FIVE ESTUARIES OFFSHORE WIND FARM

ENVIRONMENTAL IMPACT ASSESSMENT: SCOPING REPORT

Document Reference	003444569-01
Revision	1.0
Date	30 September 2021

Project	Five Estuaries Offshore Wind Farm
Sub-Project or Package	EIA Scoping
Document Title	Five Estuaries Offshore Wind Farm EIA Scoping Report
Document Reference	003444569-01
Revision	Final
Supplier Reference No	Final

Revision	Date	Status/Reason for Issue	Originator	Checked	Approved
01	300921	Final	GoBe	GoBe	VE OWFL

EXECUTIVE SUMMARY

This document supports a request for an Environmental Impact Assessment (EIA) Scoping Opinion from The Planning Inspectorate for the Five Estuaries Offshore Wind Farm (VE). VE is a Nationally Significant Infrastructure Project (NSIP). An EIA will be provided as part of a Development Consent Order (DCO) application under the Planning Act 2008.

This EIA Scoping Report has been prepared on behalf of Five Estuaries Offshore Wind Farm Ltd (VE OWFL) in accordance with Regulation 10 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 and Regulation 6 of the Marine Works (Environmental Impact Assessment) Regulations 2007.

VE is a proposed extension to the operational Galloper Offshore Wind Farm (OWF). The Galloper OWF consists of 56 WTGs and supplies electricity to approximately 380,000 households annually. A 60-strong team operates and maintains the wind farm from a state-of-the-art, purpose-built Operations & Maintenance facility in Harwich International Port. The key drivers for renewable energy in the UK, and therefore the VE project, are reducing greenhouse gas emissions, providing increased energy security, and maximising economic opportunities for the UK and local economies. The VE wind turbine generators (WTGs) will be situated within two array areas to the east of the operational Galloper OWF. The array areas will be located approximately 30 km off the coast of Suffolk, England. Extension projects, such as VE, are considered to represent a significant opportunity for cost reduction in offshore wind through the benefits of experience in constructing and operating OWFs neighbouring the site; and existing datasets and environmental studies. This is an increasingly important driver under the highly competitive UK electricity market which aims to deliver the best possible value to the consumer.

Early feasibility for VE is underway at the time of writing and therefore some project details are yet to be confirmed. The project could consist of up to 79 WTGs. Cables will connect the turbines to the offshore substation platforms and then export the power generated to shore. It is expected that there will be a number of inter-array cables, up to four export cables and up to two offshore substation platforms.

It is anticipated that the connection to the National Grid will be at a new substation to be called the East Anglia Costal Substation (EACS). The location of the EACS has not yet been confirmed by National Grid. The VE onshore export cables will be installed (underground) between the landfall and the grid connection point. There are currently several options being explored for the onshore export cable route. A landfall area has been identified between Holland-on-Sea and Frinton-on-Sea on the Essex coast. The landfall point is yet to be determined but will be located within this area of coastline. A new VE onshore substation will be needed and is likely to be constructed near to the National Grid's EACS.

Through a Site Selection Study (SSS) a preferred offshore export cable route (OECR) has been identified through extensive constraints analysis and consultation with stakeholders. However, the Scoping Boundary has been widened to allow for route refinement and micrositing. A SSS is currently being undertaken to identify the preferred onshore cable route and VE substation location. This onshore SSS will be dependent on confirmation of National Grid's EACS location (when available). Further details of the SSS are provided within this Scoping Report. Consultation is already underway with key stakeholders and will continue

through the DCO process. Public consultation will also be undertaken which will help inform the development of the project, as well as the EIA.

This Scoping Report is intended to facilitate formal consultation with The Planning Inspectorate and relevant consultees in the EIA process, inviting them to provide relevant information and to comment on the proposed approach to the EIA, to ensure that a robust Environmental Statement is prepared in support of an application for the development of VE. In that regard, the main elements of the offshore and onshore, human, biological and physical environment likely to be significantly affected by the construction, operation and decommissioning of VE have been identified. This document also outlines the extent of proposed environmental studies to be undertaken as part of the EIA.

VE OWFL is aware of the ongoing consultation and review of the existing energy National Policy Statements (NPS) and its potential wider implications on future co-operation between projects (not just offshore wind farms). VE and the nearby North Falls Offshore Wind Farm are currently being developed as two distinct projects with separate ownership/shareholders. However, co-ordination of stakeholder engagement, construction, infrastructure and operations plans are being explored for the project development phase and will be progressed where this is considered practicable and feasible.

A number of potential environmental impacts are considered within this Scoping Report. The identification of impacts within this Scoping Report has been based upon an understanding of the environmental conditions likely to be encountered within VE, utilising information that has been gained during the development of Galloper OWF and other publicly available data sources. For a number of identified potential impacts, further data collection and assessment is proposed in order to inform the EIA. For other potential impacts, it is proposed, based on an understanding of the nature of the development (including measures adopted as part of the project), that they are scoped out of the EIA (i.e. no further data collection or assessment is proposed).

Consultees are invited to consider all of the information provided in this Scoping Report and to provide comments on the proposed approach and in particular whether they agree with the conclusions. Topic specific questions for consultees are provided at the end of each technical section which have been designed to encourage reflection on the key elements of each technical topic in this Scoping Report.

