



FIVE
ESTUARIES
OFFSHORE WIND FARM

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OFFSHORE WIND FARM
PRELIMINARY ENVIRONMENTAL
INFORMATION REPORT

VOLUME 1, CHAPTER 4: SITE SELECTION
AND ALTERNATIVES

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DEFINITION OF ACRONYMS

Term	Definition
AfL	Agreement for Lease
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
AoS	Area of Search
CCC	Climate Change Committee
CfD	Contract for Difference
CION	Connection and Infrastructure Options Note
CRP	Cable Route Protocol
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
EACN	East Anglia Connection Node
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
HDD	Horizontal Directional Drill
HRA	Habitats Regulations Assessment
IMO	International Maritime Organization
MCZ	Marine Conservation Zone
MDS	Maximum Design Scenario
NGC	National Grid Company
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
O&M	Operations and Maintenance
OnSS	Onshore Substation
OTNR	Offshore Transmission Network Review
PEIR	Preliminary Environmental Information Report
PINS	The Planning Inspectorate
SAC	Special Area of Conservation
SPA	Special Protection Area



Term	Definition
SSSI	Site of Special Scientific Interest
TCC	Temporary Construction Compound
TCE	The Crown Estate
TSS	Traffic Separation Scheme
VE	Five Estuaries Offshore Wind Farm
WTG	Wind Turbine Generator
ZTV	Zone of Theoretical Visibility



DEFINITION OF TERMS

Defined Term	Definition
Agreement for Lease boundary	Offshore wind farm boundary agreed by The Crown Estate via of the leasing process
Array boundary	Extent of the area where offshore wind turbines would be located
Export Cable Corridor	Connection from the offshore substation platforms to the onshore substation (OnSS).
Grid Connection Point	Where the projects connects in to the national electricity network
Landfall Zone	Area considered for offshore cables coming ashore to be joined to the onshore cables
Offshore export cable route	Route corridor where offshore export cables will be installed
Offshore Export Cable Route Area of Search (AoS)	Area defined using constraints where offshore export cable route options could be developed
Onshore Export Cable Corridor Route Segment Options	Different options of possible onshore cable route considered through site selection process within the Onshore Infrastructure Area of Search
Onshore Infrastructure Area of Search (AoS)	Area defined using constraints where the onshore infrastructure would be located, this was used for the onshore Scoping Boundary
PEIR Red Line Boundary	Boundary used in PEIR for assessments, within which project infrastructure would be located
Scoping Boundary	Project boundary used for the request for a Scoping Opinion
Substation Search Areas	Large land parcels identified through the site selection exercise where the OnSS and associated TCC would be located



4 SITE SELECTION AND ALTERNATIVES

4.1 INTRODUCTION

- 4.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) provides a description of the site selection process and the approach undertaken by Five Estuaries Offshore Wind Farm Limited (VE OWFL) to refine the design of the proposed Five Estuaries Offshore Wind Farm project (VE). This chapter also provides information on the need for new renewable energy generation, followed by detail regarding the alternatives considered for both the onshore and offshore elements of VE.
- 4.1.2 This chapter outlines the staged approach to defining the spatial boundaries and constituent parts of VE. It also explains and details the main alternatives considered for the project, including location and infrastructure options, in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (the EIA Regulations); the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended); the Conservation of Habitats and Species Regulations 2010 (as amended) (the 'Habitats Regulations'); and the Offshore Marine Conservation (Natural Habitats, & c.) Regulations 2007 (as amended) (the 'Offshore Habitats Regulations').
- 4.1.3 Whilst there is no legal requirement to consider alternatives, where they have been considered, the Environmental Impact Assessment (EIA) should set out the alternatives considered for a proposed development and explain the main reasons for the choice between alternative options (including for example, relevant environmental, social, and economic factors). The Overarching National Policy Statement for Energy (NPS EN-1) highlights the approach to consideration of alternatives under the applicable EIA Regulations and Habitats Regulations Assessment (HRA). More detail on the legislative obligations and the information to be provided is set out in Volume 1 Chapter 2: Policy and Legislation, and throughout this chapter where relevant to site selection and alternatives.

EARLY PROJECT CONSIDERATIONS

- 4.1.4 VE identified a number of early strategic considerations, which fed into the site selection process:
- > VE ruled out being able to use the existing Galloper OWF export cables and substation. The infrastructure for Galloper OWF was installed and rated to the capacity specifically for that project, the existing cables and substation do not have capacity to transmit the required electricity from VE to the National Grid;
 - > VE committed to burying all onshore cables as opposed to using overhead lines to connect the landfall to the project substation and between the project substation and the National Grid substation. This commitment has been made to reduce long term landscape effects associated with overhead lines; and
 - > VE committed to considering trenchless technologies, such as Horizontal Directional Drilling (HDD) at the landfall, in order to bring cables from the marine environment onshore, to avoid compromising existing sea defences, help protect sensitive receptors and minimise the extent of direct interaction with coastal features. This would be subject to ground investigations and associated feasibility studies.



COORDINATED EFFORTS WITH NORTH FALLS OFFSHORE WIND FARM

4.1.5 An important consideration for the site selection and design work for VE has been the proximity of the proposed North Falls Offshore Wind Farm. Although North Falls and VE are two separate projects being developed by different shareholder groupings, co-ordination with North Falls has been (and will continue to be) explored across a range of aspects, including stakeholder engagement, surveys, and siting of onshore infrastructure. The primary goal of this coordination is to reduce the potential impact of building the onshore connection to the national electricity transmission network for the two projects. This has meant that VE has sought to identify suitable options for the project's onshore infrastructure that can accommodate either the VE project alone or co-location with North Falls. The VE onshore site selection process for the Export Cable Corridor (ECC) and the Onshore Substation (OnSS) has sought to identify options that could accommodate two projects. Coordinated activities and/or shared information to date have included:

- > Onshore export cable corridor definition;
- > Approach to identifying works accesses and construction compounds;
- > Ecology, archaeology and noise surveys and associated data onshore;
- > Land parcel identification for substation has considered opportunities for coordinated siting;
- > Landowner engagement
- > Navigational risk assessment workshop outputs from VE have been shared with North Falls; and
- > Approach to cumulative seascape, landscape and visual impact assessment

4.1.6 Coordination and engagement with North Falls has been achieved through regular team meetings and discussions.

OFFSHORE TRANSMISSION NETWORK REVIEW

4.1.7 VE OWFL is currently engaged in the government-led Offshore Transmission Network Review (OTNR), which is looking into ways that the offshore network is designed and delivered, consistent with the ambition to deliver net zero emissions by 2050. Both the Government's recent Energy Security Strategy and Net Zero goals show the importance of bringing 50GW of new offshore renewable generation online by 2030.

4.1.8 This PEIR is based on the principle of an onshore connection for VE on its own, whilst taking into account the potential cumulative impact of other projects and co-ordination with North Falls. Scenarios being explored as part of the government-led OTNR process sit outside of this PEIR. Further information on the OTNR process can be found in the Five Estuaries Consultation Booklet, available on the Five Estuaries website or at: [Five Estuaries Offshore Wind Farm - Consultation Booklet](#)



SITE SELECTION AND ALTERNATIVES APPROACH

- 4.1.9 Alternative options for methods of construction, Operations and Maintenance (O&M) and decommissioning have been considered alongside different technologies and materials within each individual PEIR chapter in order to assess and compare, so far as possible at this stage in the project, the potential environmental effects.
- 4.1.10 This chapter is set out to describe the stages of the design iteration from inception through to the current point of PEIR submission. Accordingly, the following structure is adopted:
- > Stage 1 – identification of the array area;
 - > Stage 2 – identification of proposed grid connection location;
 - > Stage 3 – identification of the landfall zones;
 - > Stage 4 – identification of offshore cable route;
 - > Stage 5 – identification of the onshore infrastructure area of search;
 - > Stage 6 – offshore refinement of project from Scoping to PEIR; statutory consultation); and
 - > Stage 7 – onshore refinement of project from Scoping to PEIR; statutory consultation.
- 4.1.11 Development of the project has continued since the production of the Scoping Report in September 2021, and this process will continue through and beyond the PEIR stage, being informed by engagement with Stakeholders, ongoing engineering design and feasibility work, consideration of additional survey data and assessment outcomes, and following receipt of consultation responses on this PEIR. A Consultation Report, to accompany the final DCO application, will provide a record of how VE has had regard to the responses received to the consultation.
- 4.1.12 An overview of the process of site selection, and the associated consultation that has informed the project design is illustrated in Figure 4.1 below.
- 4.1.13 It is important to note that whilst the site selection process is illustrated and described as a linear approach in this chapter for ease of presentation, the reality of any project development is that site selection is a complex, iterative process with decisions made having considered multiple factors. Decisions on site selection are required at various stages to enable the project to progress and are based on the best information available at the time.

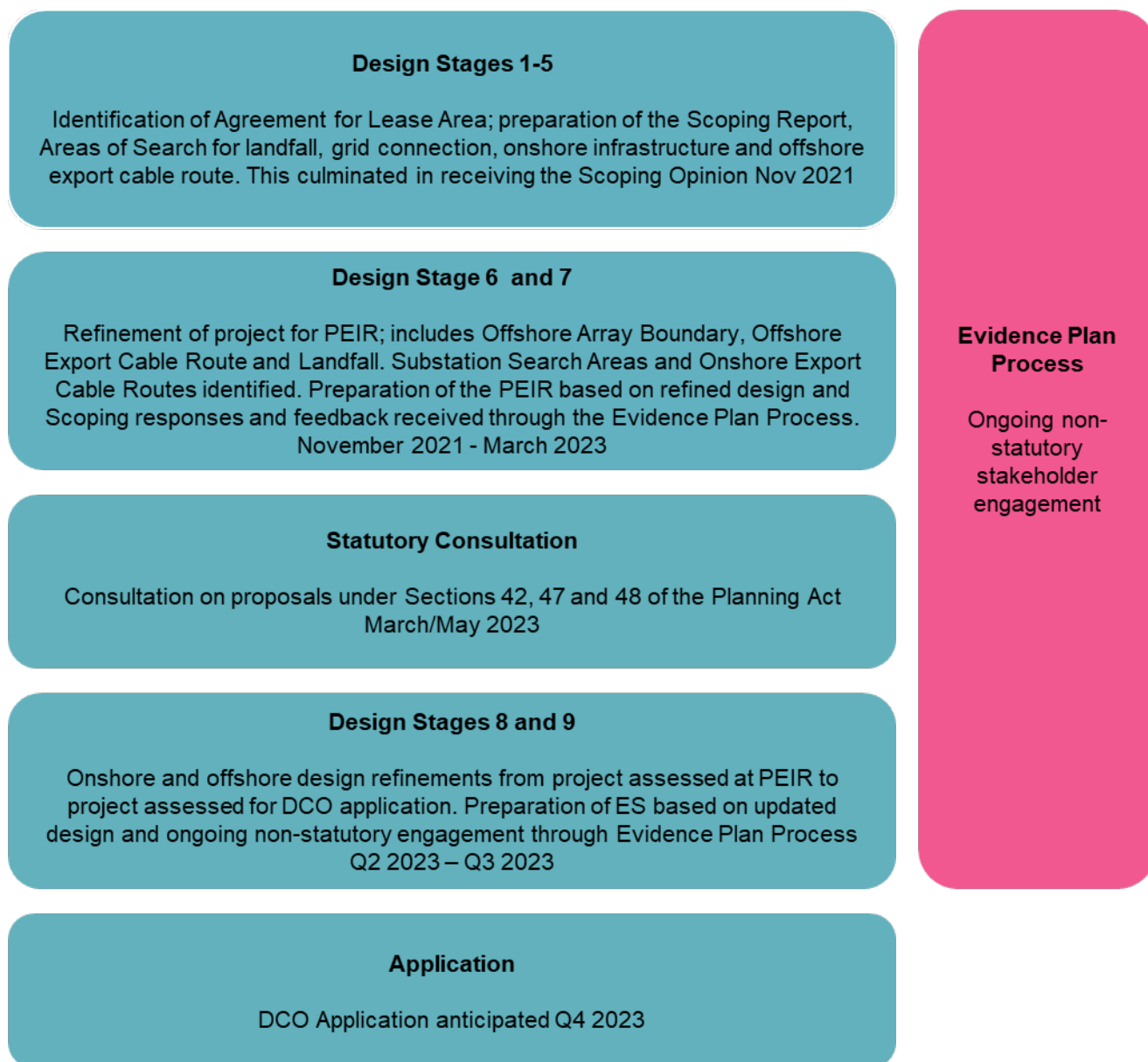


Figure 4.1: Design stage overview

4.2 STATUTORY AND POLICY CONTEXT

- 4.2.1 A full description of applicable policy and legislation is provided in Volume 1, Chapter 2: Policy and Legislation. An overview of policy and legislation specific to site selection and alternatives is provided below.

EIA REGULATIONS

- 4.2.2 Schedule 4 of the EIA Regulations requires that Environmental Statements include *"a description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) 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."*



- 4.2.3 It is worth noting that there is no requirement to assess all potential options, only to provide a review of those that have been considered.
- 4.2.4 Furthermore, under the Habitats Regulations and Offshore Habitats Regulations, a consideration of alternatives to the proposed project may be required where the development is likely to have a significant effect on a European Site that may adversely affect its integrity.
- 4.2.5 This chapter of the PEIR therefore provides a description of the reasonable spatial and geographical alternatives that have been considered in the current VE project and, where appropriate, presents a comparison of the environmental effects between different options. In some cases (for example, the array layout) alternative options form part of the proposal at this stage and assessment of the range of development detail proposed within the design envelope has been considered in detail in the relevant chapters of this PEIR.

UK PLANNING LAW

- 4.2.6 The Planning Act 2008 (as amended), and related secondary legislation, establishes the legislative requirements in relation to applications for orders granting development consent for Nationally Significant Infrastructure Projects (NSIPs) (for further detail refer to Volume 1, Chapter 2 Policy and Legislation).

NATIONAL POLICY STATEMENTS

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

"applicants are obliged to include in their Environmental Statement, as a matter of fact, information about the main alternatives they have studied. This should include an indication of the main reasons for the applicant's choice, taking into account the environmental, social and economic effects and including, where relevant, technical and commercial feasibility"; and

"in some circumstances, there are specific legislative requirements, notably under the Habitats Directive, for the [Secretary of State] to consider alternatives. These should also be identified in the Environmental Statement by the applicant."

- 4.2.9 Requirements under the Habitats Regulations and the Offshore Habitats Regulations will be addressed in the draft Report to Inform Appropriate Assessment. Where there is a policy or legal requirement to consider alternatives, paragraph 4.4.3 of NPS EN-1 highlights other guiding principles that the Secretary of State should consider when deciding what weight should be given to alternatives, specifically:
- > *"the consideration of alternatives in order to comply with policy requirements should be carried out in a proportionate manner;*
 - > *the [Secretary of State] should be guided in considering alternative proposals by whether there is a realistic prospect of the alternative delivering the same infrastructure capacity (including energy security and climate change benefits) in the same timescale as the proposed development;*



- > *where (as in the case of renewables) legislation imposes a specific quantitative target for particular technologies or (as in the case of nuclear) there is reason to suppose that the number of sites suitable for deployment of a technology on the scale and within the period of time envisaged by the relevant NPSs is constrained, the [Secretary of State] should not reject an application for development on one site simply because fewer adverse impacts would result from developing similar infrastructure on another suitable site, and [he] should have regard as appropriate to the possibility that all suitable sites for energy infrastructure of the type proposed may be needed for future proposals;*
- > *alternatives not among the main alternatives (noting that as required under the 2017 EIA Regulations reasonable alternatives are described within this chapter, studied by the applicant (as reflected in the Environmental Statement) should only be considered to the extent that the [Secretary of State] thinks they are both important and relevant to [his] decision;*
- > *as the [Secretary of State] must decide an application in accordance with the relevant NPS (subject to the exceptions set out in the Planning Act 2008), if the [Secretary of State] concludes that a decision to grant consent to a hypothetical alternative proposal would not be in accordance with the policies set out in the relevant NPS, the existence of that alternative is unlikely to be important and relevant to the [Secretary of State's] decision;*
- > *alternative proposals which mean the necessary development could not proceed, for example because the alternative proposals are not commercially viable or alternative proposals for sites would not be physically suitable, can be excluded on the grounds that they are not important and relevant to the [Secretary of State's] decision;*
- > *alternative proposals which are vague or inchoate can be excluded on the grounds that they are not important and relevant to the [Secretary of State's] decision; and*
- > *it is intended that potential alternatives to a proposed development should, wherever possible, be identified before an application is made to the [Secretary of State] in respect of it (so as to allow appropriate consultation and the development of a suitable evidence base in relation to any alternatives which are particularly relevant). Therefore, where an alternative is first put forward by a third party after an application has been made, the [Secretary of State] may place the onus on the person proposing the alternative to provide the evidence for its suitability as such and the [Secretary of State] should not necessarily expect the applicant to have assessed it."*

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

"any alternative landfall sites that have been considered by the applicant during the design phase and an explanation for the final choice"; and

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



DRAFT NATIONAL POLICY STATEMENTS

- 4.2.11 It is noted that all NPS are subject to ongoing revision, with a draft suite of NPSs produced for consultation in 2021. At the time of writing the NPSs have not been amended, however, the revised drafts include key elements of relevance to the site selection for VE. Notably the draft EN-3 NPS, in the consideration of offshore wind extension projects notes at paragraph 2.23.10 that:

“The Crown Estate may offer new leases in areas adjacent to existing consented wind farms. This could be to either the owner/operator of the existing site or to a different company from that operating the existing wind farm. These leases will form extensions to existing wind farms.”

- 4.2.12 The implications of the lease areas forming extensions to existing wind farms is taken further in acknowledging, at paragraph 2.23.12, that:

“The Secretary of State should be aware of the potential for applications for extensions to existing wind farms and that there may be constraints on such leases over which the applicant will have little or no control.”

- 4.2.13 Draft National Policy Statement for electricity networks infrastructure (EN-5) states the following, at paragraph 2.5.5:

“Radial offshore transmission options to single windfarms should only be proposed where these can be demonstrated to be the only feasible solution and a co-ordinated solution is not possible. In these instances, the Secretary of State should have regard to the need case set out in Section 3.3 of EN-1.”

- 4.2.14 At the time of writing, no confirmed viable alternative to a radial connection exists. This PEIR has been prepared in the light of the September 2021 draft NPS EN-5. DESNZ has committed to consulting on a further draft of this NPS (together with EN-1 and EN-5), which is then expected to be designated prior to submission of the application. The application will address the wording in the designated NPS. – see Offshore Transmission Network Review under Section 4.1.

PLANNING INSPECTORATE ADVICE NOTES

- 4.2.15 The Planning Inspectorate (PINS) Advice Note Seven (PINS, 2020) suggests that the EIA needs to explain:

“the reasonable alternatives considered and the reasons for the chosen option taking into account the effects of the Proposed Development on the environment”.

MARINE POLICY STATEMENT

- 4.2.16 The Marine Policy Statement (MPS) adopted by all UK administrations in March 2011 provides the policy framework for the preparation of marine plans, establishing how decisions affecting the marine area should be made in order to enable sustainable development.

MARINE PLANS

- 4.2.17 The East Inshore and Offshore Marine Spatial Plan (Defra, 2014) covers some of the offshore cable corridor areas. The Spatial Plan sets out a number of policies (such as WIND1) protecting areas where lease agreements are granted, as well as a number of policies protecting existing infrastructure, activities, and biodiversity.



4.2.18 The South East Inshore and Offshore Marine Spatial Plan (Defra, 2021) covers all of the inshore and nearshore cable corridor areas and some of the offshore. The Spatial Plan sets out a number of policies (such as SE-WIND-1) supporting offshore wind development, as well as a number of policies protecting existing infrastructure, activities, and biodiversity.

OTHER RELEVANT GUIDANCE

4.2.19 Offshore routeing options have regard to the following guidance:

- > The Crown Estate (2012) Guidance on the Principles of Cable Routeing and Spacing;
- > The Crown Estate (2019) Plan-level Habitats Regulations Assessment for the 2017 Offshore Wind Farm Extensions; and
- > The Crown Estate (2017) Cable Route Protocol.

4.2.20 For substation site selection, reference has been made to National Grid's Guidelines on Substation Siting and Design ('The Horlock Rules'). These guidelines document National Grid's best practice for the consideration of relevant constraints associated with the siting of electricity network infrastructure.

4.2.21 In addition, National Grid employs the 'Holford Rules (undated)' as guidelines on overhead line routing. Whilst environmental assessment for overhead lines addresses wider topics than the visual amenity issue on which the Rules concentrate, they remain a valuable tool in selecting and assessing potential route options as part of the environmental assessment process. They also provide the context which supports the project decision to select buried rather than overhead cables for connection to the National Grid substation connection point.

