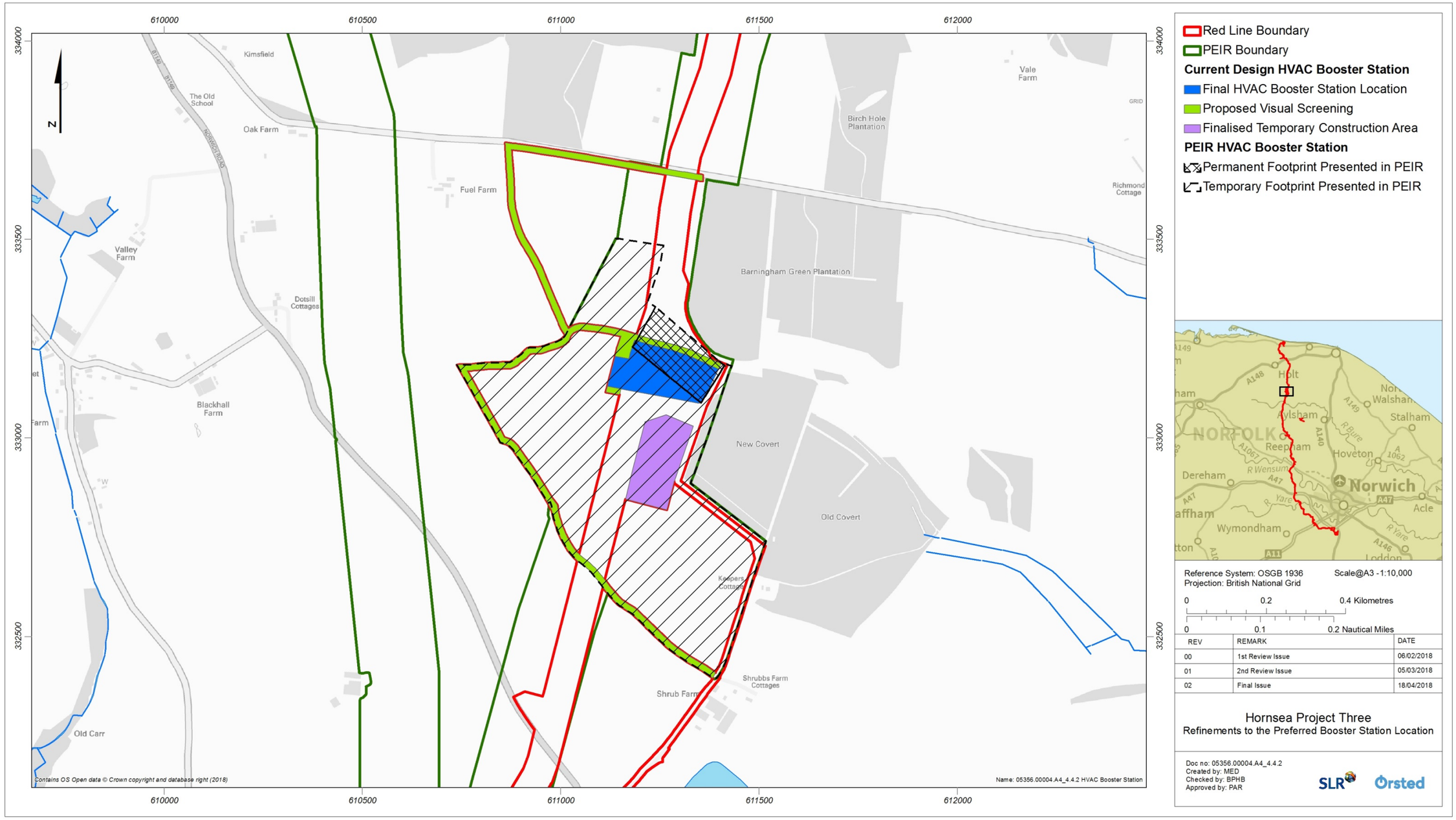

Figure 4.24: Refinements to the preferred onshore HVAC booster station location.