CONTENTS

TABLES

FIGURES

DEFINITION OF ACRONYMS

TERM	DEFINTION
(g)mS	Slightly Gravelly Muddy Sand
(g)S	Slightly Gravelly Sand
AADT	Annual Average Daily Traffic
ACC	Area Control Centre
ADR	Air Defence Radar
ADS	Archaeology Data Service
AEP	Annual Exceedance Probability
AEZ	Archaeological Exclusion Zone
AfL	Agreement for Lease
agl	Above Ground Level
AIL	Abnormal Indivisible Load
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation And Control
AIS	Automatic Identification System
ALAR	Abnormal Load Assessment Report
amsl	Above Mean Sea Level
ANO	Air Navigation Order
ANS	Air Navigation Service
AONB	Area of Natural Beauty
AoS	Area of Study
APFP Regulations	Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
ASACS	Air Surveillance and Control System
ASR	Air Quality Annual Status Report
ATC	Air Traffic Control
ATDI	Advanced Terrain Digital Imaging
ATS	Air Traffic Service
AURN	Automatic Urban and Rural Network

TERM	DEFINTION
BEIS	Department for Business, Energy & Industrial Strategy
BGS	British Geological Survey
BMAPA	British Marine Aggregate Producers Association
BoCC	Birds of Conservation Concern
BODC	British Oceanographic Data Centre
BP	Before Present
BPM	Best Practicable Means
BRAG	Black, Red, Amber and Green
BTO	British Trust for Ornithology
CA	Cruising Association
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAS	Controlled Airspace
CCS	Carbon Capture and storage
CDM	Construction Design and Management Regulations
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CfD	Contracts for Difference
CFMP	Catchment Flood Management Plan
CI	Confidence Interval
CIA	Cumulative Impact Assessment
CIAL	Corridor Identification and Approval for Linear Activities
CIEEM	Chartered Institute of Ecology and Environmental Management
CIfA	Chartered Institute for Archaeologists
CION	Connection and Infrastructure Options Note
CIRIA	Construction Industry Research and Information Association
CLR	Contaminated Land Report
CoCP	Code of Construction Practice
COLREGs	International Regulation for the Prevention of Collision at Sea
COP	Conference of the Parties
CPA	Coast Protection Act
CPA	Coast Protection Act

TERM	DEFINTION
CRM	Collision Risk Model
CRP	Cable Route Protocol
CSM	Conceptual Site Model
CTA	Control Area
CTMP	Construction Traffic Management Plan
DCLG	Department for Communities and Local Government
DCO	Development Consent Order
DDV	Drop Down Video
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DGC	Defence Geographic Centre
DHA	Designated heritage asset
DML	Deemed Marine Licence
DMRB	Design Manual for Roads and Bridges
DMRB	Design Manual for Roads and Bridges
DOC	Documented Operational Coverage
DP	Decommissioning Plan
DTI	Department of Trade and Industry
DTM	Digital Terrain Model
EA	Environment Agency
EACS	East Anglia Coastal Substation
EC	European Commission
SCC	Suffolk County Council
EcIA	Ecological Impact Assessment
ECP	England Coast Path
ECR	Export Cable Route
EEZ	Exclusive Economic Zone
EFC	Essex Field Club
EHO	Environmental Health Officer
EIA	Environmental Impact Assessment
EIFCA	Eastern IFCA

TERM	DEFINTION
EMF	Electromagnetic Field
EMR	Electricity Market Reform
EPA	Environmental Protection Act
EPP	Evidence Plan Process
EPUK	Environmental Protection UK
ERCoP	Emergency Response Co-operation Plan
ES	Environmental Statement
ESFJC	Eastern Sea Fisheries Joint Committee
ETG	Expert Topic Group
EU DCF	EU Data Collection Framework
EU	European Union
EUMOFA	EU Market Observatory for Fisheries and Aquaculture
EUNIS	European Nature Information System
EWT	Essex Wildlife Trust
FEPA	Food and Environment Protection Act
FIR	Flight Information Region
FIS	Flight Information Service
FL	Flight Level
FLO	Fisheries Liaison Officer
FLOWW	Fisheries Liaison with Offshore Wind and Wet Renewables group
FPO	Fish Producers Organisations
FRA	Flood Risk Assessment
FSA	Formal Safety Assessment
G	Gravel
GA	General Aviation
GAAC	General Aviation Awareness Council
GBP	British pound sterling
GCN	Great Crested Newt
GDP	Gross Domestic Product
GE Wind Energy	General Electric Wind Energy
GEART	Guidance for Environmental Assessment of Road Traffic