CROWN ESTATE EXTENSION ROUND

4.2.22 In 2017, The Crown Estate (TCE) defined application criteria for the leasing of sites for offshore wind project extensions. Whilst not specifically 'site selection policy' the criteria form critical components in the site selection process of the VE project; this is also reflected in the draft NPS EN-3. In addition to criteria relating to the applicants which are not directly relevant here, the criteria applied by The Crown Estate necessarily constrain elements of the project site selection process. The process, and how the VE project has sought to fulfil it, is presented in section 4.6.

4.2.23 The 2017 Extension Round criteria, which were also used to inform a strategic plan level HRA, therefore limit the spatial opportunity to extend the existing wind farm. The opportunity to extend the wind farm and realise the recognised wind energy potential at the site, exists only to the east of the operating Galloper Offshore Wind Farm in the area leased by TCE due to the requirement for the boundaries to be aligned and the existing site constraints.

CLIMATE EMERGENCY

4.2.24 In 2019, the UK Parliament declared a national Climate Emergency, setting a net zero carbon emission target, and highlighting the need for decarbonisation of the UK economy. In April 2022, the UK Government announced further commitments to progress towards net zero emissions by 2050. These commitments included:

- > Boosting the target for offshore wind of up to 50 GW by 2030;
- > Creation of a target of up to 5 GW by 2030 from floating offshore windfarms;



- > Increasing the capacity of renewable energy in the next round of CfDs; and
- > Implementing a range of measures to reduce the consenting and development time of offshore wind projects.

4.2.25 There is, therefore, a clear policy driver to develop competitive, offshore renewable energy to bring about decarbonisation of the UK economy and in order to meet the ambitious 2030 targets, as set out in the following sections below.

4.3 NEED FOR RENEWABLE ENERGY

CLIMATE CHANGE

- 4.3.1 The UK's recognition of a Climate Emergency illustrates the scale of the problem posed by man-made climate change. Specific hazards include:
- > Increased frequency of extreme weather events such as floods and drought;
 - > Reduced food supplies;
 - > Impacts on human health;
 - > Increased poverty; and
 - > Ecosystem impacts, including species extinction.

ENERGY SECURITY

- 4.3.2 The UK has been a net importer of electricity since 2010, importing a total 21.2 TWh in 2019¹, representing 6% of total electricity. Whilst energy imports fell by 2.4% in 2019 the UK remains a net importer of energy at 35% of gross energy. Key issues associated with energy security in the UK are:
- > Reduced fossil fuel availability due to international sanctions;
 - > Decline in overall fossil fuel reserves (in particular North Sea oil and gas);
 - > Required ongoing closure and decommissioning of existing ageing fossil fuel and nuclear electricity generating infrastructure; and
 - > The need for replacement sources.

COST OF LIVING

- 4.3.3 Several compounding factors have contributed to a global cost of living crisis. Recent contributing factors have included:
- > Geopolitical instability and international sanctions;
 - > Global supply chain issues;
 - > Global debt crises;
 - > Global inflation; and
 - > Global pandemics.
- 4.3.4 Recent Ofgem price rises have been in reaction to record increases in global gas prices.

¹ DUKES_2020_Press_Notice_.pdf (publishing.service.gov.uk)



THE ROLE OF OFFSHORE WIND

- 4.3.5 The UK is well-placed to lead the deployment of offshore wind with over a third of the total European potential offshore wind resource (Energy Technologies Institute, 2013) making it one of the most globally attractive locations.
- 4.3.6 In the UK Government's Ten Point Plan for a Green Industrial Revolution, it is recognised that action is necessary to avoid catastrophic climate change. The government target is to reduce 180 million tonnes of carbon dioxide equivalent between 2023 and 2032, with the overall national priority target of net zero by 2050². The first of the ten points specifically focusses on the contribution of offshore wind, through advancing offshore wind development and increasing production, with the predicted impact of the proposed offshore wind target contributing £20 billion of private investment, and £6 billion in consumer savings.
- 4.3.7 The UK CCC, in its advice on the Sixth Carbon Budget (CCC, 2020), identifies that the amount of renewable electricity generated in the UK must double by 2037 if we are to meet our legally-binding climate change targets. The role of offshore wind in delivering this additional capacity of low carbon energy is highlighted by the committee reports recognising the sector is now maturing and showing very significant cost reductions.
- 4.3.8 In response to increasing global energy prices, the UK government released the British Energy Security Strategy³ in April 2022. The intention of this strategy is to accelerate energy production in the UK and provide greater energy independence. The British Energy Security Strategy has set a target of up to 50 GW of offshore wind by 2030.
- 4.3.9 The cost of offshore wind has reduced from £150/MWh to £45/MWh over the period 2010-2020 and is now cheaper than gas generation (£50/MWh) and nuclear (35-year CfD of £105MW/h for Hinkley Point C). Offshore wind will continue to be one of the lowest-cost sources of new power generation in the 2020s and beyond. It is crucial in delivering affordable energy.
- 4.3.10 The UK Government has targeted enough offshore wind generation by 2030 to power every home in the UK. VE would make a significant contribution to supplying the UK with secure, affordable and clean renewable power.

4.4 STAKEHOLDER ENGAGEMENT

- 4.4.1 Stakeholder consultation and engagement has played a fundamental role in shaping the project. Stakeholder engagement is an integral part of the site selection process from an early stage and ensures that the views and recommendations of stakeholders are incorporated into the development of a preferred option for the project.

² The Ten Point Plan for a Green Industrial Revolution (publishing.service.gov.uk) November 2020

³ British energy security strategy - GOV.UK (www.gov.uk)



- 4.4.2 Stakeholder engagement has taken place at regular intervals throughout the site selection process, through the circulation of site selection information, holding of evidence plan meetings, and consultation events. Whilst it has not always been feasible to undertake face-to-face consultation due to covid, online and in-person events have been undertaken alongside regular stakeholder liaison to ensure feedback is incorporated within the design process.
- 4.4.3 Stakeholder engagement primarily took place under the EIA Evidence Plan Process (EPP). The EPP is a non-statutory, voluntary process and agreements are non-binding, however it provides a useful stakeholder engagement approach on key elements and outcomes of the EIA process which allows continued dialogue in between the formal (statutory and non-statutory) consultation processes. The EPP does not replace or duplicate existing requirements and is formulated to fit with the Planning Act 2008 DCO application process, including the formal pre-application consultation processes.
- 4.4.4 The EPP aims to improve and formalise the consultation process for the consent application by the discussion, agreement and documentation of issues relating to the EIA Regulations and HRA during the pre-application stages of a proposed DCO application, by:
- > Enabling the establishment of areas of common ground;
 - > Giving greater certainty to all parties on the quality and use of existing data along with the range of new data and evidence that is required to support the site selection process and considerations of alternatives;
 - > Focusing the evidence requirements to be proportionate to the project's potential impacts; and
 - > Optimising time and resource requirements for all parties.
- 4.4.5 Site selection (and especially the Areas of Search (AoS) used to inform the Scoping Boundary) was discussed initially with stakeholders as part of the Pre-Scoping Expert Technical Group (ETG) meeting (the first ETG meeting held within the EPP). All datasets and feedback raised during that meeting and subsequent site selection ETGs were used to inform the site selection process.
- 4.4.6 The onshore site selection formed the primary focus of a post-Scoping ETG meeting, held in May 2022, which comprised:
- > Presentation and discussion of the AoS and the background information used to inform the decision-making process to this date; and
 - > Summary of the initial options considered.
- 4.4.7 The developments in the project layout and configurations have been communicated to different audiences in the period between scoping in October 2021 and this PEIR, through a range of means including:
- > Non statutory public consultation between 30 June and 12 August 2022, which included two drop-in exhibitions in Tendring (Frinton and Lawford; details of consultation and feedback received are available at [Stage 1 Consultation - Five Estuaries](#));
 - > Reports of community feedback shared with all registered participants, key local and community stakeholders, and on the project website;
 - > Direct discussions with landowners;



- > Newsletters distributed to publicise the consultation;
- > Provision of a dedicated project website; and
- > Regular and targeted discussion with regulators and other stakeholder bodies.

4.5 OTHER CONSIDERATIONS

4.5.1 In addition to the specific constraints discussed in other sections of this chapter, a number of fundamental principles have been applied to the site selection process. These are drawn from the experience of VE and technical expertise of consultants supporting the process and comprise:

- > Shortest route preference for cable routing to reduce impacts by minimising footprint for the offshore and onshore cable routes as well as considering cost (hence ultimately reducing the cost of energy to the consumer) and minimising transmission losses;
- > Avoidance of key sensitive features where possible and where not, seek to mitigate impacts;
- > Minimise the disruption to populated areas;
- > The need to accommodate the range of technology sought within the design envelope, such as air insulated or gas insulated switchgear for the onshore substation; and
- > Consideration of a coordinated approach with other projects where possible, to reduce cumulative environmental impacts and impacts on communities, as noted in draft NPS EN-1 and draft NPS EN-5.

4.5.2 The site selection process for the project is iterative, taking account of key locational decisions. This process began with the identification of the offshore wind farm array location and, with the identification by National Grid of the onshore connection point, which in turn informed the placement of the onshore infrastructure. The iterative process, of constraints mapping, assessment and continued consultation on the work undertaken was key in the identification of project design for the offshore cable corridor, landfall, onshore cable corridor and onshore substation which was then taken forward to the next stage of the EIA process.

4.5.3 The overall aim of the process is to understand the relevant constraints (environmental, engineering and economic) to ensure that the final design is robust and deliverable. Furthermore, the final design will aim to minimise impacts on the environment whilst ensuring that the lowest cost of energy be passed to consumers.

4.5.4 Prior to starting each stage of the site selection process, a series of transparent design principles and engineering assumptions were identified, which guided the decisions made at each stage. These design principles and engineering assumptions covered environmental, physical, technical, commercial and social considerations and opportunities, and are set out against each project component in the following sections. Each step of the process involved gathering data from a number of different sources to define and assess the options for each component of project infrastructure. Internal project workshops were then held at key stages of the site selection process to collate and review the data gathered to date, and to reach cross-discipline decisions about refining the site selection options before testing them through consultation.



4.5.5 Figure 4.2 provides a schematic of the main steps for the project's site selection process for each of the primary project components, including the phases that will follow this PEIR consultation. Additional information is considered at each stage in the process to further narrow down the options to those where the least consenting risk occurs (i.e., where fewer sensitive or valued receptors could be affected). At the Short List stage, the utilisation of a detailed black, red, amber, green (BRAG) assessment is used to quantitatively, where possible, indicate the potential impacts of each site and route option, and thus drive the selection (and subsequent design and mitigation refinements) of the preferred option. In addition we have undertaken the following:

- > Regular and/or ad hoc calls with key stakeholders (NE, shipping navigation stakeholders, etc);
- > Expert Topic Group (ETG) meetings; and
- > Public consultation to gain feedback on onshore options.

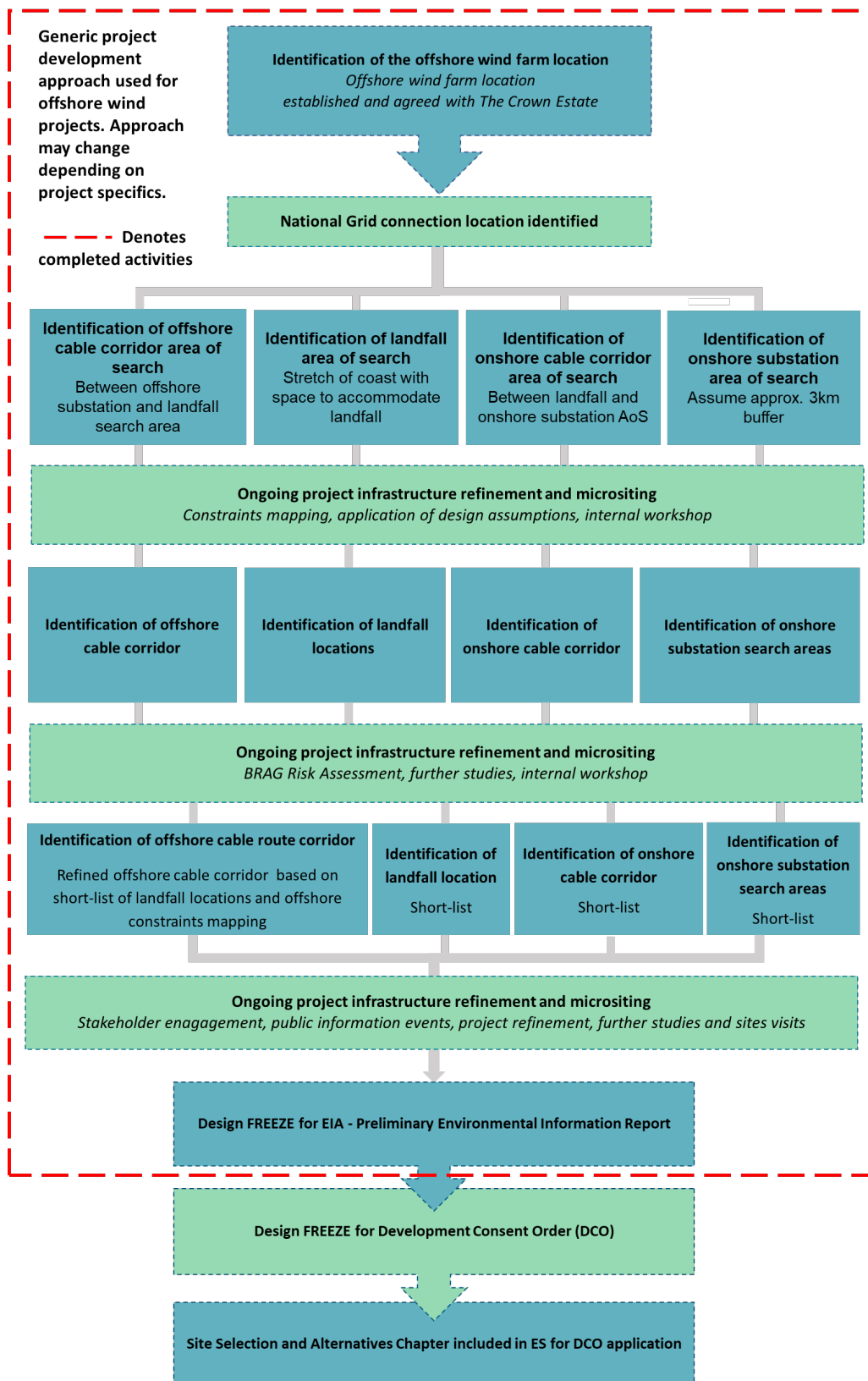


Figure 4.2: Project component site selection process



4.6 STAGE 1 – IDENTIFICATION OF THE ARRAY

4.6.1 As noted previously, the design process is often illustrated as a linear or multi-linear process for the purposes of presentation. It is however important to note that the VE project has undergone an iterative design and site selection process, in order to define a project that makes the greatest contribution to renewable energy targets whilst minimising environmental impacts and following principles of good design. The following section therefore describes the process of identifying the array boundary for the scoping phase and initial consultation. The subsequent process undertaken to refine the design for the purposes of this PEIR is described in the ‘Stages 6 and 7’ section of this chapter.

AREA FOR LEASE BOUNDARY

4.6.2 Further to the UK Government's confirmed policy 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. As previously referred to within this chapter there is policy need for maximising the opportunities within a region identified as a good site for wind resource.

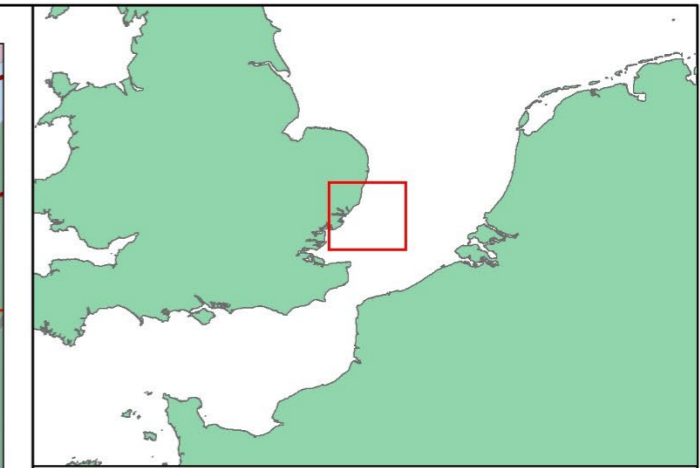
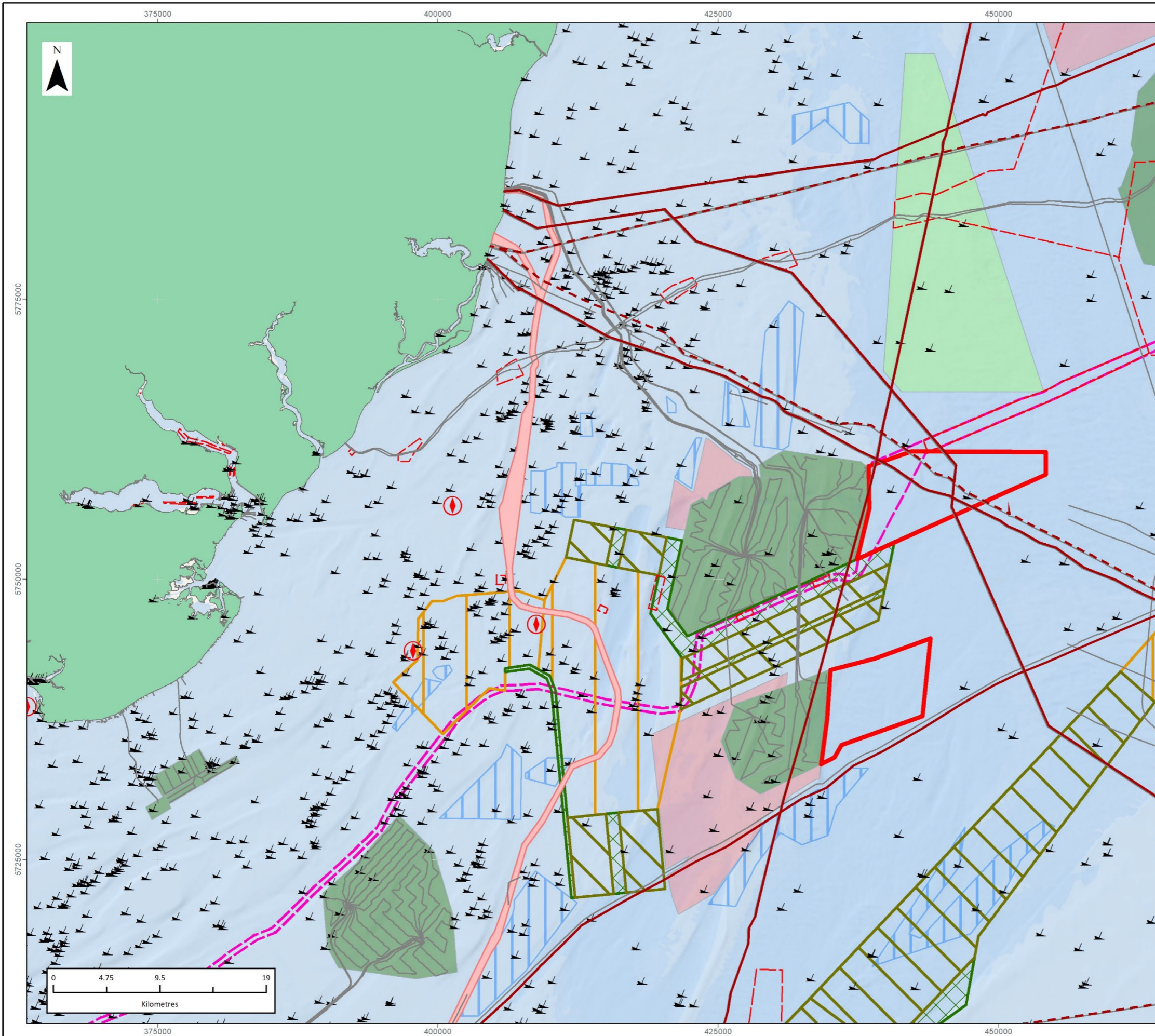
4.6.3 In response to the policy need for offshore wind, The Crown Estate launched an opportunity in 2017 for existing wind farms to apply for project extensions. The projects were required to meet specific criteria, including who may make applications, and the siting requirements.

4.6.4 The siting of a proposed extension to the Galloper Offshore Wind Farm project is necessarily spatially limited. It is not feasible to site an extension to the west, due to the presence of Greater Gabbard Offshore Wind Farm. In addition, a Traffic Separation Scheme (TSS) separates the Galloper Offshore Wind Farm's two arrays, providing a further spatial constraint. Therefore, the array areas for VE are located to the east of Galloper and maintain the distance and alignment of the TSS.