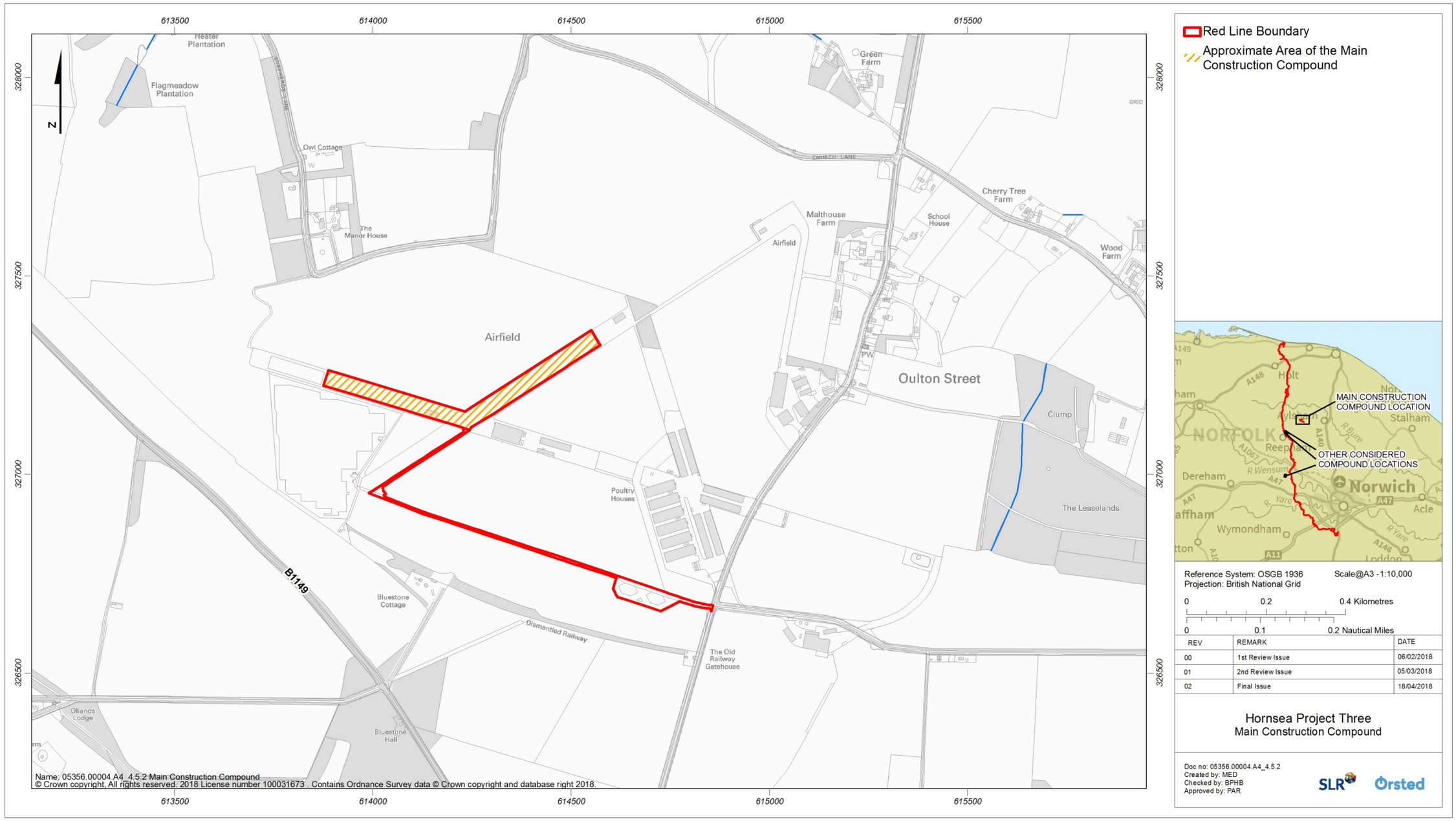

Figure 4.25: Main construction compound.