TERM	DEFINTION
GGOWL	Greater Gabbard Offshore Wind Limited
GIS	Geographical Information System
GLVIA	Guidelines for Landscape and Visual Impact Assessment
gm	Gravelly Mud
gmS	Gravelly Muddy Sand
GREP	Global Renewable Energy Partners
gS	Gravelly Sand
GT	Gross Tonnage
GVA	Gross Value Added
GWD	Groundwater Directive
HAT	Highest Astronomical Tide
HDD	Horizontal Directional Drilling
HDV	Heavy Duty Vehicle
HER	Historic Environment Record
HGV	Heavy Goods Vehicle
HHA	Harwich Haven Authority
HLC	Historic Landscape Character
HRA	Habitats Regulations Assessment
HSC	Historic Seascape Characterisation
IAIP	Integrated Aeronautical Information Package
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IAMMWG	Inter-Agency Marine Mammal Working Group
IAQM	Institute of Air Quality Management
IBTS	The International Bottom Trawl Surveys
ICAO	International Civil Aviation Organisation
ICES	International Council for the Exploration of the Sea
IDB	Internal Drainage Board
IEEM	Institute of Ecology and Environmental Management
IEMA	Institute of Environmental Management and Assessment
IFCA	Inshore Fisheries and Conservation Authorities
IFISH	Integrated Fisheries System Holding

TERM	DEFINTION
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
IHLS	The International Herring Larval Survey
ILT	Inspectie Leefomgeving Transport
IMC	Instrument Flight Conditions
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
IOF	Important Ornithological Feature
IRZ	Impact Risk Zone
iSEA	Interactive Spatial Explorer and Administrator
IUCN	International Union for Conservation of Nature
JCP	Joint Cetacean Protocol
JNCC	Joint Nature Conservation Committee
JNCC	Joint Nature Conservation Committee
KEIFCA	Kent & Essex Inshore Fisheries and Conservation Authority
KESFC	Kent and Essex Sea Fisheries Committee
km	Kilometre
LAI	Local Area of Influence
LAL	London Array Ltd
LAQM	Local Air Quality Management
LARS	Lower Airspace Radar Service
LAT	Lowest Astronomical Tide
LB	Listed building (categorised under three grades: I, II* and II)
LCA	Landscape Character Area
LCCC	Low Carbon Contracts Company
LCT	Landscape Character Type
LDV	Light Duty Vehicle
LFP	Lost Frontiers Project
LGV	Light Goods Vehicle
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve

TERM	DEFINTION
LOA	Length Overall
LOS	Line of Sight
LPUE	Landings per unit effort
LRN	Local Road Network
LSA	London Southend Airport
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Site
m	Metre
MAGIC	Multi Agency Geographic Information for the Countryside
MAIB	Marine Accident Investigation Branch
MALSF	Marine Aggregate Levy Sustainability Fund
MCA	Maritime and Coastguard Agency
MCEU	Marine Consents and Environmental Unit
MCZ	Marine Conservation Zones
MDS	Maximum Design Scenario
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
Mil	Military
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MMU	Minimum Mapping Unit
MOD	Ministry of Defence
MPCP	Marine Pollution Contingency Plan
MPS	Marine Policy Statement
MRCC	Maritime Rescue Coordination centre
mS	Muddy Sand
MSA	Minimum Safe Altitude
msG	Muddy Sandy Gravel
MW	Megawatt
MW&SQ	Marine Water and Sediment Quality
NBN	National Biodiversity Network
NCA	National Character Area

TERM	DEFINTION
NCN	National Cycle Network
NDHA	Non-designed heritage asset
NEEBG	North East Essex Badger Group
NERL	NATS En Route Limited
NFFO	National Federation of Fishermen's Organisations
NGET	National Grid Electricity Transmission
NM	Nautical Mile
NNR	National Nature Reserve
NO_2	Nitrogen Dioxide
Noise	Noise is related to a human response and is routinely described as unwanted sound, or sound that is considered undesirable or disruptive
NPPF	National Planning Policy Framework
NPS	National Policy Statements
NRA	Navigational Risk Assessment
NRHE	National Record of the Historic Environment
NSIP	Nationally Significant Infrastructure Project
NSPP	North Sea Palaeolandscape Project
NSR	Noise Sensitive Receptor
NtM	Notice to Mariners
O&M	Operations and Maintenance
OECR	offshore Export Cable Route
offshore AoS	offshore Area of Search
ONS	Office of National Statistics
onshore AoS	Onshore Area of Search
OnSS	Onshore substation
OREI	Offshore Renewable Energy Installation
OS	Ordnance Survey
OSP	Offshore Substation Platform
OSPAR	Oslo and Paris Convention (for the Protection of the Marine Environment of the North-East Atlantic)
OTP	Outline Travel Plan
OWF	Offshore Wind Farm

TERM	DEFINTION
PAD	Protocol for Archaeological Discoveries
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PCL	Potential Contaminant Linkages
PEA	Preliminary Ecological Appraisal
PEAR	Preliminary Ecological Appraisal Report
PEIR/PEI	Preliminary Environmental Information Report/ Preliminary Environmental Information
PEMP	Project Environment Management Plan
PEXA	Practice and Exercise Area
PFS	Petrol Filling Station
PINS	Planning Inspectorate
PLA	Port of London Authority
PLQRA	Phase I Preliminary Land Quality Risk Assessment
PM	Particulate matter
PM_{10}	Particulate matter with an aerodynamic diameter ≤10 μm
Pollutant Linkage	An established conceptual relationship between a source, pathway and receptor of contamination
PPE	Personal Protective Equipment
PRoW	Public Right of Way
PSA	particle size analysis
pSPA	Proposed Special Protection Area
PSR	Primary Surveillance Radar
PTS	Permanent Threshold Shift. A total or partial permanent loss of hearing at a particular frequency caused by some kind of acoustic trauma. PTS results in irreversible damage to the sensory hair cells of the ear, and thus a permanent reduction of hearing acuity at that frequency.
PWS	Private Water Supply
RAF	Royal Air Force
RAP	Recognised Air Picture
RCS	Radar Cross Section
RDP	Radar Data Processor
REC	Regional Environmental Classification