4.6.5 Prior to submitting an application to The Crown Estate an initial consideration of environmental parameters and constraints was undertaken and an area of search determined. The area of search formed preliminary offshore boundaries to delineate the location of offshore Wind Turbine Generators (WTGs). The initial boundary for VE was identified through an analysis of engineering, environmental, economic and consenting risks and subject to further feasibility analysis for key issues such as shipping routes, conservation areas and other offshore industry.



- 4.6.6 In addition to shipping routes and conservation areas, further key feasibility concerns for the array included an analysis of existing environmental 'hard constraints', based on spatial data and an understanding of the likely constraints, including:
- > Disposal sites;
 - > Aggregate extraction sites;
 - > Oil and gas infrastructure;
 - > Surface structures with helipads;
 - > International Maritime Organisation (IMO) shipping routes;
 - > Bathymetric contours (5 m intervals);
 - > Consented and/ or operational developments;
 - > Wrecks;
 - > Active pipelines; and
 - > Active cables.
- 4.6.7 A summary figure presenting the VE Array areas in the context of mapped constraints is presented below (Figure 4.3).



LEGEND

- Array Areas
- ✈ Wrecks
- Pilot boarding place
- Open Disposal Sites
- TCE Aggregate Extraction Zones
- Proposed Neuconnect Interconnector

Offshore Wind Farm - Status:

- Operational
- Under Construction
- Consented
- In Planning

Subsea Cable - 'Status'

- Power - Active
- Power - Disused
- Power - Proposed
- Telecom - Active
- Telecom - Disused
- Telecom - Proposed
- Sealink Interconnector
- Existing OWF Cables

Ship Routing Areas:

- Navigational Precautionary Areas
- Traffic Separation Scheme Lanes
- Traffic Separation Zones

Data Source:
 Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:
FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
Offshore AoS and Key Constraints

VER	DATE	REMARKS	Drawn	Checked
1	09/03/2023	For Issue	SWM	MB

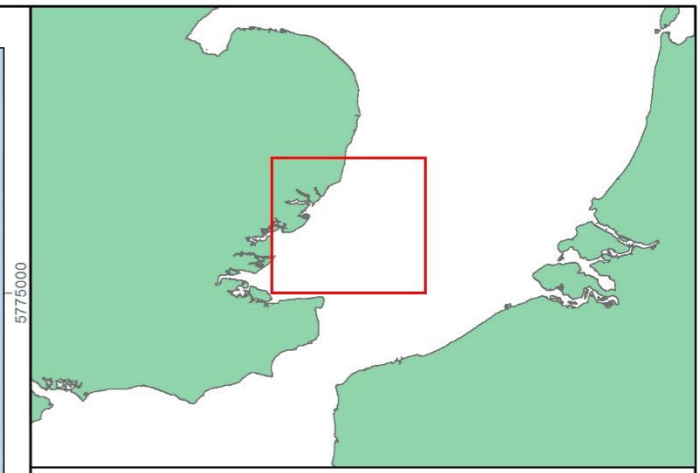
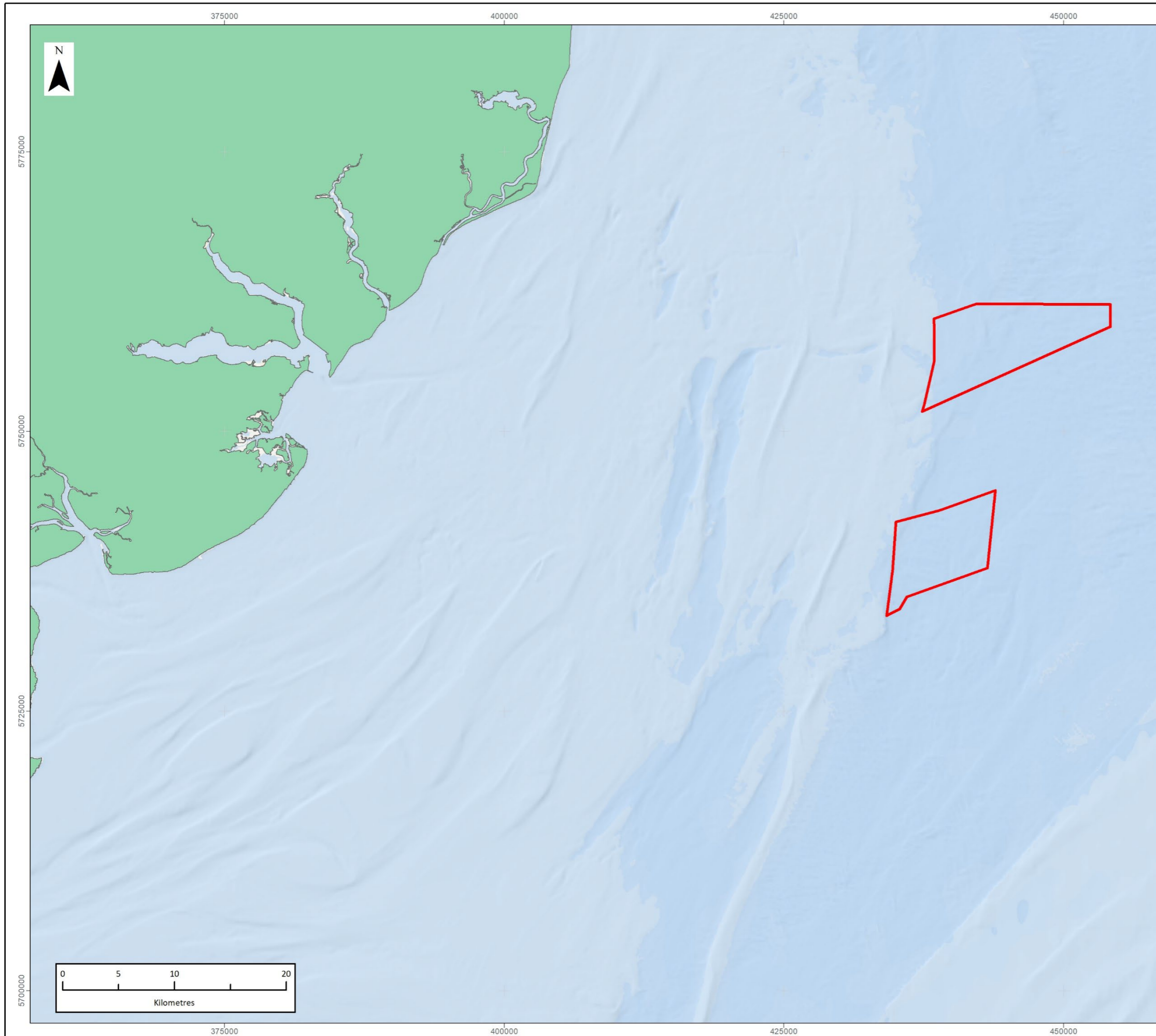
DRAWING NUMBER:
4.3

SCALE: 1:350,000 PLOT SIZE: A3 DATUM: WGS84 PROJECTION: UTM31N





- 4.6.8 Prior to confirming the award of the necessary rights to develop the extensions projects, The Crown Estate (TCE) undertook a plan-level Habitats Regulations Assessment (HRA) to assess the possible impact of the proposed windfarm extensions on relevant nature conservation sites of European importance. In August 2019, TCE formally announced the conclusion of the plan-level HRA and confirmed that an extension to Galloper could progress to an award of development rights. This array boundary forms part of the Scoping Boundary (Figure 4.4).



LEGEND

Scoping Array Areas

Data Source:
 Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:
FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
 Offshore Array Boundaries
 Taken through to Scoping

VER	DATE	REMARKS	Drawn	Checked
1	09/03/2023	For Issue	SWM	MB

DRAWING NUMBER:
 4.4

SCALE: 1:350,000 PLOT SIZE: A3 DATUM: WGS84 PROJECTION: UTM31N





4.7 STAGE 2 – IDENTIFICATION OF PROPOSED GRID CONNECTION POINT

- 4.7.1 Following establishment of the array boundary, the next step in the site selection process was the identification by National Grid of a preferred grid connection point for the project. A number of locations for the grid connection point were initially considered by the National Grid Electricity System Operator (NG ESO), and an original Connection Offer was made to the Galloper Extension (now known as Five Estuaries project) in December 2018 to connect to a planned Friston 400 kV substation in Suffolk. Initial work was undertaken by VE OWFL and early discussions with stakeholders and other regulators on this proposed location commenced in 2019.
- 4.7.2 This offer was made prior to the completion of the Connection and Infrastructure Options Note (CION), which is the framework used by National Grid to identify and agree the connection point to be offered. The CION process guidance note provided by National Grid provides more information on the process: [43631-Connection and Infrastructure Options Note \(CION\) Process Guidance Note - Issue 003.pdf \(nationalgrid.com\)](https://www.nationalgrid.com/uk/infrastructure/connections/cion-process-guidance-note-issue-003)
- 4.7.3 The CION process is defined as:
- ‘an optioneering process to identify the overall economic and efficient connection option. It provides a clear, transparent, repeatable and non-discriminatory process to ensure all relevant developers are treated in a consistent manner.’*
- 4.7.4 In practice, whilst the primary objective of the CION process undertaken by National Grid is to ensure that the most economic and efficient connection option is developed for the overall benefit of the UK consumer, the selection of a connection point also considers environmental impact, cost benefit analysis, deliverability, technology risk, planning risks amongst a suite of other criteria that may be brought into consideration depending on the project.
- 4.7.5 Subsequent to the original offer at Friston, and following a review by National Grid, and further work on the CION, a revised, post-CION Offer was presented to the Five Estuaries project, which was ultimately signed in November 2020, for a connection to an East Anglia Coastal 400 kV substation. At this point the location of the substation had not yet been determined but NG ESO indicated that it would be in the Tendring peninsula in Essex. This new substation is now known as National Grid Electricity Transmission (NGET) East Anglia Connection Node (EACN) substation. The new NGET EACN 400kV Substation facilitates the connection of the offshore generation to the main National Electricity Transmission System and will include High Voltage transformers, reactors and other typical high voltage plant and equipment. National Grid’s EACN 400kV Substation will be consented as part of their DCO for the East Anglia Green Energy Enablement (East Anglia GREEN) Project.
- 4.7.6 On receiving the revised Connection Offer, VE moved the site selection process for onshore infrastructure from Suffolk to the Tendring peninsula in Essex. This alternatives chapter proceeds on the basis of the project connecting to a National Grid substation on the Tendring peninsula in Essex. It is noted that the offer still states the “East Anglia Coastal substation”.



- 4.7.7 At this time the location of the EACN substation within the Tendring peninsula was not known and subject to ongoing National Grid site selection work. VE therefore identified an AoS within Tendring that encompassed potentially suitable locations for the four elements of transmission infrastructure (landfall, offshore cable corridor, onshore substation and onshore cable corridor). This approach was set out in the Scoping Report.
- 4.7.8 This allowed for early site identification work to commence whilst the project waited for a specific area from NGET for their new substation to be confirmed. A more refined search area was included in NGET's East Anglia GREEN non statutory consultation in Spring 2022. As the exact location of the new substation within this search area is not yet confirmed, the current substation search area, identified in Spring 2022 has been included within the VE PEIR Red Line Boundary.
- 4.7.9 The area included the existing Lawford and Little Clacton substations. The following sections describe the process adopted for selection of the location of each of the elements of the transmission infrastructure based on a substation within the Tendring peninsula.
- 4.7.10 Once NGET identified the refined search area for the EACN substation, VE then planned to identify onshore export cable corridors and a new substation location in the vicinity of the EACN taking into account onshore environmental constraints, this is set out in stage 8, section 4.12.

4.8 STAGE 3 – IDENTIFICATION OF LANDFALL ZONE

- 4.8.1 The following section describes the process of identifying the landfall zone option for the scoping phase and initial consultation.

AREA OF SEARCH

- 4.8.2 The key drivers for the identification of the landfall were the location of the grid connection offer area (as described in Section 4.7) and the location of the project AfL, as these locations dictate the relevant stretch of coastline along which a landfall can be feasibly sited to accommodate a connection point between the two.
- 4.8.3 Once the length of coastline was selected, constraints mapping and assessment was undertaken to identify potential Landfall Zones for further evaluation, avoiding, as far as possible, areas with significant ecological designations along the coast, the presence of coastal settlements and/ or other coastal development. As VE had already committed to the use of trenchless technologies such as HDD for crossing the land/ sea divide, areas at a distance inland of approximately 1 km from the coast were also included in the evaluation, the distance inland being dictated by the maximum feasible length of such techniques.

IDENTIFICATION OF LONG LIST LANDFALL ZONE OPTIONS

- 4.8.4 Coastal constraints that were preferentially avoided in the Landfall Zone site selection (unless there was the potential for trenchless techniques to avoid them by passing beneath to avoid direct disturbance or complete avoidance was not possible) included:

> Environmental constraints:



- > Avoidance of direct significant impacts on the following designations: Special Areas of Conservation (SAC), Special Protection Areas (SPA)⁴, Ramsar sites, Marine Conservation Zone (MCZ), Site of Special Scientific Interest (SSSI) and non-statutory (local nature reserves and national nature reserves) ecological sites and habitats (including Annex I reefs, sandbanks, woodlands) and to maximise the distance away from such designated sites where possible;
- > Avoidance of direct significant impacts to landscape (AONBs and Heritage Coasts) and cultural heritage designations (Scheduled Monuments Conservation Areas, Listed Buildings, Registered Parks and Gardens, chartered wrecks and Registered Battlefield) where possible;
- > Avoidance of historic landfill sites where possible;
- > Avoidance of residential areas which could result in disturbance impacts including noise and vibration;
- > Avoidance of other energy infrastructure; and
- > Consideration of the potential locations of planned projects such as North Falls and SeaLink.
- > Engineering constraints:
 - > Avoidance of areas where coastal cliffs exceed 20m in height;
 - > Consideration of areas which may require potential timing constraints (e.g., restriction on 24 hour working near to residential areas);
 - > Avoidance and/or minimising the number of crossings of existing offshore cables and pipelines;
 - > Maintaining the required separation distances with other offshore cables and pipelines;
 - > Maintaining sufficient space for offshore cable installation (including anchor spread of installation vessels) whilst ensuring an appropriate safety buffer with existing sub-sea cables and pipelines;
 - > Feasibility and geotechnical risk of the required length of trenchless crossing technique e.g. Horizontal Directional Drill (HDD); and
 - > Avoidance of flood risk and interaction with aquifers including Flood Zones 2 and 3 and Source Protection Zones where possible.
- > Land requirements:

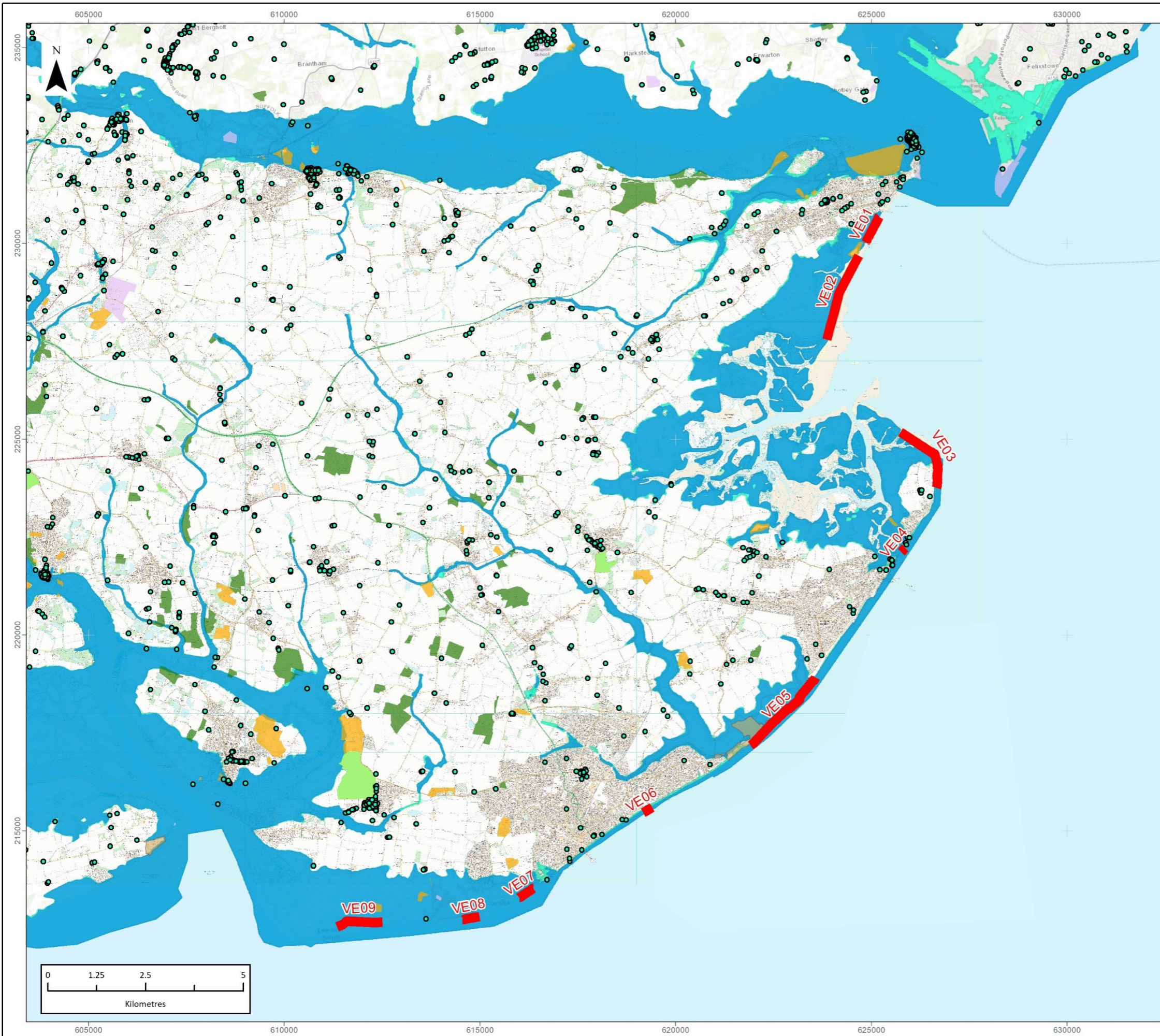
⁴ It should be noted that for the offshore approach it is almost impossible to avoid the Outer Thames Estuary SPA because of its extent and location.



- > Locations set back from the coast to reduce risk associated with coastal erosion (as informed by relevant Shoreline Management Plans);
- > Accessibility of existing road network for construction vehicles and/or the need for land requirements (either temporary or permanent) for road widening; and
- > Suitably sized area for construction compounds associated with the HDD and landfall works.

4.8.5 Following the constraints mapping and analysis exercise, nine potential Landfall Zones were identified that had the potential to meet the design principles and engineering criteria in accommodating the required infrastructure. These locations, presented in Figure 4.5, comprised the long list options at this stage of the assessment, as listed below:

- > VE01 - Dovercourt;
- > VE02 – Hamford Water North;
- > VE03 – The Naze;
- > VE04 – Walton-on-the-Naze;
- > VE05 – Holland Haven;
- > VE06 – Clacton-on-Sea North;
- > VE07 – Clacton-on-Sea South;
- > VE08 – Jaywick West; and
- > VE09 – St Osyth Marsh.