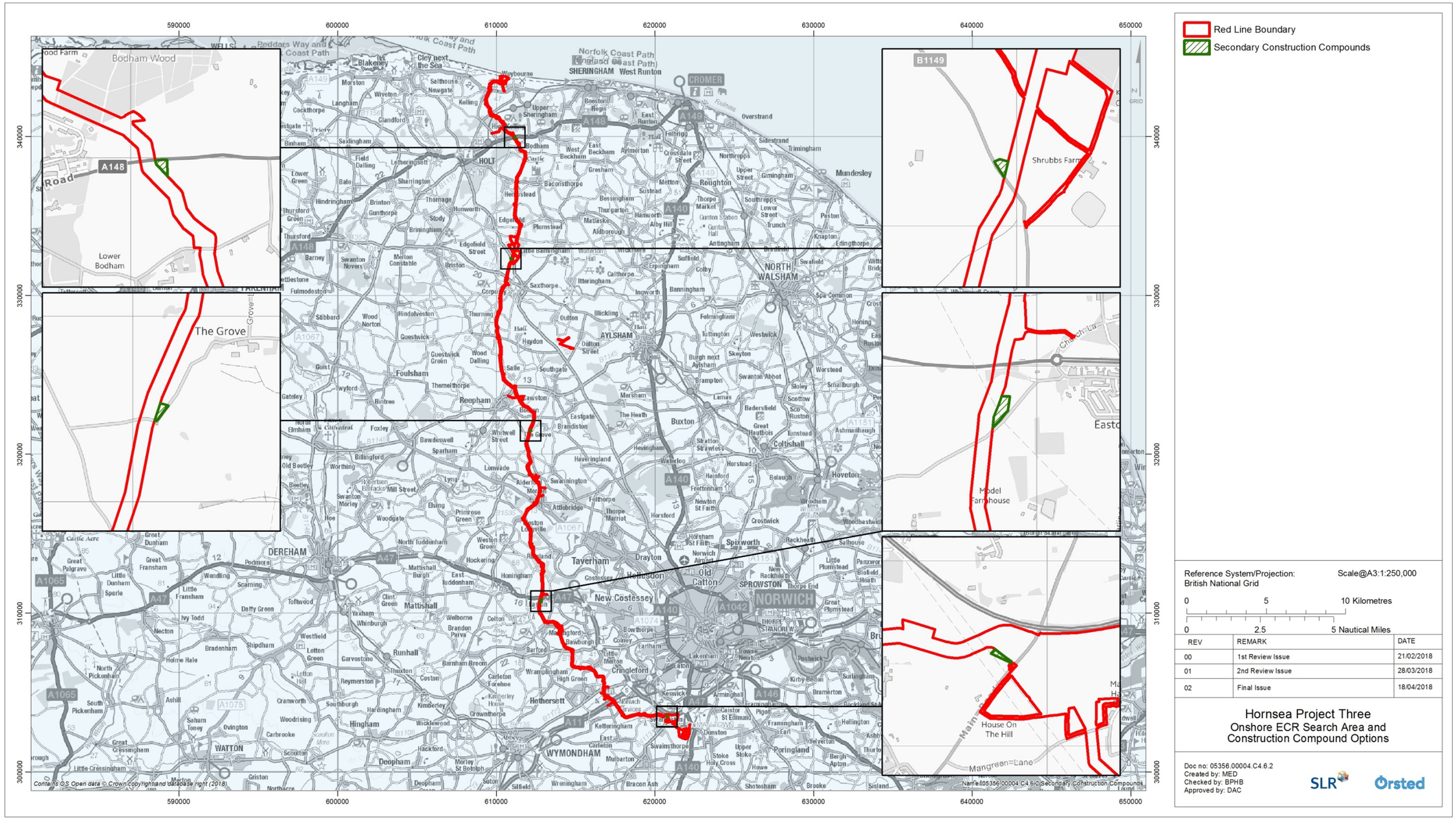

Figure 4.26: Secondary construction compounds.