TERM	DEFINTION
RIAA	Report to Inform Appropriate Assessment
RLB	Red Line Boundary
RNLI	Royal National Lifeboat Institution
Royal Haskoning DHV	RH DHV
RPG	Registered Parks and Gardens
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
S	Sand
SAC	Special Areas of Conservation
SAR	Search and Rescue
SCA	Seascape Character Area
SCADA	Supervisory Control and Data Acquisition
SCANS	Small Cetaceans in the European Atlantic and North Seas
SCHAONB	Suffolk Coast Heaths Area of Outstanding Natural Beauty
SCI	Site of Community Importance
SCOS	Special Committee on Seals
SCT	Seascape Character Type
SEA	Strategic Environment Assessment
SFRA	Strategic Flood Risk Assessment
sG	Sandy Gravel
SLVIA	Seascape, landscape and visual assessment
sM	Sandy Mud
SMA	Seasonal Management Area
SMP	Shoreline Management Plan
SMRU	Sea Mammal Research Unit
SNCB	Statutory Nature Conservation Body
SoCC	Statement of Community Consultation
SOLAS	International Convention for the Safety of Life at Sea
SoS	Secretary of State
SPA	Special Protection Areas
SPL	Sound Pressure Level.

TERM	DEFINTION
SPM	Suspended Particulate Matter
SPZ	Source Protection Zone
SRN	Strategic Road Network
SSC	Suspended Sediment Concentration
SSR	Secondary Surveillance Radar
SSS	Site Selection Study
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage System
Sustrans	The organisation responsible for setting up and managing the NCN
TAC	Total Allowable Catch
TBT	Tributyltin
TCE	The Crown Estate
TDC	Tendring District Council
TJB	Transition Joint Bay
TOC	Total Organic Carbon
TP	Transition Piece
TSS	Traffic Separation Scheme
TTS	Temporary Threshold Shift.
UK	United Kingdom
UKCP	United Kingdom climate predictions
UKFEN	UK Fisheries Economics Network
UKFIM	UK Fisheries Information Mapping
UKHO	United Kingdom Hydrographic Office
UKLFS	United Kingdom Low Flying System
UXO	Unexploded Ordnance
VE OWFL	Five Estuaries Offshore Wind Farm Limited
VE	Five Estuaries Offshore Wind Farm
VFR	Visual Flight Rules
VMS	Vessel Monitoring System
VTS	Vessel Traffic Services
WeBS	Wetland Bird Survey
WFD	Water Framework Directive

TERM	DEFINTION
WHS	World heritage site
WSA	Wider Study Area
WSI	Written Scheme of Investigation
WTG	Wind Turbine Generator
WWI	World War One
WWII	World War Two
ZTV	Zone of Theoretical Visibility

1. INTRODUCTION

1.1 BACKGROUND

1.1.1 This Environmental Impact Assessment (EIA) Scoping Report has been prepared on behalf of Five Estuaries Offshore Wind Farm Limited (VE OWFL) in accordance with Regulation 10 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017[1] (the 2017 EIA Regulations).

1.1.2 The Five Estuaries Offshore Wind Farm (VE) is a proposed extension to the operational Galloper Offshore Wind Farm, which is located 30 km off the coast of Suffolk, England. VE comprises an offshore generating station with a capacity of greater than 100 Megawatt (MW) and therefore is a Nationally Significant Infrastructure Project (NSIP), as defined by Section 15(3) of the Planning Act 2008[2]. As such, there is a requirement to submit an Application for a Development Consent Order (DCO) to the Secretary of State (SoS). A Marine Licence is also required under the Marine and Coastal Access Act 2009[3] before carrying out any licensable marine activity, which includes the works required to construct VE. This will be included within the DCO (if granted).

1.1.3 The DCO will be accompanied by an Environmental Statement (ES) prepared in accordance with the 2017 EIA Regulations, the development falling under Schedule 2 of the 2017 EIA Regulations. This Scoping Report supports a request for a formal EIA Scoping Opinion from the Planning Inspectorate the Planning Inspectorate in relation to VE.

1.1.4 This Scoping Report presents an initial overview and description of the project and a review of the potential impacts associated with the construction, operation and maintenance, and decommissioning phases of VE.

1.1.5 All project details presented in this report are accurate at the time of writing. Based on this understanding, this Scoping Report aims to identify the potential likely significant effects arising from VE on the physical, human and biological environments. This report also outlines the proposed approach to understanding and characterising the baseline conditions and assessing environmental impacts through the EIA process.

1.1.6 This Scoping Report also builds on and makes reference to agreements already made through discussion with stakeholders regarding selected topics which have been discussed prior to the publication of this report (see Chapter 6).

CO-OPERATION WITH OTHER PROJECTS

1.1.7 VE OWFL is aware of the ongoing consultation and review of the existing energy National Policy Statements (NPS) and its potential wider implications on future co-operation between projects (not just offshore wind farms).