LEGEND

- █ Landfall Zones
- Listed Buildings
- █ Historic Landfill Sites
- █ Registered Parks and Gardens
- █ Scheduled Monuments
- █ Ancient Woodlands
- █ Country Parks
- █ East Anglia Flood Zone 2
- █ East Anglia Flood Zone 3

PROJECT TITLE:
FIVE ESTUARIES OFFSHORE WINDFARM

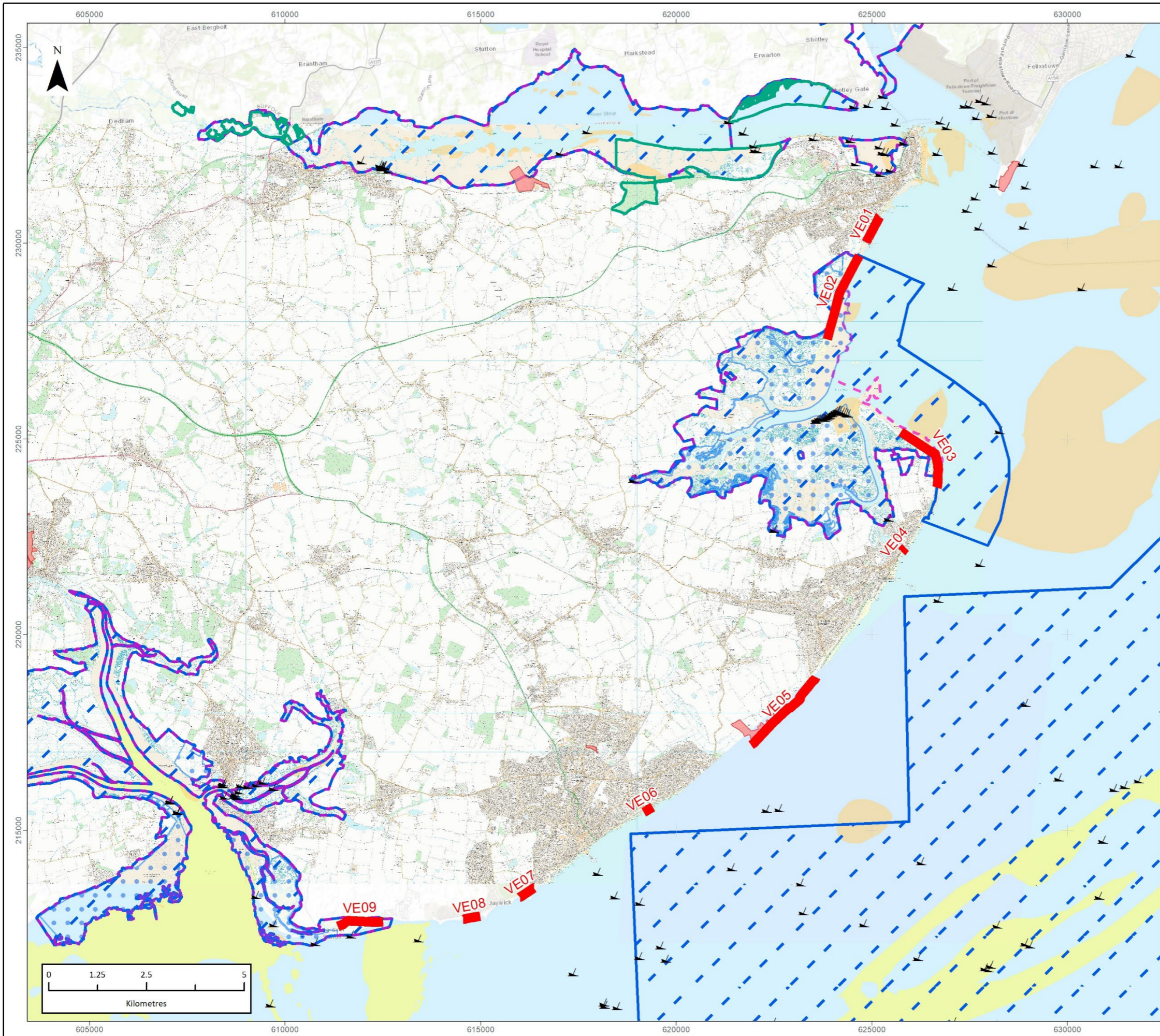
DRAWING TITLE:
Potential Landfall Zones and Constraints (1/3)

VER	DATE	REMARKS	Drawn	Checked
1	10/03/2023	For Issue	SWM	MB

DRAWING NUMBER:
4.5a

SCALE: 1:100,000 PLOT SIZE: A3 DATUM: OSGB 1936 PROJECTION: BNG





LEGEND

- █ Landfall Zones
- Wrecks
- RSPB Reserves
- Local Nature Reserves
- National Nature Reserves
- Ramsar Sites
- Special Protection Areas
- Annex I Reefs
- Annex I Sandbanks

Black area offshore of VE05 Landfall is consequential of onshore vector basemap (25k OS).

PROJECT TITLE:
FIVE ESTUARIES OFFSHORE WINDFARM

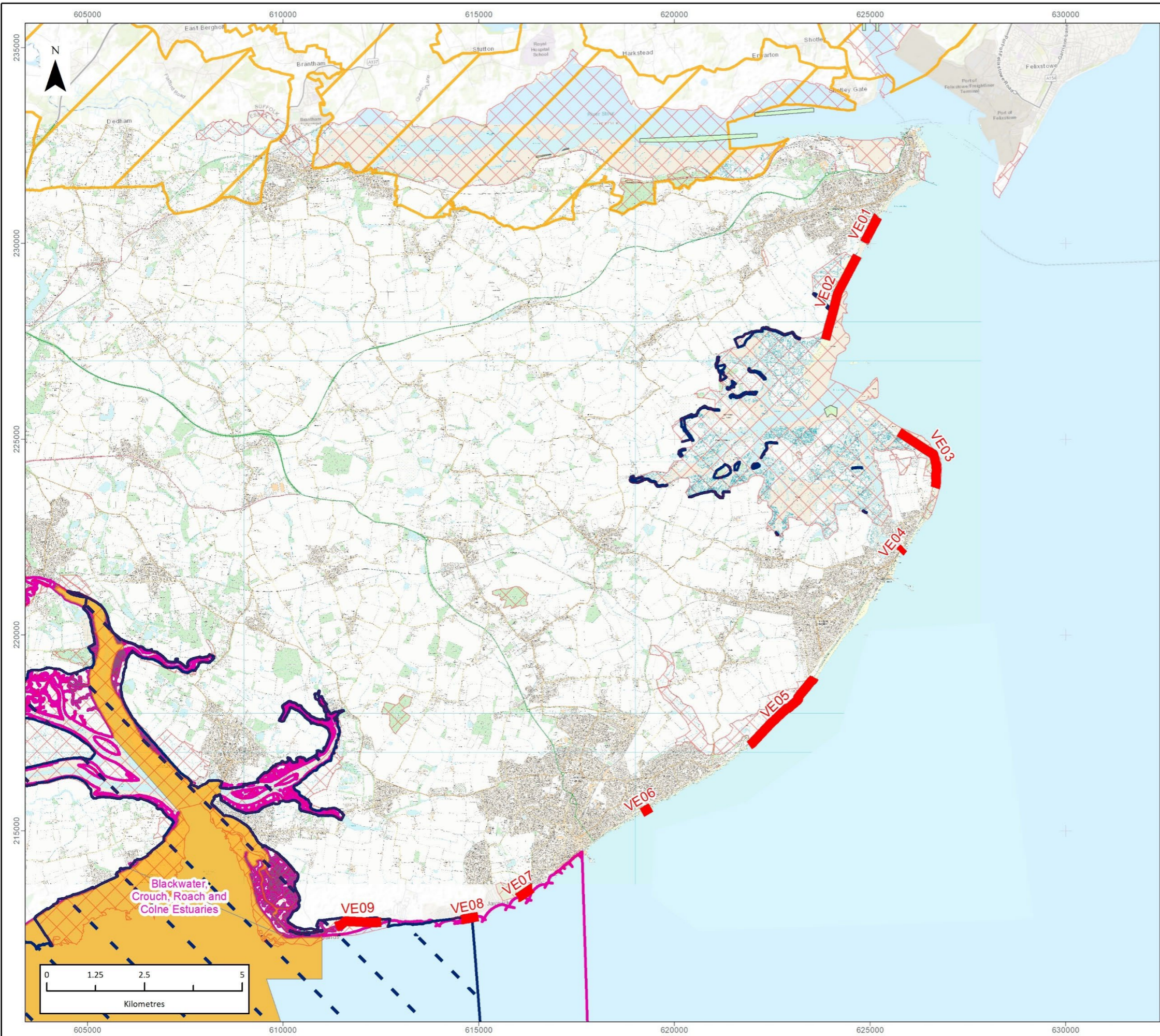
DRAWING TITLE:
Potential Landfall Zones and Constraints (2/3)

VER	DATE	REMARKS	Drawn	Checked
1	10/03/2023	For Issue	SWM	MB

DRAWING NUMBER:
4.5b

SCALE: 1:100,000 | PLOT SIZE: A3 | DATUM: OSGB 1936 | PROJECTION: BNG





LEGEND

- █ Landfall Zones
- Sites of Specific Scientific Interest
- Special Areas of Conservation
- Marine Conservation Zones
- Shellfish Waters

Disposal Sites:

- Open

PROJECT TITLE:
FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
Potential Landfall Zones and Constraints (3/3)

VER	DATE	REMARKS	Drawn	Checked
1	10/03/2023	For Issue	SWM	MB

DRAWING NUMBER:
4.5c

SCALE: 1:100,000 PLOT SIZE: A3 DATUM: OSGB 1936 PROJECTION: BNG





IDENTIFICATION OF LANDFALL ZONE

4.8.6 Each of the nine long list landfall zones was subject to further consideration of constraint and feasibility through application of a Black (no go), Red, Amber, Green (manageable constraint) (BRAG) assessment for each component constraint in order to rank and select the most suitable potential areas.

OVERALL SUMMARY OF LONG LIST APPRAISAL

4.8.7 Table 4.1 presents the long list of landfall zones and indicates which were then taken through to the shortlisting assessment.

Table 4.1: Summary of long list evaluation

Landfall Zone Option	Taken forward to short list?
VE01: Dovercourt	> No - Discounted due to need to install under/in close proximity to residential caravan park, recreation ground, shallow water extent at landfall and presence of historic landfill.
VE02: Little Oakley	No – Discounted due to potential significant impact on designated sites.
VE03: The Naze	> No - not viable due to eroding cliffs, potential significant impact on designations and residential property proximity.
VE04: Walton-on-the-Naze	> No - Discounted as no or extremely constrained cable route from the landfall onshore and surrounded by residential property along with insufficient landfall site working area.
VE05: Holland Haven	Yes – Limited potential for significant impacts on designated sites and residential property and good access.
VE06: Clacton-on-Sea North	> No – Discounted as cable would need to be installed adjacent to/under residential properties. Residential developments immediately to the north, east and west of the site. Onward onshore cable route would have to cross residential areas.



Landfall Zone Option	Taken forward to short list?
VE07: Clacton-on-Sea South	> No - Discounted due to potential for significant impacts on a number of designated sites.
VE08: Jaywick West	> No - Discounted due to extent of shallow working area at landfall and potential for significant long-term impact on a number of designated sites.
VE09: St Osyth Marsh	No - Not viable due to potential for significant long-term impact on a number of designated sites

4.8.8 Following the above considerations in the BRAG assessment, the HDD feasibility assessments and additional information, including site walkovers conducted in June 2021, it was determined VE05 Holland Haven was the only feasible Landfall Zone. On this basis, Landfall 05 Holland Haven was included within the Scoping Boundary and subject to more detailed design. This would define the onshore and offshore cable route design work as the centre point between the Landfall Zone and the Grid Connection Point.

4.9 STAGE 4 – IDENTIFICATION OF OFFSHORE EXPORT CABLE ROUTE

4.9.1 The following section describes the process of identifying the offshore cable route options for the scoping phase and initial consultation. The subsequent process undertaken to refine the design for the purposes of this PEIR is described in the ‘Stages 6 (Section 4.11) and 7 (Section 4.12)’ of this chapter.

AREA OF SEARCH

4.9.2 An Offshore Export Cable Route Area of Search (AoS) was developed across an area between the array areas to the potential Landfall Zone. Constraints mapping and assessment was undertaken to define an area based on the AfL and key constraints to develop an area of search for future route identification. The constraints that informed the alignment included:

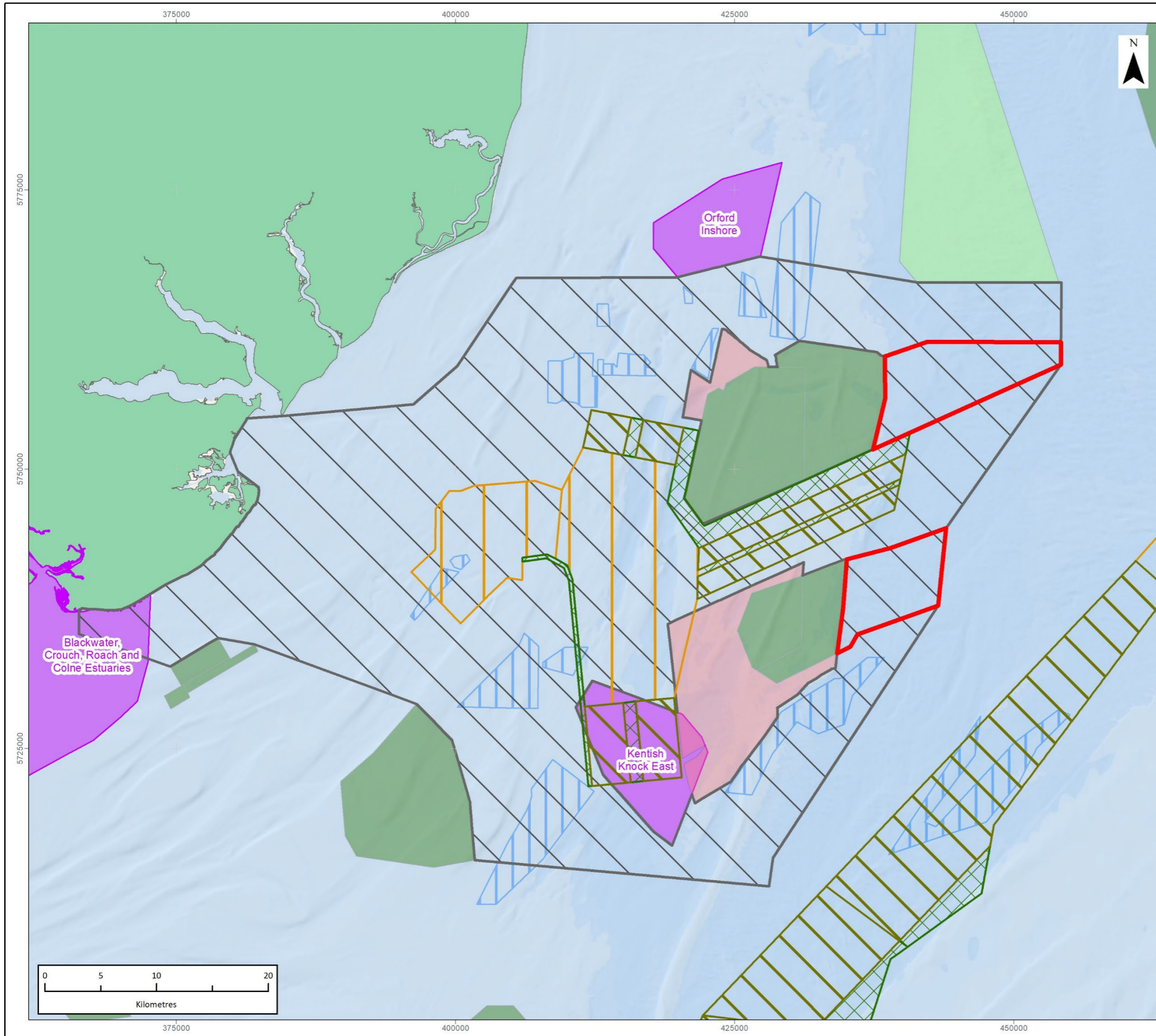
- > East Anglia 2 OWF turbine array (creates part of the northern boundary of the AoS);
- > Orford Inshore Marine Conservation Zone (MCZ) (creates part of the northern boundary of the AoS);
- > East Anglia 1 and 3 Export Cable (creates part of the northern boundary of the AoS);
- > Galloper OWF turbine array;
- > Greater Gabbard OWF turbine array;
- > North Falls AfL area;
- > Kentish Knock East MCZ;



- > London Array OWF turbine array;
- > Gunfleet Sands OWF turbine array;
- > Harwich deep water dredged channel; and
- > Proposed aggregate extraction sites.

4.9.3 The initial AoS is presented in Figure 4.6 below. Once the Offshore Export Cable Route AoS was developed, a range of other potential constraints were taken into account in order to avoid and / or minimise interaction with various offshore interests, including:

- > Location of the Traffic Separation Scheme (TSS) and other IMO navigational routing measures;
- > The Sunk Pilot Boarding Station that services the ports of Harwich, Felixstowe, Ipswich and Mistley;
- > The Harwich Deep Water Channel;
- > Margate and Long Sands Special Area of Conservation (SAC);
- > Southern North Sea SAC;
- > Outer Thames Estuary Special Protection Area (SPA);
- > Potential Annex 1 habitats;
- > Existing and proposed offshore infrastructure such as cables and pipelines;
- > Proposed projects, such as the North Falls Project and SeaLink
- > Aggregate extraction sites;
- > Disposal sites;
- > Defined anchorage areas;
- > Areas of seabed with shallow water which may reduce under keel clearance;
- > Defined shipping routes and high density areas of traffic (such as ferry routes);
- > Known wrecks and Archaeological Exclusion Zones; and
- > The location of the North Falls cable route corridor.



LEGEND

- Array Areas
- Offshore ECC Options Search Area (Summer 2020)
- TCE Aggregate Extraction Zones
- Marine Conservation Zones

Offshore Wind Farm - Status:

- Operational
- Under Construction
- Consented
- In Planning

Ship Routing Areas:

- Navigational Precautionary Areas
- Traffic Separation Scheme Lanes
- Traffic Separation Zones

Data Source:
 Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:
FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
Offshore Export Cable Routes AoS and Key Constraints

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DRAWING NUMBER:
4.6

SCALE: 1:350,000 PLOT SIZE: A3 DATUM: WGS84 PROJECTION: UTM31N





IDENTIFICATION OF LONG LIST OF OFFSHORE EXPORT CABLE ROUTE OPTIONS

4.9.4 The process of identifying potential offshore cable routes within the AoS was undertaken in line with a range of design principles (and receptors/constraints), as well as with reference to relevant guidance, notably including the 2017 Crown Estate 'Cable Route Protocol' (CRP). This protocol comprises a set of principles and requirements for offshore wind developers in the planning of offshore export cable routes. All the principles and requirements within the CRP are relevant to the site selection process, but of particular relevance are the following:

- > Principle 3: This principle makes it clear that the "Cable Route Protocol applies specifically to Habitats Regulations Sites", however it should be taken to include all other protected sites and sensitive habitats.
- > Requirement 9: This requirement sets out what constraints must be mapped during the site selection process, namely: Habitats Regulations sites and features of these sites, areas of Annex I habitats and irreplaceable habitats. Requirement 9 also makes it clear that consultation with the relevant SNCB should be undertaken at this stage.
- > Requirement 10: This requirement makes it clear that design parameters of possible cabling infrastructure, including number and capacities of the export cables with their indicative spacing requirements and the additional structures, should be included within the site selection process.

4.9.5 Table 4.2 sets out how these key principles and requirements of the CRP have been taken into account during the site selection process.

Table 4.2: Consideration of the key CRP principles and requirements in VE OWFL's site selection study

Principle/ Requirement	Principle/ Requirement detail	Consideration within the site selection process
Principle 3	The Cable Route Protocol applies specifically to Habitats Regulations Sites. However, as a matter of best practice the approach set out in the Cable Route Protocol may also be applied to other protected sites (both marine and terrestrial) and known sensitive habitats, and this is strongly encouraged. This includes, <i>inter alia</i> , MCZs and SSSIs.	<p>Interaction with all national designations and international designations has been minimised as far as practicable. However, during consultation with shipping and navigational stakeholders it was noted that routing the offshore cable to the north of Margate and Longsands SAC risked compromising the navigational safety of mariners.</p> <p>Consequently, the offshore AoS overlaps with the Margate and Longsands SAC at the northern periphery. This overlap has been necessary to maintain a buffer distance from a pilotage area to the north.</p> <p>Similarly, shipping and navigation stakeholders flagged that reduction of</p>



Principle/ Requirement	Principle/ Requirement detail	Consideration within the site selection process
		<p>navigable water depth was a key stakeholder concern particularly within key routes and shallower areas. Therefore, the offshore AoS was refined to remain within deeper water channels, as far as feasible. This process resulted in an overlap with the Outer Thames Estuary SPA.</p>
Requirement 9	<p>Within the offshore AoS the developer must identify (and map where possible) the following, which are to be given significant weight in cable route planning:</p> <ul style="list-style-type: none"> > Habitats Regulations sites (SACs, SPAs and Ramsar sites, whether fully designated or not); > Features of the Habitats Regulations sites (including priority habitats and species); > Habitats Regulations sites with conservation objectives to recover features to favourable condition; > Areas of known Annex I habitat outside protected areas but within the AoS; and <p>Habitats that are known to be irreplaceable or very difficult to replace (e.g., chalk reef).</p>	<p>All relevant Habitat Regulation sites and their features, and Annex I habitats outside of designated sites, were identified and used to undertake a constraints analysis to refine the offshore AoS. As detailed above, under principle 3, it has not been possible in all instances to avoid the SACs and SPAs, however areas of overlap have been minimised as far as practicable.</p> <p>The status and sensitivity of the relevant designated features to the installation of cables have also been considered; sensitive routing and the 'avoid, reduce, mitigate' hierarchy (which also accords with Principle 5 of the CRP) has been adopted to reduce the impact on these habitats as far as is practicable.</p>
Requirement 10	<p>Developers must prepare an outline view of the possible cabling infrastructure requirements (acknowledging that this may change as the design of the project evolves). The outline should include the potential number and capacities of the export</p>	<p>Details of the possible cable infrastructure requirements including spacing, cable protection and likely preparation works have been considered. Key details that have been considered in line with the design envelope approach as set out in Volume 2, Chapter 1: Offshore Project Description. The design information</p>



Principle/ Requirement	Principle/ Requirement detail	Consideration within the site selection process
	<p>cables with their indicative spacing requirements and the additional structures (e.g., substations and converter stations) which the project is likely to require.</p> <p>Within the AoS, developers must identify (and where possible, map) hard engineering constraints such as existing infrastructure/licence areas, challenging ground conditions and sections of the coast where landfall is not possible. Developers should also form an initial view on the likely areas within the AoS where cable preparation works and/or cable protection may be needed (noting that this information is likely to change as survey work is undertaken).</p>	<p>has considered the realistic worst-case scenario.</p> <p>Data acquired during offshore survey work has been used to inform and refine the design envelope for consideration in this PEIR.</p>

4.9.6 In parallel with the Landfall Zone identification and assessment, initial offshore cable route constraint mapping was undertaken within the AoS. As the ongoing process for assessment and refinement of the Landfall Zones appraisal developed, a long list of offshore export cable routes was developed to identify viable options for offshore export cable corridors from the Array Boundary to the preferred landfall zone.