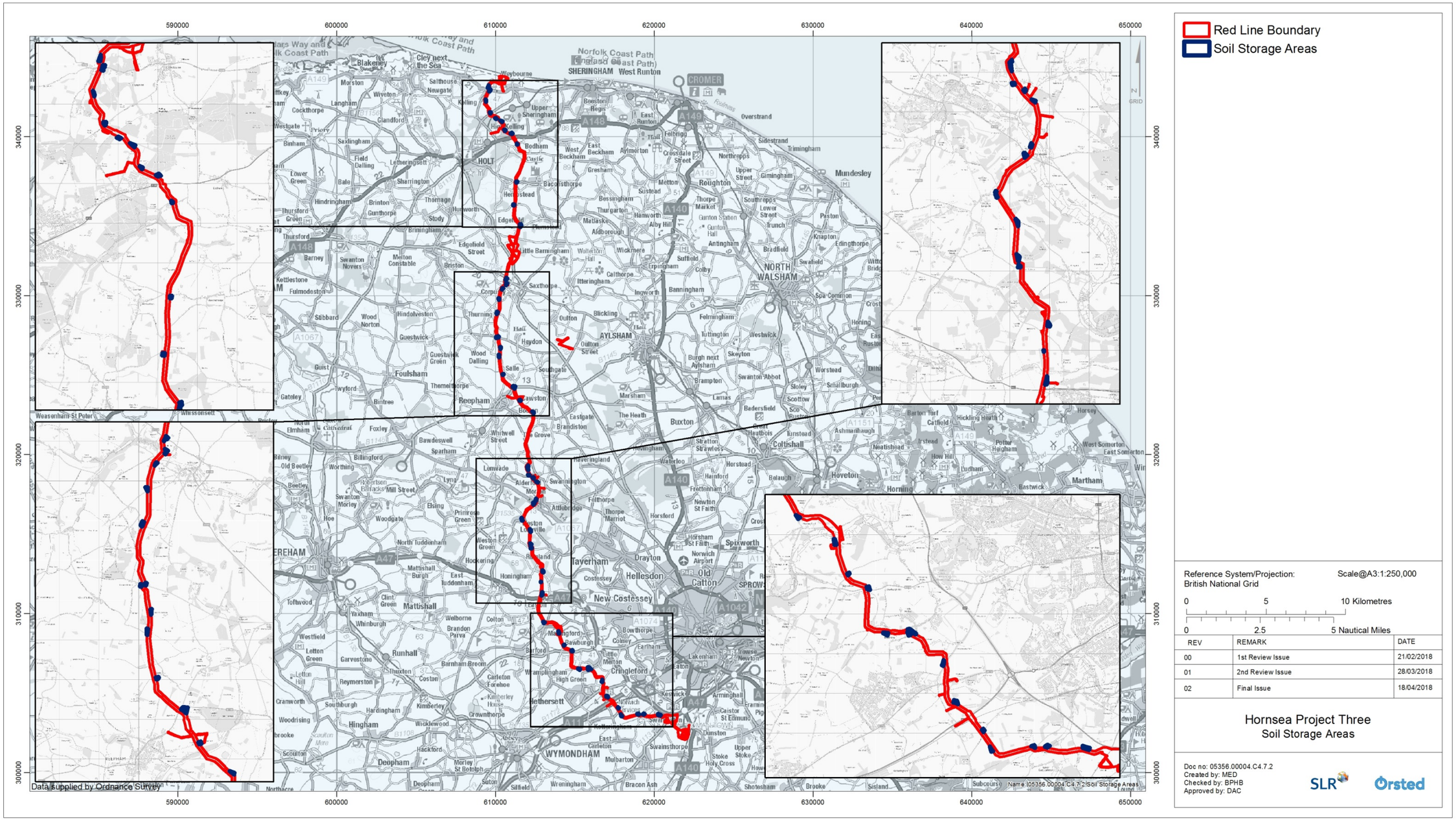

Figure 4.27: Temporary storage areas.