[1] https://www.legislation.gov.uk/uksi/2017/572/contents
[2] https://www.legislation.gov.uk/ukpga/2008/29/contents
[3] https://www.legislation.gov.uk/ukpga/2009/23/contents

1.1.8 Based on the OFGEM Offshore Transmission Network Review (OTNR) consultation, VE OWFL is aware of other alternative options that could be considered in future, provided the relevant regulatory and support mechanisms were in place.

1.1.9 VE and the nearby North Falls Offshore Wind Farm are currently being developed as two distinct projects with separate ownership/shareholders. However, co-ordination of stakeholder engagement, construction, infrastructure and operations plans are being explored for the project development phase and will be progressed where this is considered practicable and feasible.

SCOPING BOUNDARY

1.1.10 Offshore and onshore scoping boundaries for VE are presented in Figure 1.1 and Figure 1.2 respectively. These scoping boundaries include the search areas within which the onshore and offshore infrastructure is proposed to be installed (at the time of writing).

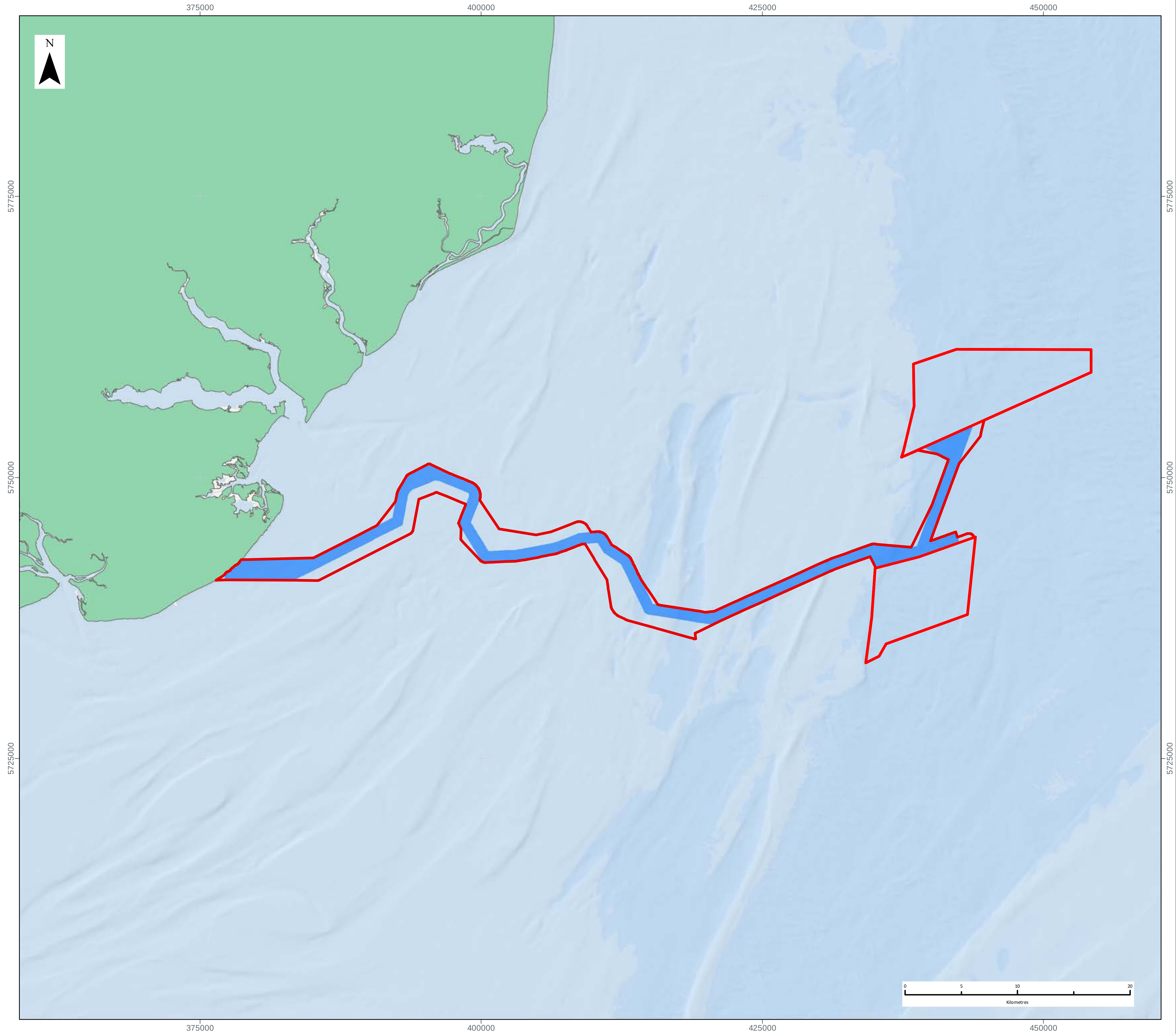
1.1.11 The location for the proposed arrays were selected by VE OWFL on the basis of a number of environmental and engineering constraints (described in Chapter 5) pursuant to The Crown Estate issuing an opportunity for operating offshore wind farms to apply for extensions in 2017.