4.9.7 The initial identification of broad offshore cable routes was based on the application of high-level design principles, developed in line with guidance (e.g., the CRP) and stakeholder engagement; these criteria denote that the routes should:

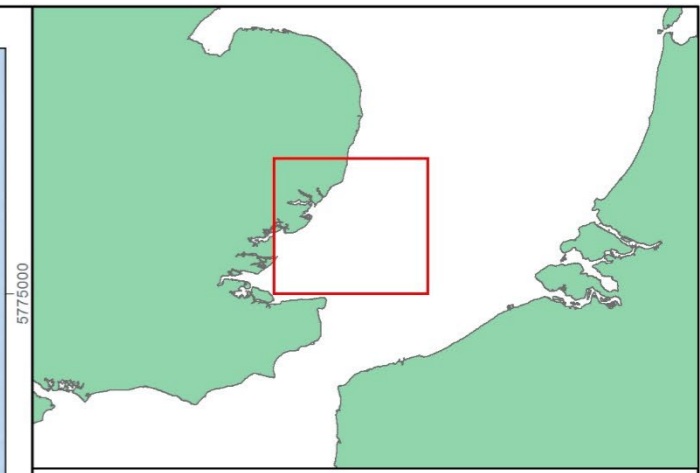
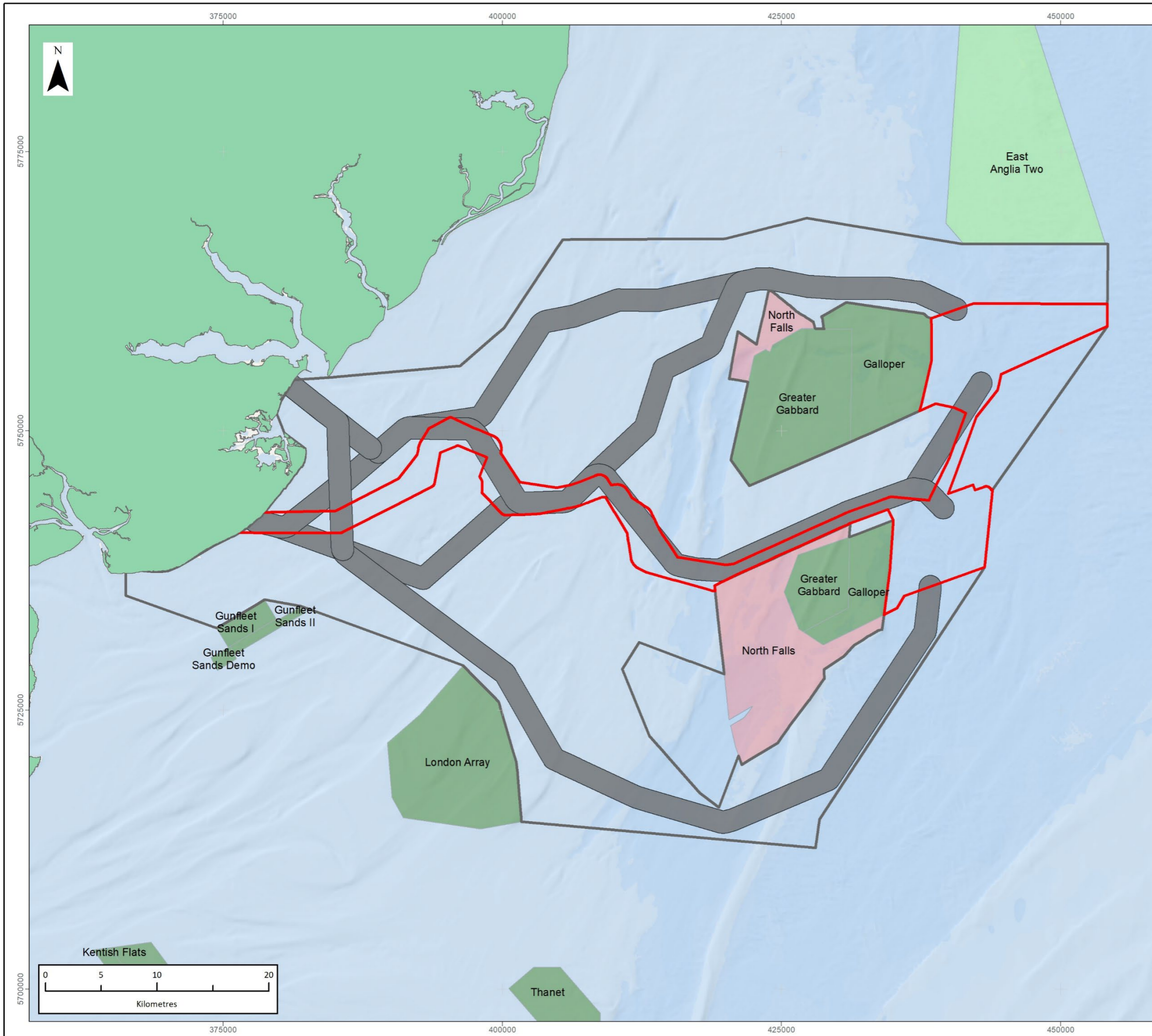
- > Connect to viable landfall locations;
- > Be as short as possible;
- > Avoid direct long-term significant impacts to sites designated for nature conservation as far as possible;
- > Avoid direct significant impacts to ecologically important Annex I sandbanks and Annex I reefs as far as possible;
- > Minimise number of crossings of existing offshore cables and pipelines. Where crossing is required, cables and pipelines to be crossed at 90° or as near as possible to that;
- > Maintain required separation distances with other offshore cables and pipelines;



- > Avoid existing offshore wind farms;
- > Maintain sufficient space for offshore cable installation (including anchor spread of installation vessels) whilst maintaining an appropriate safety buffer with existing sub-sea cables and pipelines;
- > Avoid known wrecks as far as possible and completely avoid protected wrecks and a buffer zone of 250m⁵;
- > Avoid anchorage areas;
- > Avoid actively dredged areas such as the Harwich Deep Water Channel; and
- > Minimise interaction with aggregate dredging areas.

4.9.8 The long list of offshore cable routes was also informed by discussions and engagement with key stakeholders including Natural England, the Maritime and Coastguard Agency (MCA), Trinity House, Sunk VTS users' group, Chamber of Shipping (CoS), Port of London Authority, Port of Harwich, London Gateway, Inshore Fisheries Conservation Authority, Tarmac, Cemex, and commercial fisheries representatives. Following the constraints mapping and consultation, as well as further input from the Landfall Zone appraisal, offshore cable routes were BRAG assessed.

⁵ 250m at Long List stage, being reduced to 100m at Short List stage based on more detailed data



LEGEND

- Final Scoping RLB
- Offshore ECC Options Search Area (Summer 2020)
- Offshore ECC Options (2020)

Offshore Wind Farm - Status:

- Operational
- Under Construction
- Consented
- In Planning

Data Source:
 Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:
 FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
 Offshore Export Cable Route Area
 of Search taken through to Scoping

VER	DATE	REMARKS	Drawn	Checked
1	09/03/2023	For Issue	SWM	MB

DRAWING NUMBER:
 4.7

SCALE: 1:350,000 PLOT SIZE: A3 DATUM: WGS84 PROJECTION: UTM31N





SELECTION AND REFINEMENT OF OFFSHORE EXPORT CABLE ROUTE

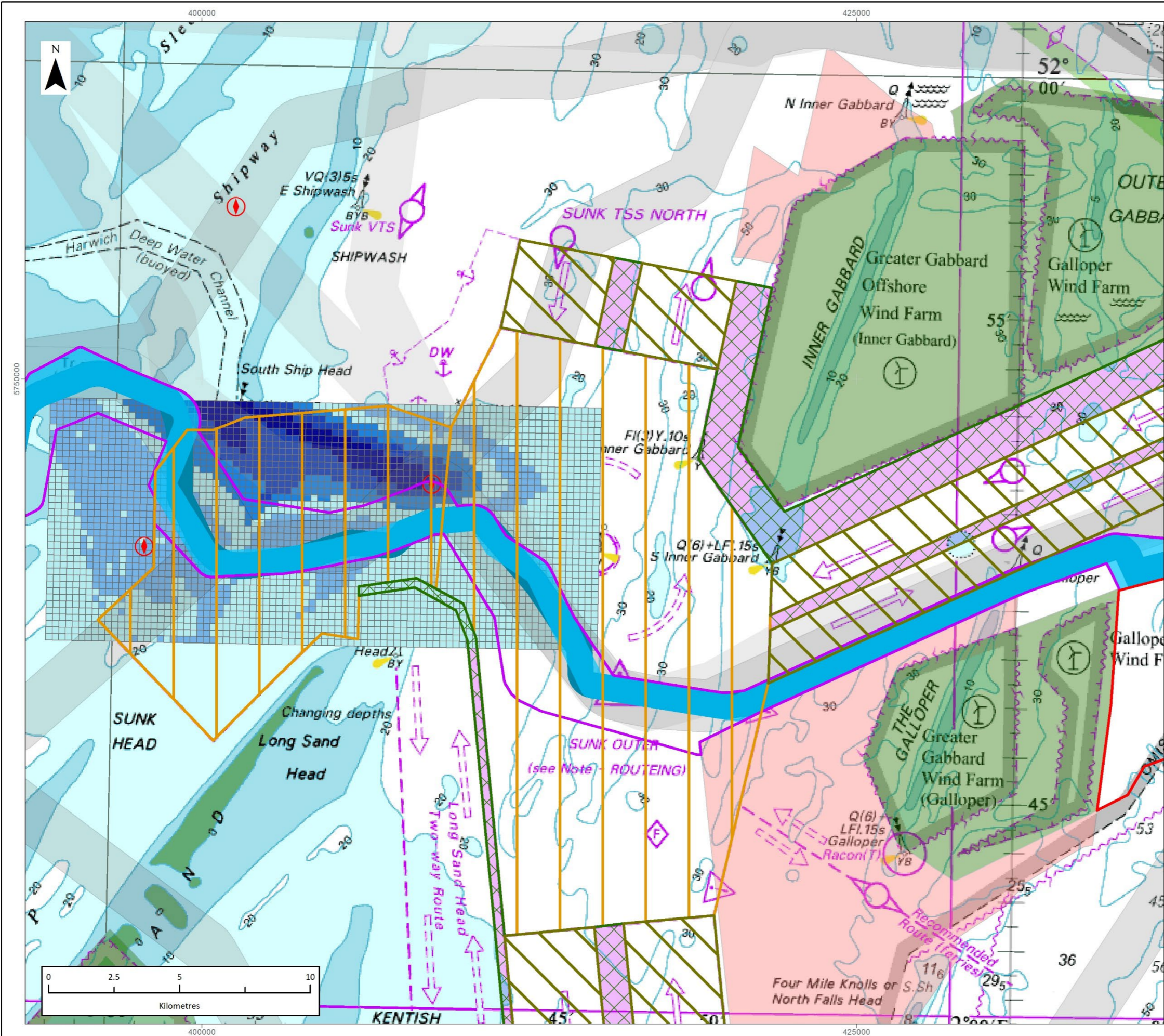
- 4.9.9 The final Offshore Export Cable Route selected was informed by:
- > Avoidance and/or minimising the number of crossings of existing offshore cables and pipelines Interaction with proposed aggregate extraction sites
 - > Interaction with historic munitions disposal areas
 - > Interaction with dredged shipping channel into Harwich
 - > Interaction with traffic Separation scheme and Sunk Precautionary Area
 - > Interaction with pilot boarding activities
 - > Extent of interaction with Margate and Longsands SAC
 - > Shallow water less than 10m deep (with the exception of inshore waters to make landfall)
- 4.9.10 The Offshore Cable Route was then refined taking into account:
- > Conservation designations:
 - > Where there is potential for likely significant effect on site, or adverse effect on integrity of a designated site cable routing has sought to avoid designated sites. However, this has not been possible in all cases. Details of the designated sites and interactions are provided below.
 - > Marine physical processes and coastal defences:
 - > The presence of mobile sediment has informed considerations in relation routing through areas of constrained navigable water depths; and
 - > The presence of coastal defences has informed assessment of landfall feasibility and need to consider HDD installation options.
 - > Fish and shellfish ecology:
 - > Presence of shellfish beds and fish spawning areas were considered in cable routing and avoided where possible noting that fish spawning areas extend over large areas of the southern North Sea.
 - > Benthic ecology:
 - > Sites designated for benthic ecology and potential for presence of potential Annex 1 habitat were considered in cable routing and avoided where possible.
 - > Ornithology:
 - > Sites designated for ornithology were considered in cable routing and avoided where possible. However, this has not been possible in all cases.
 - > Shipping and navigation:
 - > Routing measures and constraints including traffic separations schemes, precautionary areas, anchorages, deep water routes, dredged channels, pilot boarding areas and aids to navigation have been considered and informed the route corridor development.



- > Commercial fisheries:
 - > Areas of importance for commercial fisheries, and feedback from commercial fisheries groups have been considered in cable routing as far as possible⁶.
- > Marine archaeology:
 - > Where possible, designated wrecks have been avoided.
- > Other sea users:
 - > Existing infrastructure (e.g., cables) have been avoided or crossed in line with good practice guidance in terms of separation distances and crossing angles.
 - > Planned proximate infrastructure (such as the North Falls and SeaLink projects)
- > Socioeconomics:
 - > The presence of beaches, nature reserves and other coastal recreation activities.

4.9.11 Further refinement of the Offshore Cable Route was also provided through engagement with a range of stakeholders to understand how the construction and operation and maintenance of export cables might affect various interests along the developing route option. Following workshops, VE received detailed feedback from shipping and navigation stakeholders, which was then incorporated into route development and refinement. In addition to the main long list and short list options a number of route variations have been considered, assessed and discussed with stakeholders in the vicinity of the Sunk Precautionary Area, associated pilot boarding area and Margate and Longsands SAC as outlined in Figure 4.8.

⁶ Consultation has been undertaken with local fishermen to understand the importance of the local fishing grounds. At the time of writing, no specific grounds were identified as being critical for avoidance or would be significantly impeded through the installation of transmission assets



LEGEND

- Scoping Array Areas
- Scoping Offshore Area of Search
- Final Scoping Preferred Offshore ECC
- Offshore ECC Options (May 2021)
- Offshore ECC Options (Oct 2019)
- Offshore ECC Options (2020)

Offshore Wind Farm - Status:

- Operational
- Under Construction
- Consented
- In Planning

Ship Routeing Areas:

- Navigational Precautionary Areas
- Traffic Separation Scheme Lanes
- Traffic Separation Zones
- Pilot boarding place

Traffic Density, Pilot Vessels:

- 0
- 1
- 2 - 3
- 4
- 5

Data Source:
Basemap:

PROJECT TITLE:
FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
Route refinement as a Result of Shipping and Navigation Constraints

VER	DATE	REMARKS	Drawn	Checked
1	10/03/2023	For Issue	SWM	MB

DRAWING NUMBER:
4.8

SCALE: 1:150,000 PLOT SIZE: A3 DATUM: WGS84 PROJECTION: UTM31N





4.9.12 The key issues identified through consultation included the need to avoid:

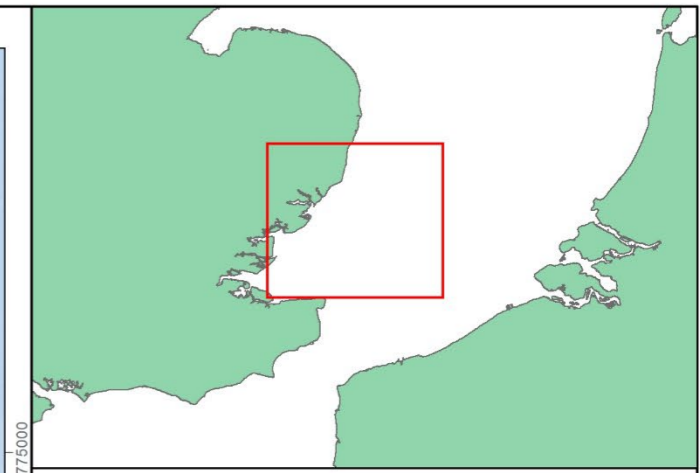
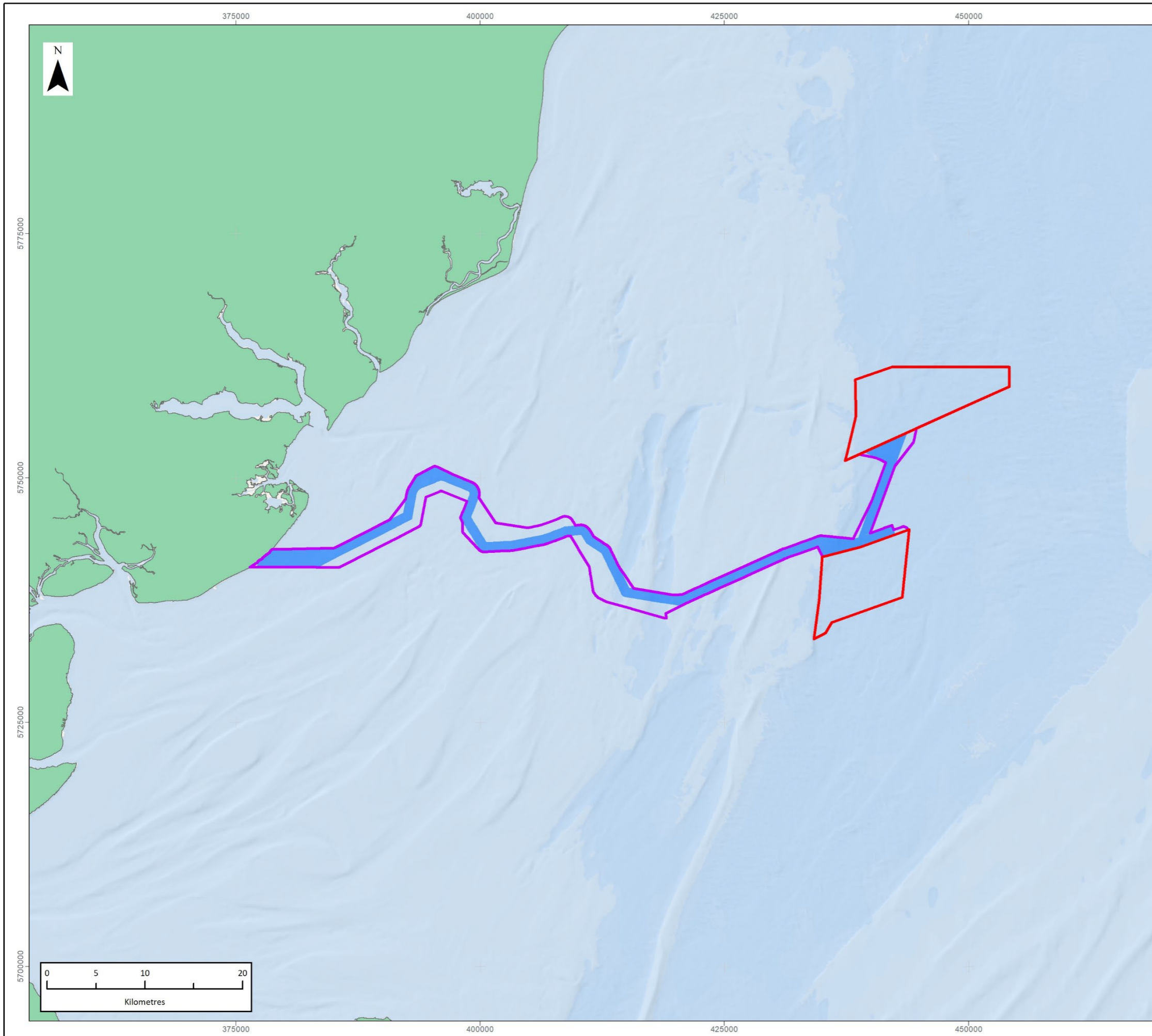
- > Crossings of existing buried infrastructure where bathymetry is <20m;
- > Any areas where bathymetry is <8m wherever possible (with the exception of inshore waters to make landfall);
- > Crossings of existing buried infrastructure in areas of high shipping density;
- > Wrecks as far as possible and completely avoid protected wrecks and with a buffer zone of 100m;
- > Anchorage areas and keep >500m separation where possible;
- > Pilot Boarding areas and other navigation aids;
- Proximity of North Falls cable route and potential for cumulative effects;
- > Crossing deep water channels at anything other than right angles and avoid turning areas; and
- > High density shipping areas as indicated in AIS or pass across such areas at 90° (or as near as possible to that angle).