4.13 Stage 9 – The application boundary

4.13.1.1 Prior to finalisation of the application (red line) boundary a variety of amendments were made to the project following feedback from Phase 2 Consultation.

4.13.2 Offshore Cable Corridor and Offshore HVAC Booster Station Search Area

4.13.2.1 Both the near shore and seaward potential alternative routes have been taken forward with the seaward option reducing the direct impact of cable laying on the NNSSR SAC and the near shore doing similar with regards to the Cromer Shoal Chalk Beds MCZ. Both amendments were driven through the feedback from stakeholders received throughout the pre-application consultation process.

4.13.3 Landfall Area

4.13.3.1 The preferred location of the cable landfall and temporary landfall compound was informed by a number of technical and environmental factors including the nearshore potential alternative route and constraints associated with the eastern onshore cable corridor. Of the three potential routes considered, two were assessed in the PEIR, routeing to the east and west of Weybourne, and a third presented in the Statutory Consultation (Phase 2.A) further to the west but was not assessed at that time. The eastern landfall area was discounted due to proximity to residential properties while the western area presented at PEIR was initially progressed. Following concerns raised by statutory consultees as well as members of the general public regarding the impact on Kelling Heath SSSI/County Wildlife Site (CWS), the chalk reef feature of the Cromer Shoal Chalk Beds MCZ and interaction with the heritage railway line the third alternative route was subsequently taken forward. This area avoids cliffs and geomorphological SSSIs, avoids the technically challenging engineering design that would be required to HDD to original western route under the railway and also avoids Kelling Heath SSSI.

4.13.4 Onshore Cable Corridor

4.13.4.1 The optimum route for an onshore grid connection can be considered to be the shortest route from A to B from landfall to the main NGET substation.

4.13.4.2 The final route presented within this Environmental Statement is considered to effectively achieve this optimisation, within the environmental, technical and social constraints that have been identified along the proposed cable route corridor.

4.13.4.3 Decisions made by the multi-disciplinary team in response to consultee comments and feedback, detailed technical, commercial and environmental studies, have directly informed the final route alignment and selection of the HDD locations.

4.13.4.4 Various alternative cable corridor options were considered in response to consultation feedback during Phase 2.B and Phase 2.C consultation. Some, such as a landowner request to avoid a campsite and marl pit site near Hempstead would reduce impact on a business during construction, whereas at other locations multiple options were considered for a variety of reasons. For example, near Little Melton a final cable corridor route was selected following consideration of previous options that impacted on ecological designations, heritage assets and a large proposed residential development (further details can be found in volume 4, annex 4.4: Post PEIR Changes). The final route included a HDD under a CWS woodland in order to minimise any potential ecological impacts.

4.13.4.5 The final route for the Hornsea Three application can be seen in detail within the plans that accompany the application for Development Consent. This route is considered to balance environmental and technical constraints whilst taking into account feedback from landowners and other stakeholders wherever feasible.

4.13.5 Onshore HVAC booster station

4.13.5.1 As explained in paragraph 4.12.5.2, the onshore HVAC booster station footprint and associated compound were substantially reduced in extent from the larger search areas identified at PEIR. In addition, the alignment of the onshore HVAC booster station was adjusted slightly to take further advantage of an existing belt of trees that lies immediately to the north, and to site the building onto the lowest lying, flat land, in order to reduce the overall visual effect. The relocation also allowed the avoidance of hedgerows and trees and restricted the number of agricultural fields that would be affected. A strategic landscaping corridor was also identified to allow for additional tree planting and visual screening, in addition to that provided by the existing woodland around the site. Throughout the site selection process, these and previous refinements were made in an effort to take account of landowner and other stakeholder concerns and environmental constraints whilst providing a viable technical solution for the project by maintaining a site for an onshore HVAC booster station.