1.1.12 A grid offer was accepted in late 2020 to connect to a new substation to be called the East Anglia Costal Substation (EACS). The location of the EACS is currently subject to an ongoing National Grid site selection exercise. It is anticipated that the EACS will be sited within the onshore AoS as presented in Figure 1.2. Chapter 5of this Scoping Report provides further details on how the scoping boundaries have been refined and defined.

1.1.13 Within the onshore and offshore Areas of Search (AoS) the offshore infrastructure (Wind Turbine Generators and platforms), onshore and offshore export cable routes (ECRs), landfall and onshore substation will be located. The onshore and offshore AoS have been identified, following consideration of the guidance and requirements set out in Chapter 5. They have been refined by applying high level engineering and environmental constraints to the area between the array and the coastal area of Essex adjacent to the potential location of the EACS.

1.1.14 Figure 1.1 sets out the offshore scoping boundary for the area under consideration for the offshore export cable route (ECR) corridor and associated landfall area and the array sites. Extensive stakeholder engagement has been carried out to define the preferred VE offshore ECR corridor within the scoping boundary, which is also illustrated in Figure 1.1. Geophysical and benthic survey is being carried out on the array areas (and an associated 500m buffer) and the preferred offshore ECR corridor. VE OWFL are aware that the scoping boundary for the VE preferred offshore ECR (as set out in Figure 1.1) also incorporates the area surveyed by the North Falls Offshore Wind Farm project for their potential ECR and included in their Scoping Document (North Falls Offshore Wind Farm Ltd, 2021). VE's scoping boundary is wider than the preferred VE offshore ECR corridor that has been consulted upon, to provide flexibility in design and to assess, where possible, the potential of reducing interaction with other parties within the area.

1.1.15 Figure 1.2 sets out the scoping boundary for the area considered for VE onshore infrastructure including the landfall, cable routes and substation. A detailed site selection process is ongoing and initial stakeholder discussions have been held to determine the options available for onshore infrastructure locations. VE are aware that the onshore scoping boundary is similar to that for the North Falls Offshore Wind Farm project (as detailed in their Scoping Document (North Falls Offshore Wind Farm Ltd, 2021) and this could give rise to opportunities for coordination between the two projects for onshore siting and routing studies, should this be feasible and appropriate. It should be noted that the final location of the VE infrastructure and routing to the EACS substation is subject to change following confirmation, by National Grid of their substation location.



LEGEND

- Array Areas
- Offshore Scoping Boundary
- Preferred Offshore Export Cable Route

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Site overview of scoping boundary - offshore

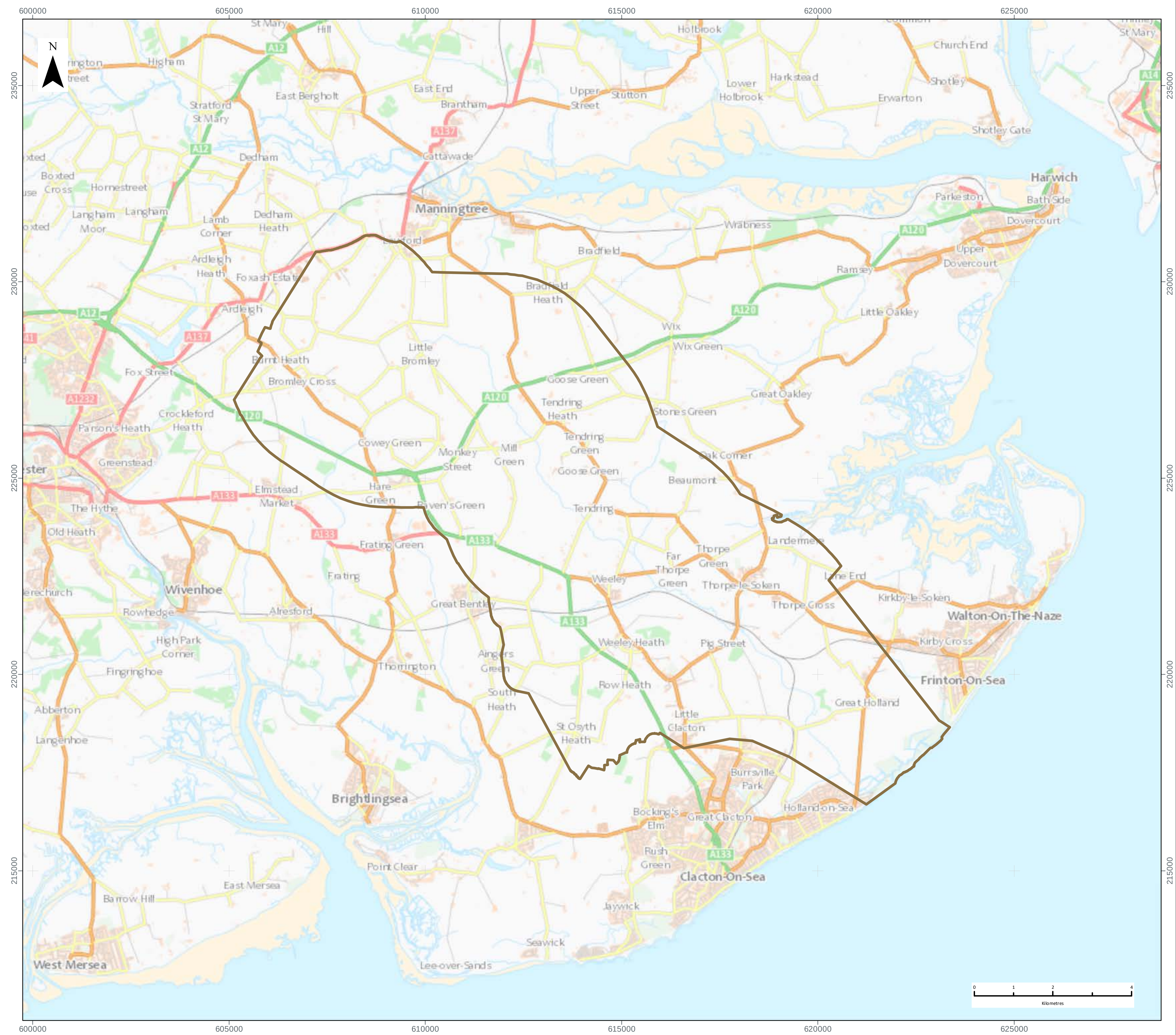
VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	BPHB	SM