Following discussions with shipping and navigation stakeholders the option that avoided crossing the high-density area for pilot boarding and avoided crossing a historic munitions disposal area was selected, thus reducing navigational safety risks highlighted by the shipping and navigation stakeholders (

4.9.13 Figure 4.9). The preferred Offshore Cable Route was the subject to geophysical and benthic surveys in Q2-Q4 2021.

4.9.14 In order avoid potential impacts on navigational safety around the Sunk pilot boarding area (that was highlighted in workshops with shipping and navigation stakeholders), the Offshore Cable Route overlaps the northern tip of the Margate and Long Sands SAC, but avoids the byelaw area of the SAC, which is understood to be the most ecologically sensitive location and currently prohibits fishing activity.

Whilst the preferred Offshore Cable Route was subject to geophysical and benthic survey, the boundary used for EIA scoping and PEIR was widened to encompass the North Falls offshore export cable route to enable future discussions on coordination, and minimise interactions with proximate projects where possible and appropriate. The VE Offshore Cable Route taken forward from Scoping is presented in Figure 4.9.



LEGEND

- Scoping Array Areas
- Scoping Offshore Area of Search
- Preferred Offshore Export Cable Route at Scoping

Data Source:
 Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:
 FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
 Offshore Export Cable Route
 taken forward to Scoping

VER	DATE	REMARKS	Drawn	Checked
1	09/03/2023	For Issue	SWM	MB

DRAWING NUMBER:
 4.9

SCALE: 1:400,000 PLOT SIZE: A3 DATUM: WGS84 PROJECTION: UTM31N





4.10 STAGE 5 – IDENTIFICATION OF ONSHORE INFRASTRUCTURE SCOPING BOUNDARY

4.10.1 The following section describes the process of identifying the Onshore Infrastructure Area of Search (AoS) for the scoping phase. The subsequent process undertaken to develop siting options for the onshore substation (OnSS) and Export Cable Corridor (ECC) within the AoS for the purposes of this PEIR is described in ‘Stage 7’ (Section 4.12) of this Chapter.

AREA OF SEARCH

4.10.2 The guiding principles for locating the VE onshore infrastructure was to identify an economic and efficient connection (i.e., as close as possible to the grid connection point) that does not give rise to significant adverse residual environmental impacts, taking into account the available space to accommodate the proposed above ground infrastructure. One of the key technical requirements was for the OnSS to be within around 3 km (maximum 5 km) from the grid connection point to minimise the length of the 400 kV connection.

4.10.3 It was therefore not possible to identify more defined locations for VE transmission infrastructure until NGET had identified more accurately the location for their new EACN substation.

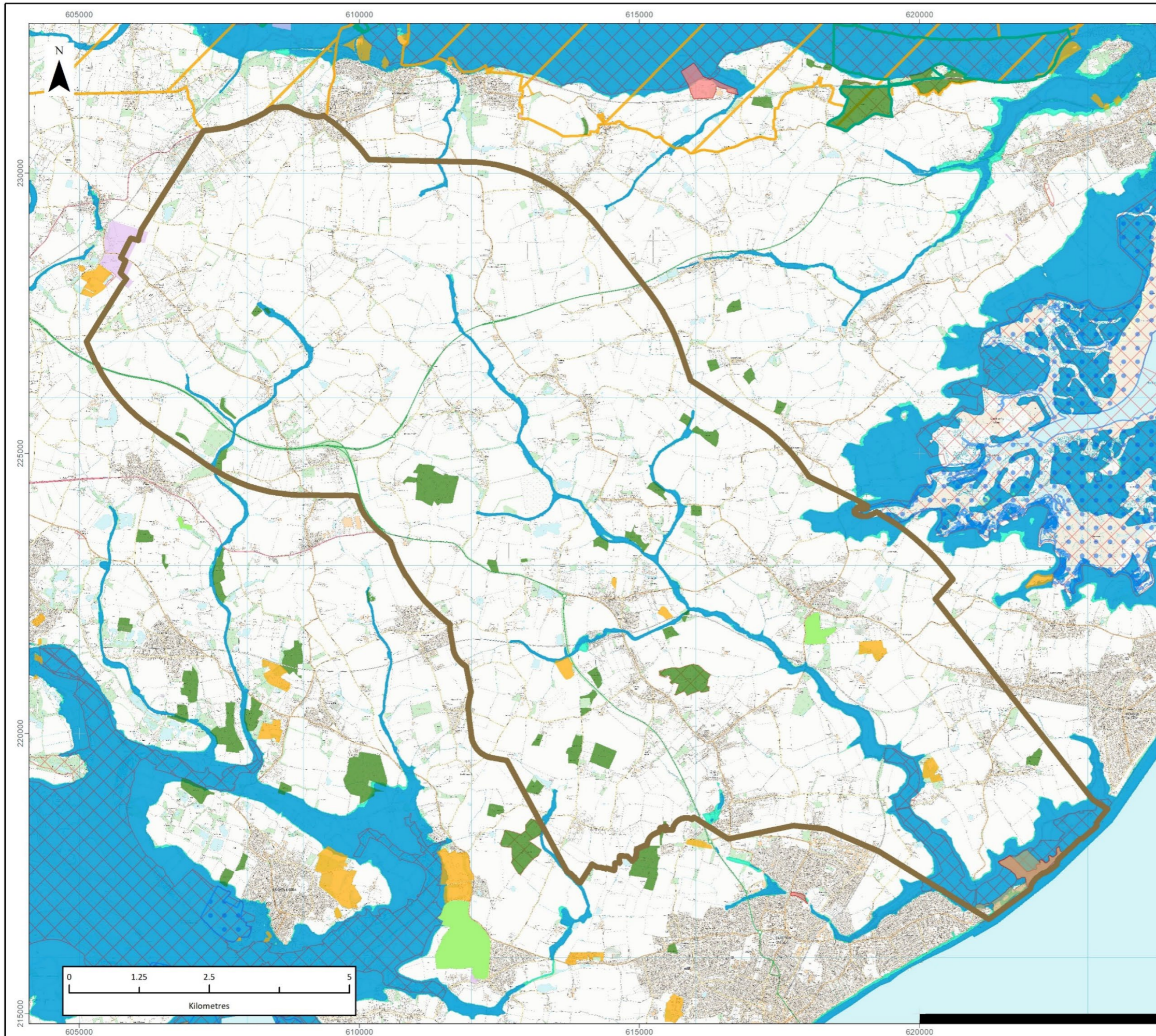
4.10.4 The Onshore Infrastructure AoS was therefore identified to provide a more refined project boundary to use for Scoping. This was done through an iterative process, initially publicly available data was collated to provide spatial mapping of potential constraints including environmental designations, heritage designations and engineering constraints. In addition, engineering constraints were considered to ensure that there is sufficient room and flexibility within the area to ensure onshore routing options could be accommodated. Key constraints that informed the initial Onshore Infrastructure AoS included:

- > Settlements as indicated on Ordnance Survey (OS) 1:25,000 mapping;
- > Settlements as indicated on Ordnance Survey (OS) 1:25,000 mapping
- > EA data for surface water flood risk, including consideration of Flood zones zone 2 and 3; and
- > International and European designated nature conservation sites (SAC, SPA, and Ramsar).

4.10.5 Figure 4.10 shows the search area and the key constraints.

4.10.6 Consultation with stakeholders continued prior to scoping through the Evidence Plan Process and bilateral meetings to introduce the proposed search area. In addition, the proposed site selection criteria/ principles were presented to consultees for the development of:

- > The Onshore infrastructure AoS; and;
- > The methods for identification of a long list / short list/ preferred options.



- LEGEND**
- Onshore Cable Corridor Area of Search
 - Special Areas of Conservation
 - Special Protection Areas
 - RSPB Reserves
 - Historic Landfill Sites
 - Registered Parks and Gardens
 - Scheduled Monuments
 - Ancient Woodlands
 - Country Parks
 - Local Nature Reserves
 - Areas of Outstanding Natural Beauty
 - National Nature Reserves
 - Sites of Specific Scientific Interest
 - Ramsar Sites
 - East Anglia Flood Zone 3
 - East Anglia Flood Zone 2

Data Source: Ordnance Survey, Environment Agency, DEFRA, Historic England, Natural England, RSPB, East Anglia Flood Zone 3, East Anglia Flood Zone 2, National Nature Reserves, Sites of Specific Scientific Interest, Ramsar Sites, Special Protection Areas, Special Areas of Conservation, Scheduled Monuments, Registered Parks and Gardens, Ancient Woodlands, Country Parks, Local Nature Reserves, Areas of Outstanding Natural Beauty, National Nature Reserves, Sites of Specific Scientific Interest, Ramsar Sites, East Anglia Flood Zone 3, East Anglia Flood Zone 2

PROJECT TITLE:
FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
**Onshore Infrastructure Area of Search /
Onshore Scoping Boundary and Constraints**

VER	DATE	REMARKS	Drawn	Checked
1	10/03/2023	For Issue	BPHB	FM

DRAWING NUMBER:
4.10

SCALE: 1:70,000 | PLOT SIZE: A3 | DATUM: OSGB 1936 | PROJECTION: BNG





4.11 STAGE 6 – REFINEMENT OF OFFSHORE PROJECT FOR PEIR; STATUTORY CONSULTATION

4.11.1 The following sub-sections describe the process in the evolution of the project design from the Scoping phase, through to the design in its current form, for the purposes of PEIR assessments and formal statutory consultation.

ARRAY REFINEMENT

4.11.2 VE undertook a review of survey data for the Array Boundary and the outcomes of more detailed technical assessments completed to inform the PEIR. The conclusion of this review was that no modification was required due to potential engineering or ecological impacts but analysis of shipping and navigation data and stakeholder engagement indicated a need to consider refinement of the northern array boundary.

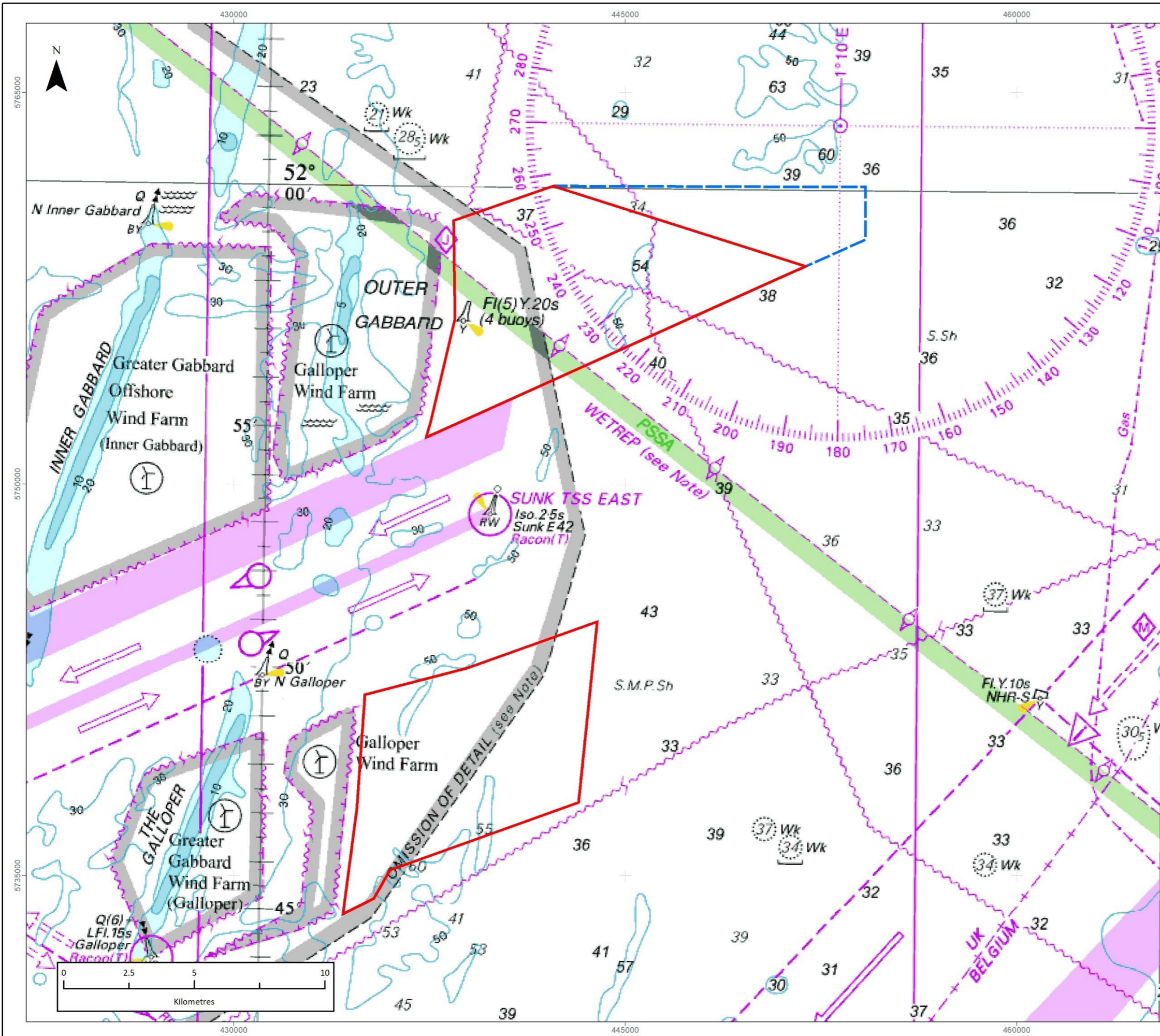
4.11.3 The northern array boundary has therefore been refined following detailed consultation with shipping and navigational stakeholders, and analysis of both vessel traffic surveys and long-term vessel traffic data.

4.11.4 Following consultation and analysis of the long-term vessel traffic data, the boundary of the northern array has been realigned southwards but pivoted on an existing vertex along the northern edge, broadly creating a trapezium (Figure 4.11). This change creates additional sea room immediately north and east of the northern array boundary and an angle parallel with the direction of heavily trafficked commercial routes. This refinement of the northern array boundary represents a 22 % reduction for the northern array boundary and a 16% reduction for the combined array boundary overall.

4.11.5 Benefits of the refinement of the northern array boundary include:

- > Minimising displacement to heavily trafficked commercial routes and allows course adjustments to be made earlier;
- > Increased sea room for adverse weather routeing to safely continue;
- > Allows optimal alignment on entry/exit into/out of the North Hinder Junction;
- > Minimising collision risk for crossing traffic since interaction of existing hotspots is minimised;
- > Increased sea room for vessels awaiting orders in/out of the Sunk routeing measure;
- > Increased sea room for the RORC North Sea Race; and
- > Navigation corridor between the northern array area and East Anglia Two is offset at the eastern extent creating additional sea room for transits and adjusting vessel headings.

4.11.6 The southern array boundary remains unchanged from the scoping stage.



LEGEND

- Array Areas (PEIR)
- Scoping Stage Array Areas

Data Source:
 Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:
FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
**Northern Array Area Changes
 between Scoping and PEIR**

VER	DATE	REMARKS	Drawn	Checked
1	09/03/2023	For Issue	SWM	MB

DRAWING NUMBER:
4.11

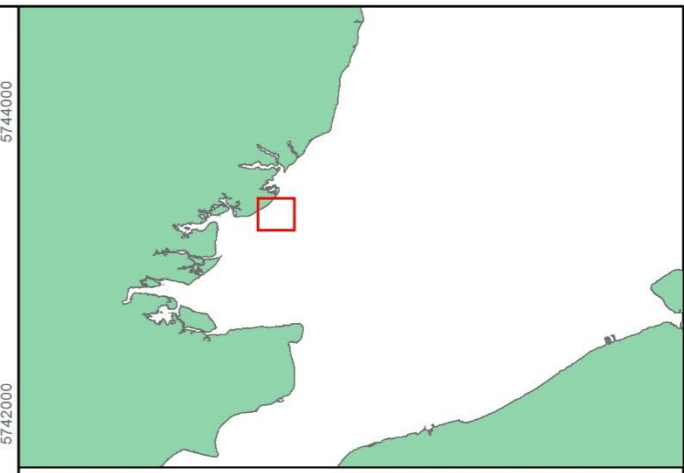
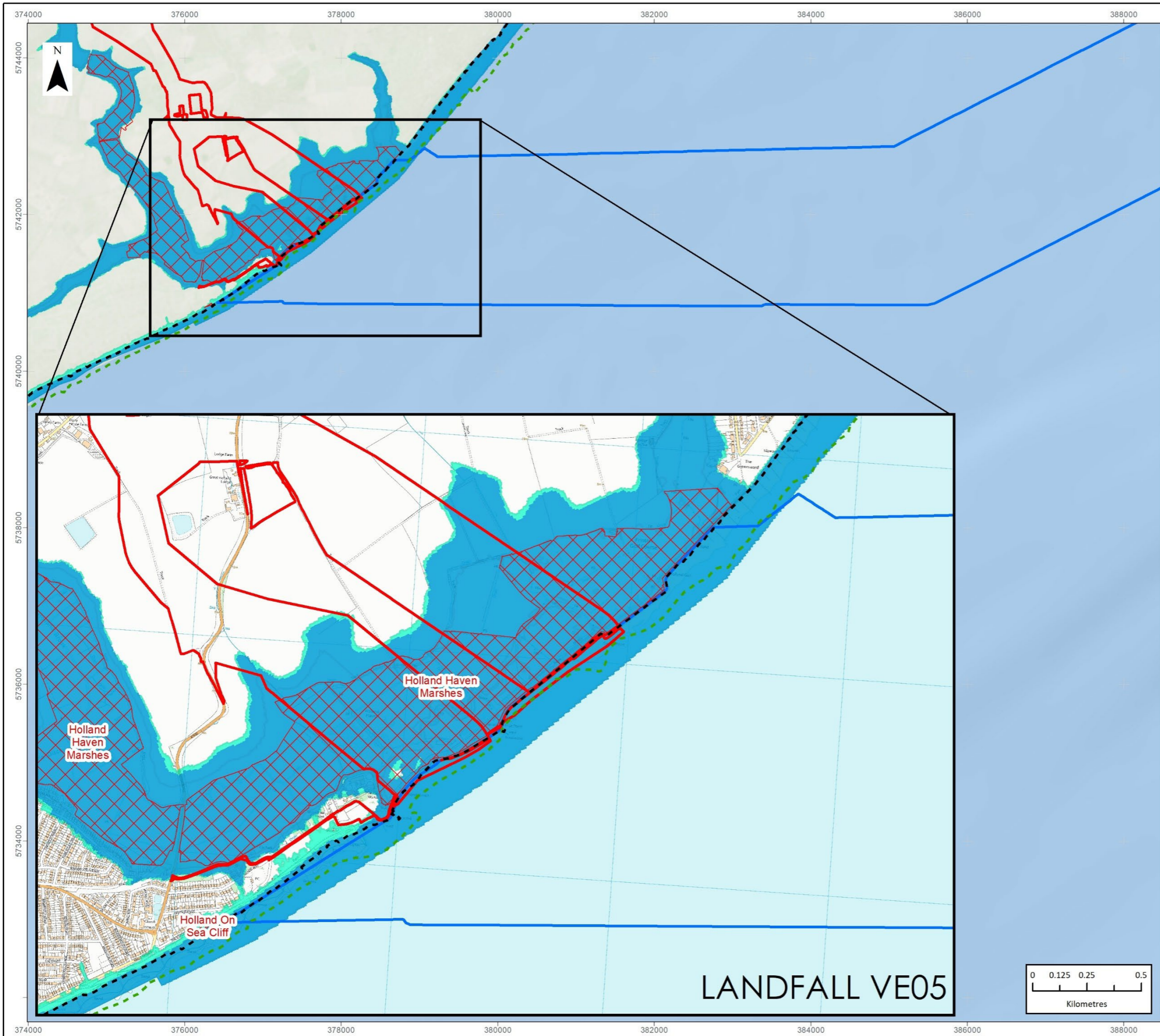
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LANDFALL ZONE REFINEMENT

- 4.11.7 Whilst the process for site selection of the Landfall Zone was relatively advanced at Scoping, with a preferred Landfall Zone identified, detailed design development work has continued to define two options within the selected landfall zone, alongside geotechnical investigations (Figure 4.12).
- 4.11.8 Alongside consultation on the PEIR, engineering studies will continue on the Landfall Zone including further consideration of potential for impacts on the SSSI associated with construction compounds and access. Feedback from PEIR consultation and this further work will inform further refinement and definition of the Landfall Zone design.