4.13.6 Onshore HVDC converter/HVAC substation

4.13.6.1 Following detailed electrical substation design after Phase 2.A and in response to stakeholder feedback (section 4.7), the footprint of the substation increased slightly to provide increased landscaping and to rationalise the volume of ground works that would be required, with the footprint for the temporary construction compound reducing in size to minimise disturbance.

4.13.6.2 The final alignment of the compound is directly adjacent to the permanent footprint of the substation in order to be as far away from residential receptors as possible. A thin strip of land to the south of the onshore HVDC converter/HVAC substation has also been identified to enable the planting of a strategic landscape screening corridor.

4.13.7 Compounds

4.13.7.1 The current application provides for a hierarchy of construction compounds. In addition to the onshore HVDC converter/HVAC substation and onshore HVAC booster station compounds, the following temporary onshore compounds will also be required:

- Hornsea Three landfall construction compound;
- Main construction compound;
- Secondary compounds; and
- Storage areas.

4.13.7.2 An area within Oulton Airfield was selected as the main construction compound. While it is recognised that concerns remain regarding the use of this site specifically in terms of access; it is considered that these can be overcome through suitable traffic management measures and in dialogue with the local authority.

4.13.7.3 Secondary compound sites identified along the route are typically located in areas of agricultural use and often where land could not be used by the farmer during construction because the cable installation works would have temporarily restricted access to these locations. Wherever possible they have been sited to avoid environmental constraints, are located away from sensitive receptors and closer to the more complex works such as HDD sites, onshore cable corridor pinch points or restricted working areas.

4.13.8 Access

4.13.8.1 Following PEIR submission an access strategy was developed and accesses which fell outside the previous consultation boundary were consulted on during Phase 2.B consultation. Following this consultation the access routes were subject to further detailed adjustments with the aim being to keep to existing access routes and roads wherever viable.

4.14 Conclusion

4.14.1.1 The site selection process undertaken for Hornsea Three has culminated in the application for Development Consent for the areas and works assessed throughout this Environmental Statement. Wherever possible, Hornsea Three has sought to accommodate concerns raised by stakeholders through the site selection process whether by adjustments to the areas or designs being considered. As detailed in volume 1, chapter 5: EIA Methodology, the project has employed a maximum design scenario approach. Therefore, it is recognised that whilst the site selection process undertaken to date has included refinements to the project envelope so far as practical, there remain some areas of uncertainty around the final project design.

4.14.1.2 Whilst the exact nature of the final design of project components is unknown, the application for Development Consent does constrain this to ensure that it is compliant with the project as assessed. For example, whilst the detailed design of the onshore HVDC converter/HVAC substation has not yet been conducted, various documents within the application constrain how this could be built out in future as detailed below:

- Volume 1, chapter 3: Project Description provides the maximum design scenario for the HVDC converter/HVAC substation
- The Works Plan – Onshore (application document reference A2.42) details the total area within which works associated with the onshore HVDC converter/HVAC substation must table place
- The Onshore Limits of Deviation Plan (application document reference A2.13.1) details which works can be conducted in which areas of the area shown in the Works Plan
- The Development Consent Order (application document reference A3.1) places requirements on the detailed design of the eventual onshore HVDC converter/HVAC substation including specifying which body is responsible for confirming that Hornsea Three complies with these requirements.

4.14.1.3 Similar constraints are placed on all components of Hornsea Three and, in this way, the outcomes of the site selection process described in this chapter are evident throughout the application for Development Consent.

4.15 References

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