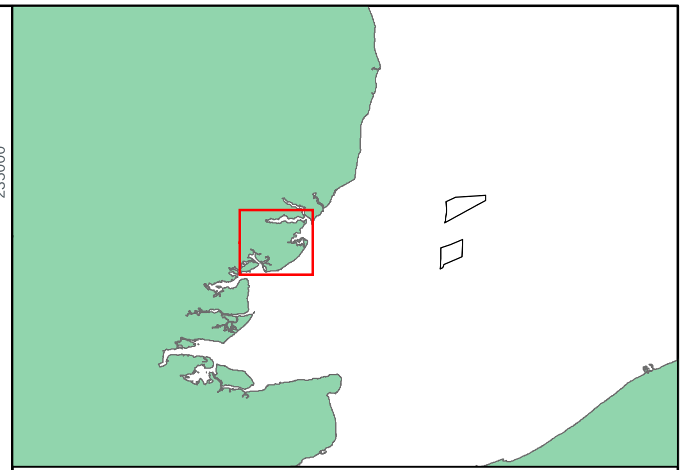
DRAWING NUMBER:

1.1

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

FIVE ESTUARIES
OFFSHORE WIND FARM





LEGEND

Onshore Area of Search

Data Source:
Basemap: Contains OS data © Crown Copyright and database right 2020

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Site overview of scoping boundary - onshore

VER	DATE	REMARKS	Drawn	Checked
1	17/09/2021	For Issue	BPHB	SM

DRAWING NUMBER:

1.2

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

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Introduction\VE_Scoping_Boundary_Onshore.mxd

1.2 PURPOSE OF THIS SCOPING REPORT

1.2.1 To start the DCO process, VE OWFL has prepared this EIA Scoping Report, which presents an initial review of the potential issues associated with the construction, operation and maintenance, and decommissioning phases of VE. The purpose of the Scoping Report is to request a formal Scoping Opinion from the SoS in accordance with Regulation 10 of the 2017 EIA Regulations and to ensure a proportionate EIA.

1.2.2 To comply with Regulation 10 of the 2017 EIA Regulations, this Scoping Report provides:

> Plans sufficient to identify the area required for the construction, operation and decommissioning of VE; and

> A brief description of the nature and purpose of the proposed development and of its possible effects on the environment.

1.2.3 The Scoping Report also identified key environmental features which have the potential to be affected by VE and outlines additional data that will be collated to facilitate a detailed assessment of the potential impacts within the EIA. Furthermore, this report provides an overview of all potential issues and provides robust and sufficient justification for focusing the EIA on those issues which have the potential to be significant (in EIA terms) and to reduce the emphasis on issues which are demonstrably not significant (in EIA terms). This approach enables the EIA to be focused on the potential key issues. The overall objective of the EIA will be to satisfy the requirements of the Planning Act 2008 and the associated 2017 EIA Regulations.

1.2.4 The ES, which reports the EIA, will be based on the Scoping Opinion, informed by the recommendations of the consultees and the information contained within this Scoping Report.

NOTIFICATION OF ACCOMPANYING ENVIRONMENTAL STATEMENT

1.2.5 The Applicant hereby gives notice, pursuant to Regulation 8(1)(b) of the 2017 EIA Regulations, that the Application for a DCO will be accompanied by an ES. The ES will include at least the information set out in Regulation 14(a) - (e) and any additional information specified in Schedule 4 relevant to the specific characteristics of VE and to the environmental features likely to be significantly affected. It will include the information reasonably required for reaching a reasoned conclusion on the likely significant effects of VE.

1.3 THE APPLICANT

1.3.1 The Applicant is VE OWFL. The project partners are the same as the operational Galloper Wind Farm and include a Macquarie-led consortium (25%), RWE (25%), Siemens' financing arm, Siemens Financial Services (25%), ESB (12.5%) and Sumitomo Corporation (12.5%). RWE is leading the development of the project.

1.3.2 RWE Renewables is RWE´s renewables powerhouse of the future. Until 2022 up to net €5 billion will be available for renewables and innovative storage technologies, the operating business is focusing on offshore and onshore wind as well as photovoltaics. World-wide we power over 10 million homes and have over 2,600 employees.