LEGEND

- ▬ PEIR Offshore Export Cable Corridor
- ▬ PEIR Onshore Red Line Boundary
- - - Mean Low Water Springs
- - - Mean High Water Springs
- East Anglia Flood Zone 2
- East Anglia Flood Zone 3
- Sites of Special Scientific Interest

Data Source:
 Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:
FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
**Landfall Boundary Refinements
 Between Scoping and PEIR**

VER	DATE	REMARKS	Drawn	Checked
1	09/03/2023	For Issue	SWM	MB

DRAWING NUMBER:
4.12

SCALE: 1:50,000 PLOT SIZE: A3 DATUM: WGS84 PROJECTION: UTM31N





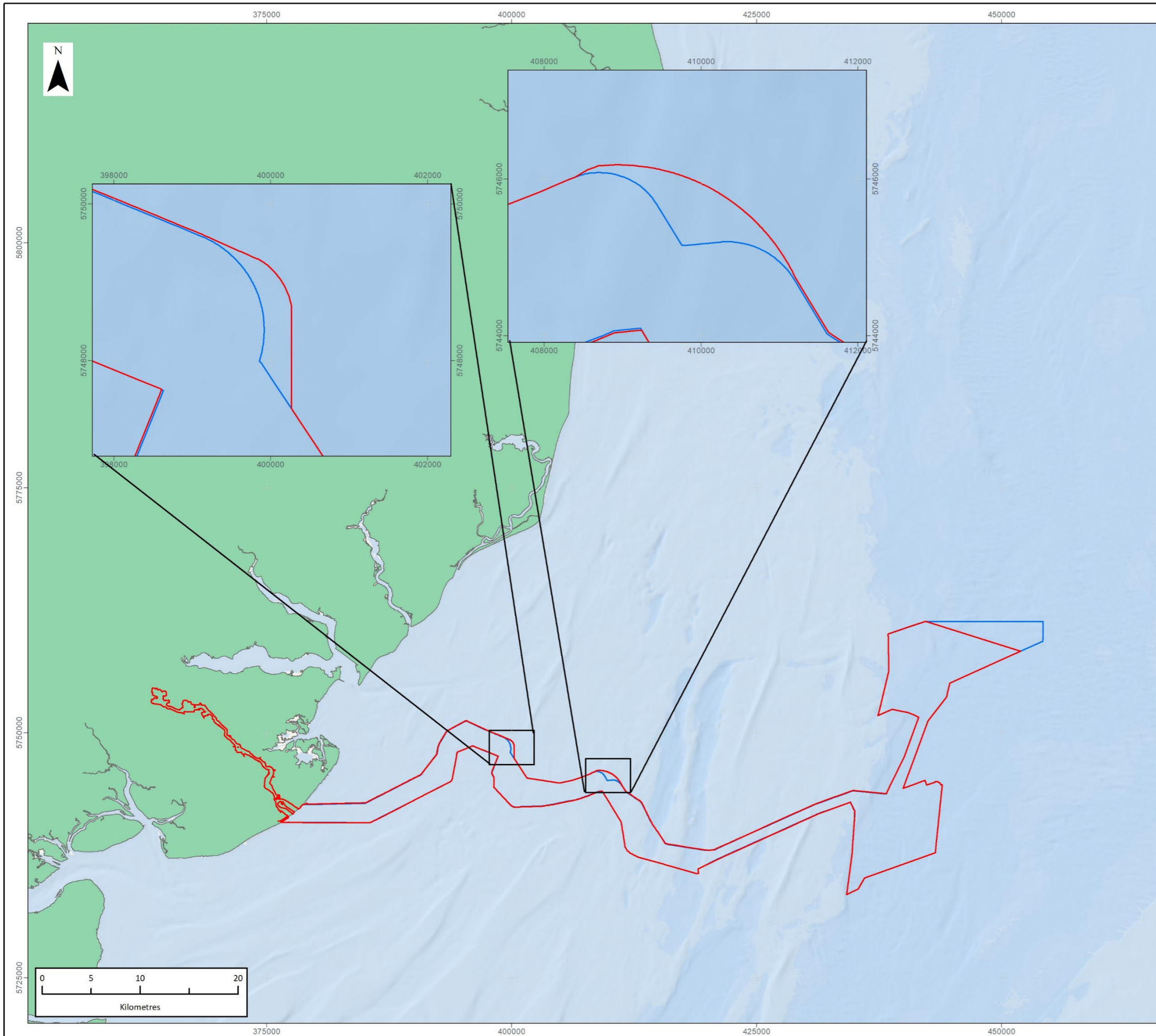
OFFSHORE CABLE ROUTE REFINEMENT

4.11.9 The Offshore Export Cable Route presented in this PEIR, remains very similar to the Scoping boundary. However, in order to help minimise the number of potential cable crossings with the North Falls project, the Scoping boundary was expanded slightly in two discrete locations (Figure 4.13).

4.11.10 Details of the Offshore Export Cable Route interaction with designated sites is provided in Table 4.3

Table 4.3: Offshore Export Cable Route interactions with marine designated sites

Site	Direct Interaction	Interactions with the PEIR Boundary	Features or description
Southern North Sea SAC	Yes	Interacts with eastern portion of the preferred cable route corridor for approx. 48km	Primary reason for site selection is harbour porpoise (<i>Phocoena phocoena</i>), of which herring and sandeel are key prey species. The interaction is in the winter area of importance for harbour porpoise.
Margate and Long Sands SAC	Yes	SAC intersects with the preferred cable route corridor for approx. 2 km	Designated for sandbanks, which may represent spawning habitats for sandeel.
Outer Thames Estuary SPA	Yes	SPA intersects with the preferred cable route corridor for approx. 19 km	Designated for wintering aggregations of red throated diver.
Hamford Water SPA and Ramsar	No	N/A	N/A
Kentish Knock East MCZ	No	N/A	N/A
Orford Inshore MCZ	No	N/A	N/A
Blackwater, Crouch, Roach and Coine Estuaries MCZ	No	N/A	N/A



LEGEND

- ▭ PEIR RLB
- ▭ Scoping RLB

Data Source:
Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:
FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
**Offshore Export Cable Route Updates
between Scoping and PEIR**

VER	DATE	REMARKS	Drawn	Checked
1	09/03/2023	For Issue	SWM	MB

DRAWING NUMBER:
4.13

SCALE: 1:400,000 PLOT SIZE: A3 DATUM: WGS84 PROJECTION: UTM31N





4.12 STAGE 7 – REFINEMENT OF ONSHORE PROJECT FOR PEIR AND STATUTORY CONSULTATION

IDENTIFICATION OF ONSHORE SUBSTATION SEARCH AREAS

4.12.1 Using the Onshore Infrastructure AoS, a number of potential longlist Substation Search Areas were identified by VE. Once NGET identified their refined search area in the vicinity of the existing Lawford substation the project could look to identify viable Substation Search Areas which met the technical criteria and where within an approximately 3 km radius from the connection point.

IDENTIFICATION OF SUBSTATION SEARCH AREAS LONG LIST

4.12.2 In order to identify the most appropriate location to site the OnSS, National Grid's Guidelines on Substation Siting and Design (The Horlock Rules) were taken into consideration. These guidelines document National Grid's best practice for the consideration of relevant constraints associated with the siting of electricity network infrastructure. The Horlock Rules have been considered, as part of the development of the OnSS, relating to design, local context and land use, amenity, and line entry.

4.12.3 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. The principles embodied in the Horlock Rules are relevant to the infrastructure at the proposed OnSS.

4.12.4 Table 4.4 below summarises the Horlock Rules, (National Grid, 2003), and VE's approach to them.



Table 4.4: VE application of Horlock Rules

Overall system options and site selection	VE's approach (onshore)
<p>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.</p>	<p>Environmental issues have been considered throughout the development phase to date, from initial desktop research to detailed EIA studies, and will continue to be considered throughout the site selection phase.</p>
<p>Amenity, cultural or scientific value of sites</p>	
<p>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.</p>	<p>All internationally and nationally designated sites have been avoided for the new onshore substation search areas.</p>
<p>Local context, land use and site planning</p>	
<p>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.</p>	<p>All areas of local amenity value in the location of the new onshore substation search areas have been protected as far as reasonably practicable. In addition, consideration has been given to important existing habitats and landscape features including ancient woodland, historic hedgerows, surface and ground water sources and nature conservation areas when considering sites for the onshore substation search areas. Where impacts cannot be avoided, these will be addressed through appropriate mitigation and design, the principles will be captured in an Outline Landscape and Ecological Management Plan (to accompany the DCO application).</p>



Overall system options and site selection	VE's approach (onshore)
<p>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.</p>	<p>The new onshore substation siting exercise has considered the availability of sites that benefit from existing screening, looking at existing landscaping, landform, and existing built development.</p> <p>The view to the new onshore HVAC substation from surrounding areas will be partly screened by existing vegetation and visual mitigation such as the planting of supplementary trees will assist in this screening over time. Further detail on potential additional planting will be presented in the outline Landscape and Ecology Management Plan (to accompany the DCO application).</p>
<p>The proposals should keep the visual, noise and other environmental effects to a reasonably practicable minimum.</p>	<p>Visual, noise and other environmental effects have been minimised as far as possible through the selection of the onshore substation search areas. For example, consideration has been 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 Volume 3, Chapter 9: Noise and Vibration.</p>
<p>The land use effects of the proposal should be considered when planning the siting of substations or extensions.</p>	<p>Existing land use, planning policies and planning history within and adjacent to the potential site locations considered in the options appraisal have been taken into account and form an integral part of the selection of the final onshore substation search areas.</p> <p>The selected site is characterised by agricultural fields, with ongoing design continuing to minimise effect on land use, agriculture, and recreation. Given the location for the site it is difficult to avoid Best and Most Versatile agricultural land. The site complies with planning policy in the area (see Volume 3, Chapter 5: Ground Conditions).</p>



Overall system options and site selection	VE's approach (onshore)
Design	
<p>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.</p>	<p>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.</p>
<p>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.</p>	<p>The area required for the onshore substation site was determined with reference to past developer experience, an initial assessment of relevant information available from technology suppliers together with the Applicant's current expectations regarding land required for access, landscape works and other mitigation for the components required for the proposed project substation. The design of the onshore substation is at an early stage and will be subject to ongoing refinement as the project progresses, as informed through further consultation and project design work.</p>
<p>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.</p>	<p>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 substation.</p>
Line entry	
<p>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.</p>	<p>VE will not employ overhead lines. All cables will be buried underground.</p>
<p>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.</p>	<p>The onshore substation site developments will not include any additional overhead line towers.</p>



- 4.12.5 As well as a large number of datasets collected to determine constraints in the Onshore Infrastructure AoS, a number of key principles were identified to select the potential Substation Search Areas. For the long list process, these comprised:
- > Avoid residential titles (including whole garden);
 - > Avoid direct significant impacts to internationally and nationally designated areas (e.g. SACs, SPAs, AONBs and SSSIs etc.);
 - > Avoid mature woodland and historic woodland;
 - > Avoiding listed buildings and scheduled monuments;
 - > Flood risk, including avoiding areas that fall within Flood Zones 2 and 3.
 - > Avoid current and historic landfill sites;
 - > 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 (specific wording from Horlock Rules);
 - > Zones 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 (specific wording from Horlock Rules);
 - > Zones should keep the visual, noise and other environmental effects to a reasonably practicable minimum (specific wording from Horlock Rules) – see below regarding the buffer zone around residential properties; and
 - > The space required should be limited to the area required for development consistent with appropriate mitigation measures and to minimise the adverse effects on existing land use and Public Rights of Way (specific wording from Horlock Rules).
- 4.12.6 The Tendring District Council Local Plan Strategic Allocations were also examined to identify any strategic development areas that may conflict with the site selection process, along with the Essex County Council Minerals Local Plan to identify mineral extraction areas and mineral safeguarding areas.
- 4.12.7 To assist with the identification of zones that would keep the visual, noise and other environmental effects to a reasonably practicable minimum, a 250 m buffer was applied to residential properties. Whilst this would not remove impacts associated from visual or noise effects it helps to provide a visual guide to the areas with the greatest distance of separation from residential properties. Landscape specialist input was also provided in respect of the potential visual impacts and screening possibilities for each option.



- 4.12.8 It was also important for the project to consider co-ordination with North Falls, who also have the EACN substation at their connection point. Therefore, an additional site selection criterion for the OnSS was to consider sites that would be large enough to allow for up to two project onshore substations to be located to provide a single focused area for development. Consideration of the potential for co-location or clustering of the onshore substations for the two projects has therefore been included in the VE development process to assess the potential benefits of such co-ordination, should this be feasible. The project considered sites that would have enough room for the substation and construction compounds for VE alone and for co-located substation sites with North Falls, where the two could be located either alongside or adjacent to each other. The search areas would also need to be large enough to accommodate a construction compound.
- 4.12.9 From the Onshore Infrastructure AoS, a Longlist of Substation Search Areas was identified taking into account the maximum operational footprint and existing constraints.

IDENTIFICATION OF SUBSTATION SEARCH AREAS SHORT LIST

- 4.12.10 A BRAG assessment was undertaken on the long list of options to develop a short list with the addition of further data, including the Tendring District Council Local Plan Strategic Allocations noted above, as well as data for common land and agricultural land classifications. In addition, Historic Environment Records (HER), planning applications and site walkover surveys of all Substation Search Areas (June 2021) were also used to help refine the option shortlisting. Prior to the revision of the BRAG at this stage, the following amendments were made to the Substation Search Areas:
- > Refinement to many Substation Search Areas to take account of specific features including woodland blocks, field boundaries, watercourses, and infrastructure. These amendments were aimed at aligning more closely with the Horlock Rules; and
 - > Review of the strategic residential / commercial allocations within the Tendring District Council Local Plan identified that some Substation Search Areas were conflicted, and these were then excluded from the BRAG.
- 4.12.11 As set out in section 4.7, National Grid confirmed a reduced search focused immediately around the existing Lawford substation. Using an approximate 3 km radius, a review was undertaken of the substation search areas. One of the key technical requirements was for the OnSS to be within around 3 km from the grid connection point to minimise the length of the 400kV connection. Sites that had been identified further than 5 km away were immediately discounted.
- 4.12.12 Initial high level appraisals were carried out for the remaining Substation Search Areas. These included:
- > Consideration of any increased engineering complexity, including high numbers of additional obstacle crossings;
 - > Space for planting / screening to reduce landscape impact;
 - > known and probably archaeological sites;
 - > transport and access; and
 - > ecology, air quality, hydrology (considering the relevant principles in the revised NPPFs and PPG) and noise although these showed no major differences between



the Substation Search Areas and would be more relevant for micro-siting the OnSS within the zones.

4.12.13 Table 4.5 presents the three Substation Search Areas identified as suitable for further design development and for discussion with stakeholders.

Table 4.5: Substation Search Areas

Site location	Landscape	Transport and Access	Archaeology
SSA 1 (S31b)	Provides sufficient area and existing landscape features to implement landscape mitigation	Access achievable but would require improvements to minor roads close to residential and community properties or long-haul road and removal of vegetation to facilitate	Has large areas which could be considered low risk for archaeology. Although highest potential for more significant features within NE of zone.
SSA 2 (S33)	Provides sufficient area to provide landscape mitigation. Although open an exposed so would require substantial mitigation	Access achievable but would require improvements to minor roads close to residential and community properties or long-haul road and removal of vegetation to facilitate	Has large areas which could be considered low risk for archaeology.
SSA 3 (S27)	Provides sufficient area and existing landscape features to implement landscape mitigation	Provides good optionality for access given proximity to A120	Has large areas which could be considered low risk for archaeology.

4.12.14 As a result of this process of option development and evaluation, three Substation Search Areas (SSA 1, SSA 2 and SSA 3) were identified for further development and presented within the Non Statutory public consultation held between 30 June and 12 August 2022.

4.12.15 The Substation Search Areas, presented in this PEIR are the same as those presented within the non-statutory public consultation. SSA 1 and SSA 2 have been refined into a single larger search area for the purposes of PEIR.

4.12.16 Therefore two Substation Search Areas are shown on Figure 4.14 and listed below:

- > SSA West- north of Ardleigh road (which combines SSA1 and SSA2 from the consultation in summer 2022); and
- > SSA East - south of Bentley Road (SSA3 from the consultation in summer 2022).



4.12.17 For the purposes of PEIR indicative OnSS locations have been included to assist with the assessments and to provide context for the scale of the development within the larger Substation Search Areas. A single OnSS location will be identified for the DCO.

ONSHORE EXPORT CABLE ROUTE REFINEMENT

4.12.18 Following the identification and characterisation of the Onshore Infrastructure AoS, a number of potential Onshore ECC routes were identified. Once NGET had identified its refined search area in the vicinity of the existing Lawford substation, VE was then able to identify viable Substation Search Areas (discussed in 4.7) and Onshore ECC routes could be identified which would connect the landfall to the Substation Search Areas and the Grid Connection Point.

4.12.19 The maximum design parameters taken into consideration for the Onshore ECC routes were:

- > Cable corridor construction swathe width up to 60m;
- > Cable corridor construction swathe width at pinch points – 40m;
- > Trenchless crossing indicative compound length – 100m; and
- > Trenchless crossing indicative compounds width – 100m.

4.12.20 Onshore ECC routes were then developed using the following routing principles:

- > Avoid close proximity to residential dwellings;
- > Avoid close proximity to historic buildings;
- > Avoid designated sites;
- > Minimise impacts to local residents in relation to access to services and road usage, including footpath closures;
- > Wherever possible the cable route will seek to utilise open agricultural land;
- > Minimise requirement for complex crossing arrangements, (e.g., road, river and rail crossings);
- > Avoid areas of important habitat, trees, ponds and agricultural ditches;
- > Install cables in flat terrain maintaining a straight route where possible;
- > Avoid other services (e.g. gas pipelines) but aim to cross at right angles where crossings are required;
- > Minimise the number of hedgerow crossings, utilising existing gaps in field boundaries if possible; and
- > Minimise impacts on agricultural practices and access, avoid rendering parcels of agricultural land inaccessible during construction and installing cables along field boundaries where possible.



4.12.21 At this stage VE continued to explore opportunities to co-ordinate with the nearby North Falls Offshore Wind Farm project. This included identifying an Onshore ECC route that would be wide enough for two projects, should it be both possible and beneficial to align the projects within the same corridor. For the initial Onshore ECC route selection activities, the following parameters were used to define the initial corridor widths:

- > Standard trenching – 120 m
- > Minor / Less Complex crossing / standard trenched routes – 204m; and
- > Large / Complex (and therefore likely deeper) trenchless crossings – 280m.

IDENTIFICATION OF ONSHORE ECC ROUTES

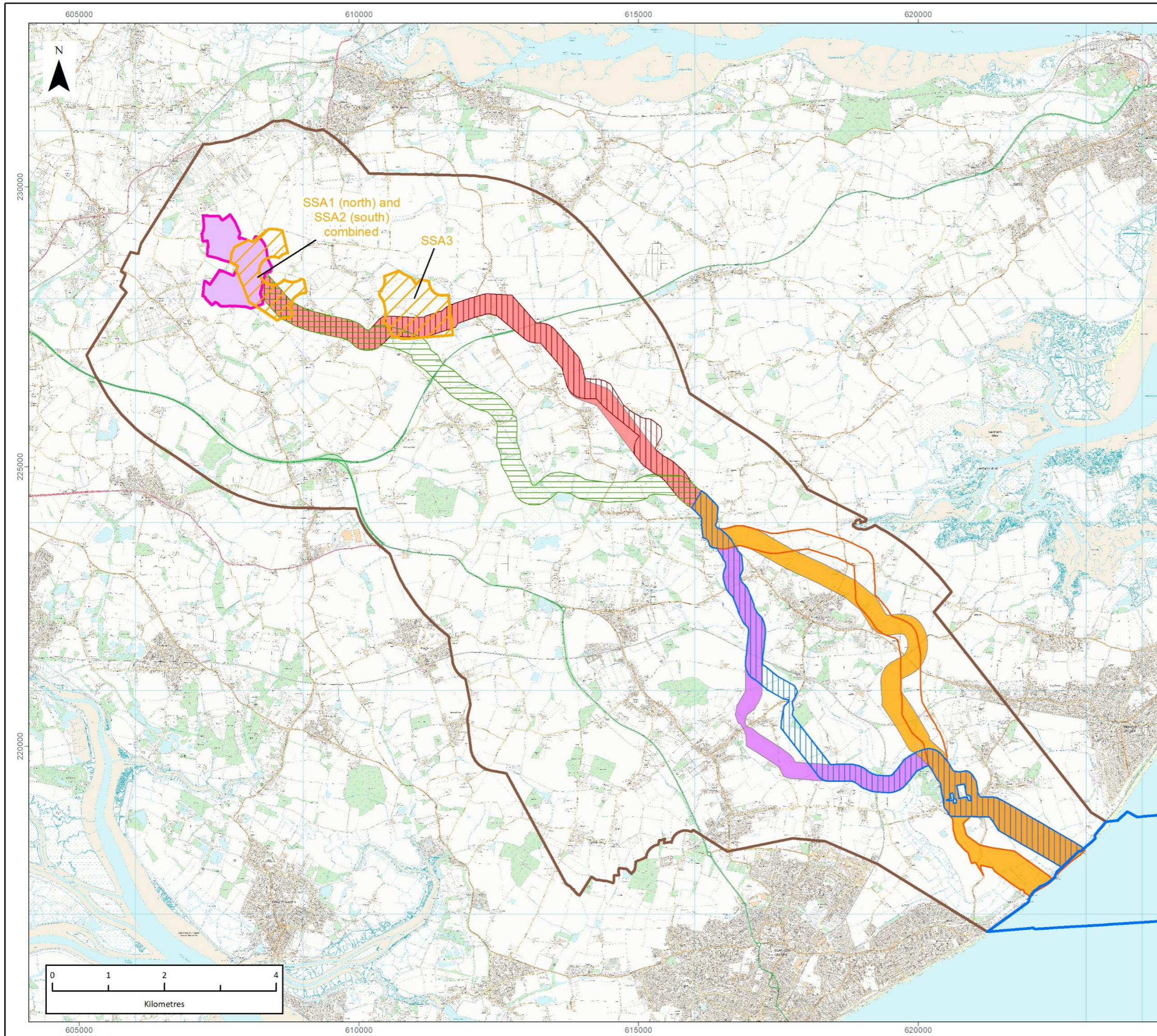
4.12.22 For the purposes of the routing selection, broad 500 m wide corridors were identified that connected the Landfall Zone to the Grid Connection Point, these were refined in subsequent phases of the site selection exercise (refinement of the preferred broad corridor(s)) down to the RLB presented at PEIR. The locations of the identified Onshore ECC options considered are shown on Figure 4.14.

4.12.23 When identifying broad 500 m wide corridors inevitably there is occasional overlap with some of the constraints, and an additional exercise was undertaken to identify the key Constraint Areas (CA) along these broad corridors to provide more detail of the available space.

4.12.24 A Black-Red-Amber-Green (BRAG) assessment was carried out during the site selection phase of the project. This involved an assessment of the options, to compare the environmental, engineering, land management and cost constraints and opportunities of each option.

4.12.25 This assessment was undertaken as a site selection exercise to compare a number of the most viable potential onshore cable route sections. The Onshore ECC routes considered within the BRAG assessment aim to identify a preferred single Onshore ECC route connecting from the Landfall Zone between Holland-on-Sea and Frinton-on-Sea to the general search area identified by NGET around the Lawford substation for the Grid Connection Point in the Tendring District of Essex.

4.12.26 The Onshore ECC Route Segment Options considered within the appraisal are shown on Figure 4.14 below.



LEGEND

- Onshore Infrastructure Area of Search
- Offshore Export Cable Route Area of Search
- Onshore Substation AoSs
- National Grid Substation AoS
- East AWM Alternative (North)
- East 1 (North)
- North West 1
- East 1 (South)
- East AWM Alternative (South)
- West 1
- West 2

Data Source:
 Basemap: Ordnance Survey Vector Map Local Raster. Contains Ordnance Survey data © Crown copyright and database rights (2023).

PROJECT TITLE:
 FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
 Onshore Export Cable Corridor
 Route Segments

VER	DATE	REMARKS	Drawn	Checked
1	3/13/2023	Final	SWM	FM

DRAWING NUMBER:
 4.14

SCALE: 1:70,000 PLOT SIZE: A3 DATUM: WGS84 PROJECTION: BNG





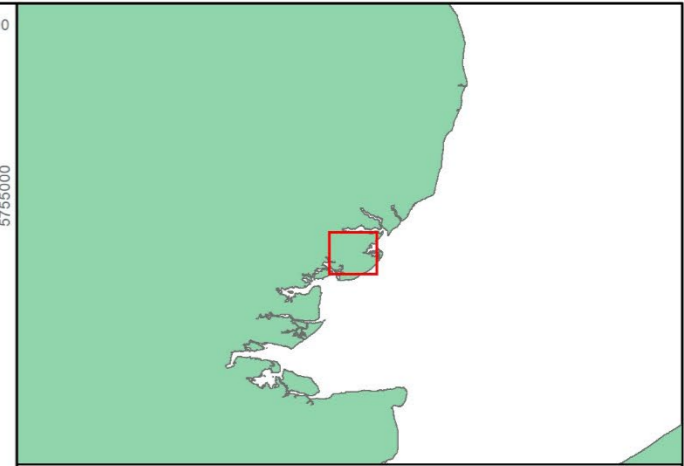
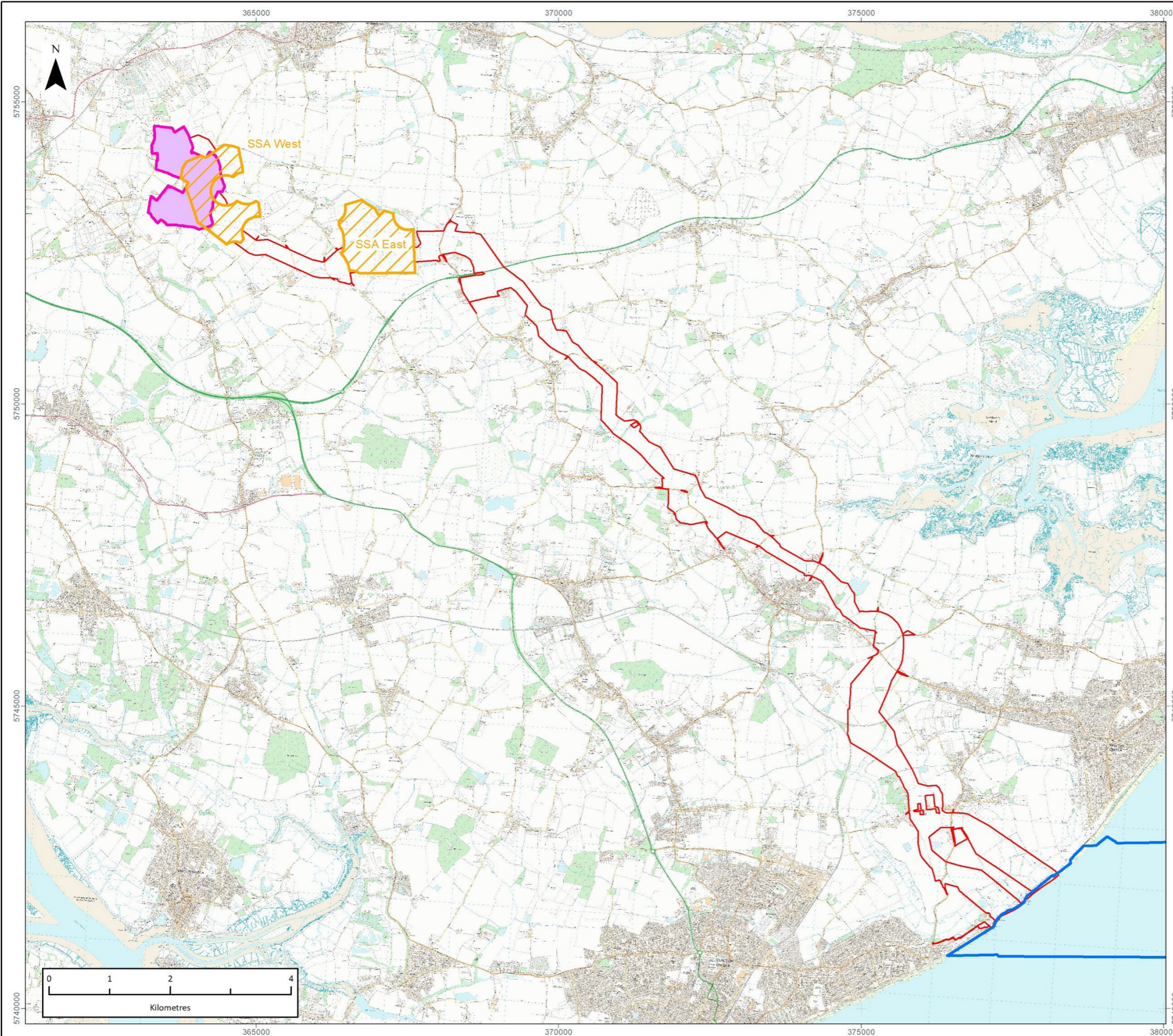
- 4.12.27 The BRAG assessment was undertaken to identify a long list of Onshore ECC Route Segment Options based upon a set of criteria as outlined above.
- 4.12.28 The Onshore ECC Route Segment Options identified are listed below; these were assessed as segments (Southern/Northern) split north and south of where they all the routes intersected north west of Thorpe-Le- Soken.
- > East AWM Alternative (North)
 - > East 1 (North)
 - > North West 1
 - > East 2 (South)
 - > East AWM Alternative (South)
 - > West 1
 - > West 2
- 4.12.29 As part of the process of assessing the Onshore ECC Route Segment Options, a number of refinements were made to further reduce potential impacts, such as movement away from habitats of principal importance (to a minimum of 20 m), avoiding and maximising distance from designated historic buildings, and reorientation of crossings of railways). One of the key technical constraints within the process was the identification of the Affinity Water Main (AWM) which broadly runs east to west along the same route as the East 1 and East 2. On receiving the utilities data the project sought to identify routes which had crossing alignments of this water main greater than 60° angle but optimal at 90°. This was a key criterion in identifying the more detailed preferred alignment of the Onshore ECC Route, which became the AWM. These crossing alignments are required to minimise the risk of induced voltages affecting the water main, and for practical construction of the crossings with the water main
- 4.12.30 From the Onshore ECC Route Segment Options shown following the initial BRAG and consideration of other consenting, engineering and economic considerations the following routes were dropped from further consideration:
- > West 1: Significant space constraints (very narrow gaps between residential ribbon development) and greater number of complex obstacle (railway and watercourse) crossings;
 - > West 2: Significant space constraints (very narrow gaps between residential ribbon development) and greater number of complex obstacle (railway and watercourse) crossings;
 - > East 1 (North): Significant number of sub-optimal crossings of the affinity watermain (technically unfeasible); and
 - > East 2 (South): Sub-optimal crossings of the affinity water main (technically unfeasible).
- 4.12.31 It was concluded that the following Onshore ECC Route Segment Options would be included within the stage 1 public consultation, held between 30 June and 12 August 2022.:
- > Southern part of the route is: East AWM Alternative
 - > Northern part of the route could be either: East AWM Alternative (North) or North West 1



4.12.32 Following consideration of technical issues, preliminary environmental assessments, and feedback received from landowners and communities Onshore ECC Route Segment Option North West 1 was removed from the project design. Initial assessments of this Onshore ECC Route Segment Option indicated the following key issues:

- > More crossings of watercourses and more gradients associated with this made it harder to mitigate environmental impacts and more challenging from an engineering perspective;
- > Lower lying land, with greater flood risk during construction;
- > More complex land use meant that a cable through this area had the potential to be more disruptive to more individual landowners; and
- > The proximity to Tendring, and Tendring Primary School, is significantly reduced with the use of the other cable route search area.

4.12.33 In addition, feedback received in response to Stage 1 consultation raised a number of concerns regarding the proximity to Tendring. While these impacts would primarily be limited to the construction phase and assessed and mitigated for as part of the EIA process, these concerns helped reinforce the decision to remove this option. The final Onshore ECC for PEIR is shown on Figure 4.15



- LEGEND**
- PEIR Onshore Red Line Boundary
 - Offshore Export Cable Route Area of Search
 - Onshore Substation Search Areas
 - National Grid Substation AoS

Data Source:
 Basemap: Ordnance Survey Vector Map Local Raster, Contains Ordnance Survey data
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PROJECT TITLE:
FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
Onshore Export Cable Corridor at PEIR

VER	DATE	REMARKS	Drawn	Checked
1	3/13/2023	For Issue	SWM	N/A

DRAWING NUMBER:
4.15

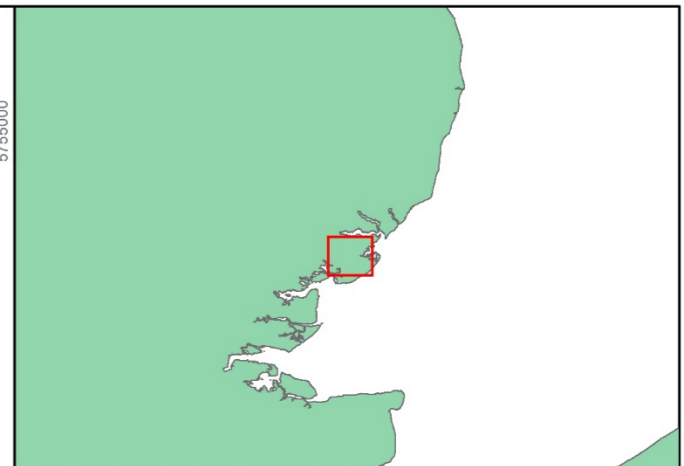
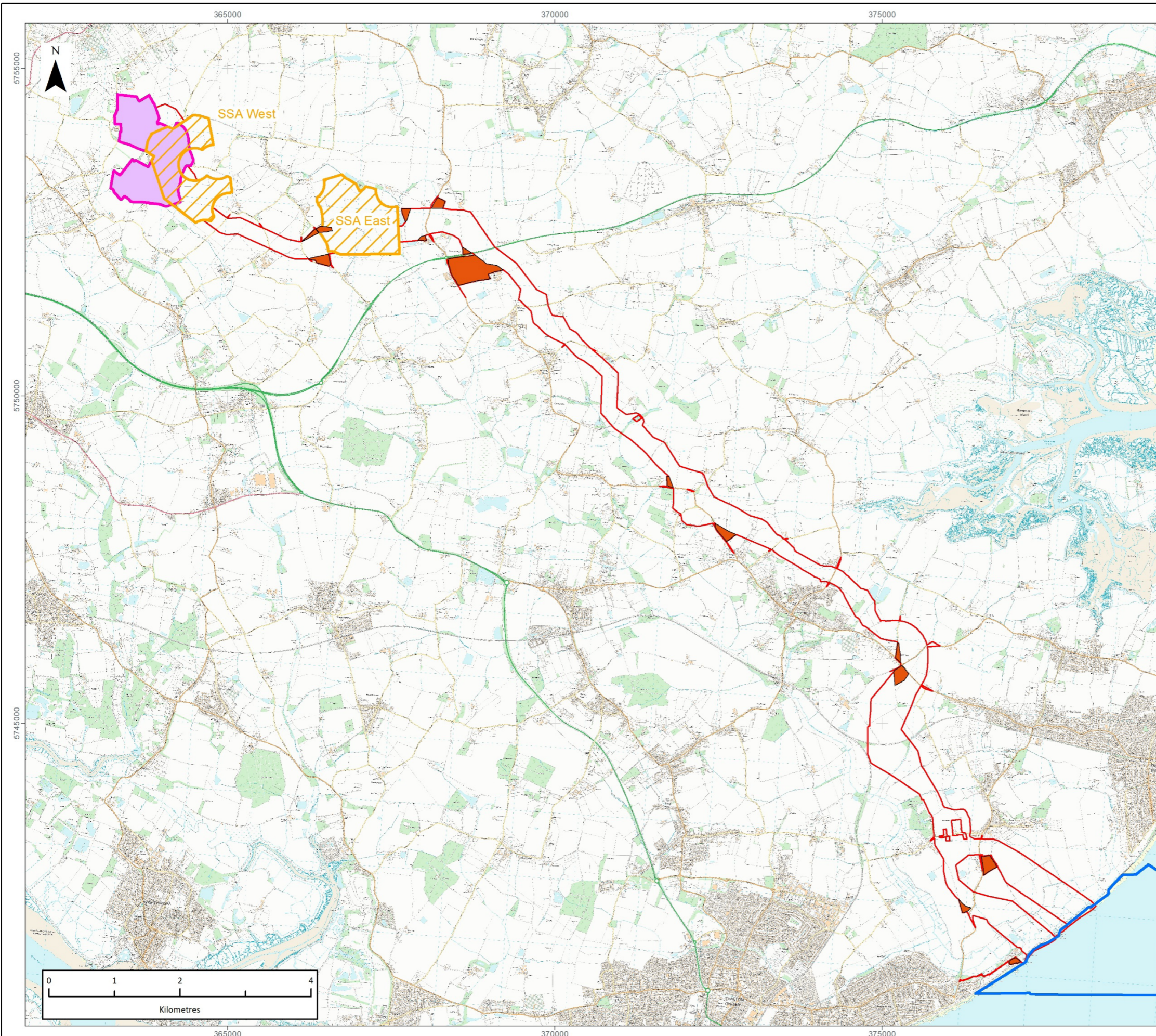
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ONSHORE TEMPORARY CONSTRUCTION COMPOUNDS

- 4.12.34 Indicative TCC zones have been identified along the Onshore ECC route for PEIR (see Figure 4.16). The locations of the TCCs were based on assessment of suitable land available adjacent to the Onshore ECC route at crossings of roads where HGV access was considered to be taken from, compounds were identified either side of roads where possible.
- 4.12.35 Refinement of location of TCCs may be required following feedback to the consultation and as a result of design refinement of the Onshore ECC Route.



- LEGEND**
- PEIR Onshore Red Line Boundary
 - Offshore Export Cable Route Area of Search
 - Onshore Substation Search Areas
 - National Grid Substation AoS
 - Temporary Construction Compounds

Data Source:
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PROJECT TITLE:
 FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:
 Indicative Temporary Construction Compound Zones at PEIR

VER	DATE	REMARKS	Drawn	Checked
1	3/13/2023	For Issue	SWM	MB

DRAWING NUMBER:
 4.16

SCALE: 1:60,000 PLOT SIZE: A3 DATUM: WGS84 PROJECTION: UTM31N





4.13 CONCLUSION

- 4.13.1 The site selection process undertaken for VE so far has resulted in the current engineering design, total area, and construction, operation, maintenance and decommissioning techniques assessed throughout the PEIR. Wherever possible and practicable, VE has sought to accommodate preferences and concerns raised by stakeholders through the site selection process whether by adjustments to the development boundary, areas of works, or designs being considered.
- 4.13.2 Examples of this with regard to stakeholder comments are set out in the PEIR chapters. The site selection process and alternatives considered have been through a process of detailed analysis of environmental, social, and engineering constraints, with key feasible alternatives taken forward for consultation either through the Scoping process, the Evidence Plan, or through specific consultation meetings. The consultation processes undertaken are summarised in this document.
- 4.13.3 As detailed in Volume 1, Chapter 3: 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 a number of refinements to the project envelope so far as practical, there remain some areas of flexibility in the final project design.
- 4.13.4 In relation to coordination with the North Falls project, the options being assessed in this PEIR facilitate the opportunity to coordinate on offshore the export cable routing, the onshore export cable route, and the onshore substations in that they can be separately located or co-located on the same site. The offshore RLB for PEIR enables Five Estuaries to continue to engage with North Falls to assess opportunities to reduce cumulative impacts in the marine environment and make RLB refinements following the PEIR consultation and stakeholder feedback.

NEXT STEPS

- 4.13.5 Following the completion of VE's statutory consultation, this chapter will be updated to include new 'Stages 8 (offshore) and 9 (onshore)' that will highlight any changes or revisions between the proposals as they are currently set out and assessed within PEIR and those which are included for the final DCO submission. These will broadly cover:
- > Selection of landfall location and proposed drilling compounds
 - > Refinement of onshore ECC and TCC locations
 - > Selection of the OnSS location and associated temporary construction compound
 - > Refinement of the offshore export cable route
- 4.13.6 An FRA will be undertaken for substation locations to inform selection of the final site. This will include consideration of all potential sources of flooding e.g., surface water, groundwater, sewers etc.
- 4.13.7 As discussed earlier due to the location of the VE and North Falls projects, we continue to work closely on key elements such as cable corridor selection (to optimise both onshore routes).



4.14 REFERENCES

CCC, 2020. The Sixth Carbon Budget. The UK's path to Net Zero. Committee on Climate Change. December 2020 Presented to the Secretary of State pursuant to section 34 of the Climate Change Act 2008.

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www.theccc.org.uk/publication/2022-progress-report-to-parliament/.



F I V E 
ESTUARIES
OFFSHORE WIND FARM

PHONE
EMAIL
WEBSITE
ADDRESS

0333 880 5306
fiveestuaries@rwe.com
www.fiveestuaries.co.uk

COMPANY NO

Five Estuaries Offshore Wind Farm Ltd
Windmill Hill Business Park
Whitehill Way, Swindon, SN5 6PB
Registered in England and Wales
company number 12292474