1.3.3 In the UK, RWE is currently the third largest renewable generator, with a diverse portfolio of onshore wind and offshore wind amounting to over 2.2 gigawatts (GW). Its biggest share of renewable generation is from offshore wind. RWE is ideally positioned in the UK, with a combination of flexible power assets in addition to wind and solar. RWE already generates around 12% of all the electricity generated in the UK, a figure that we expect to grow as we expand our renewables portfolio.

1.3.4 RWE is investing billions of pounds into projects in the UK and currently has an operating UK portfolio of nine offshore wind farms. In 2020 wind farms operated by RWE Renewables in the UK invested over £4.3 million into local communities, through their community benefit funds.

1.3.5 RWE Renewables operational offshore wind farms on the East coast of England, Galloper (353MW) and Greater Gabbard (504MW) generate enough low-carbon renewable energy each year to power the equivalent of over 780,000 UK homes. Greater Gabbard Offshore Wind Farm is a joint venture between SSE Renewables (50%) and RWE Renewables (50%). SSE Renewables operates the Greater Gabbard Offshore Wind Farm. Galloper is owned by a Macquarie led consortium (25%), RWE Renewables (25%), Siemens' financing arm, Siemens Financial Services (25%), ESB (12.5%) and a fund established by Sumitomo Corporation, Sumitomo Mitsui Banking Corporation and Development Bank of Japan (12.5%). RWE Renewables has led the development and construction of the Galloper project and its ongoing operation on behalf of the project partners.

1.3.6 The projects have led to the creation of 15 skilled apprentice opportunities, around 160 long-term skilled jobs to support the operation and maintenance of the wind farms, and around £3 billion in project investment overall. The teams have worked extensively with schools and educational institutes, and teachers and pupils along the East coast, to deliver numerous career insight sessions and STEM presentations to promote knowledge of the renewables industry and associated job opportunities.

1.3.7 RWE is also actively involved in industry bodies including RenewbleUK and the East of England Energy Group (EEEGR). Over recent years RWE has supported numerous supply chain and industry events, via sponsorship and speaking opportunities, and participation in meet the buyer events, business breakfasts, awards and sponsorship. This activity is ongoing, including participation in the recently launched East Anglia Wind Cluster Forum.

1.3.8 Moving forward, the UK will continue to play a key role in RWE's strategy to grow its renewables business and to become carbon neutral by 2040. As one of the world's leading players in offshore wind, the company supports the UK Government in achieving its goal of having every single home powered by offshore wind within the next 10 years.

1.4 THE EIA SCOPING TEAM

1.4.1 The preparation of the EIA scoping is being led by GoBe Consultants Ltd working closely with SLR Consulting. In addition, a number of specialist consultancies have provided expert input into the scoping topic chapters (see Table 1.2 below).

1.4.2 GoBe Consultants' EIA activities and ESs are accredited by the Institute of Environmental Management and Assessment (IEMA) under the EIA Quality Mark Scheme. This demonstrates GoBe Consultants' commitment to ensuring EIA is undertaken at high quality and in accordance with best practice.

1.4.3 Pursuant to Regulation 14(4) of the 2017 EIA Regulations, the ES will be prepared by competent experts and the ES will outline the relevant expertise or qualifications of the experts.

1.5 POLICY AND LEGISLATIVE CONTEXT

THE PLANNING ACT 2008

1.5.1 The Planning Act 2008 (as amended) is the primary legislation that established the legal framework for applying for, examining, and determining applications for NSIPs taking into account the guidance in National Policy Statements (NPS).

NATIONAL POLICY STATEMENTS

1.5.2 NPSs are produced by the UK Government and set outs set out the government's policy for the delivery of energy infrastructure and provides the legal framework for planning decisions. for major infrastructure projects. A DCO application for VE will be assessed and decided on by the Planning Inspectorate in the context of the policy set out within the NPSs. The three NPSs of relevance to VE are:

- EN-1 Overarching Energy (DECC, 2011a);
- EN-3 Renewable Energy Infrastructure (DECC, 2011b), which covers nationally significant renewable energy infrastructure (including offshore generating stations in excess of 100 MW); and
- EN-5 Electricity Networks Infrastructure (DECC, 2011c), which covers the electrical infrastructure associated with an NSIP.

1.5.3 VE OWFL is aware of the review of these NPSs currently being conducted by the Department for Business, Energy & Industrial Strategy (BEIS) which has made it clear that the current NPSs remain in force until they are formally superseded. Consultation drafts were published by BEIS in September 2021 with the formal consultation running until 29 November 2021. The EIA and DCO application will take account of the requirements of the revised NPS when formally adopted within the meaning of section 104 of the Planning Act 2008.

1.5.4 In addition, the Marine Policy Statement[4] (MPS) adopted by all UK administrations in March 2011 provides the policy framework for the preparation of marine plans and establishes how decisions affecting the marine area should be made in order to enable sustainable development.

THE DEVELOPMENT CONSENT ORDER

1.5.5 The key stages in the DCO application process, from pre-application through to post decision, along with the timescales associated with each key stage, are illustrated in Figure 1.3.

[4] https://www.gov.uk/government/publications/uk-marine-policy-statement

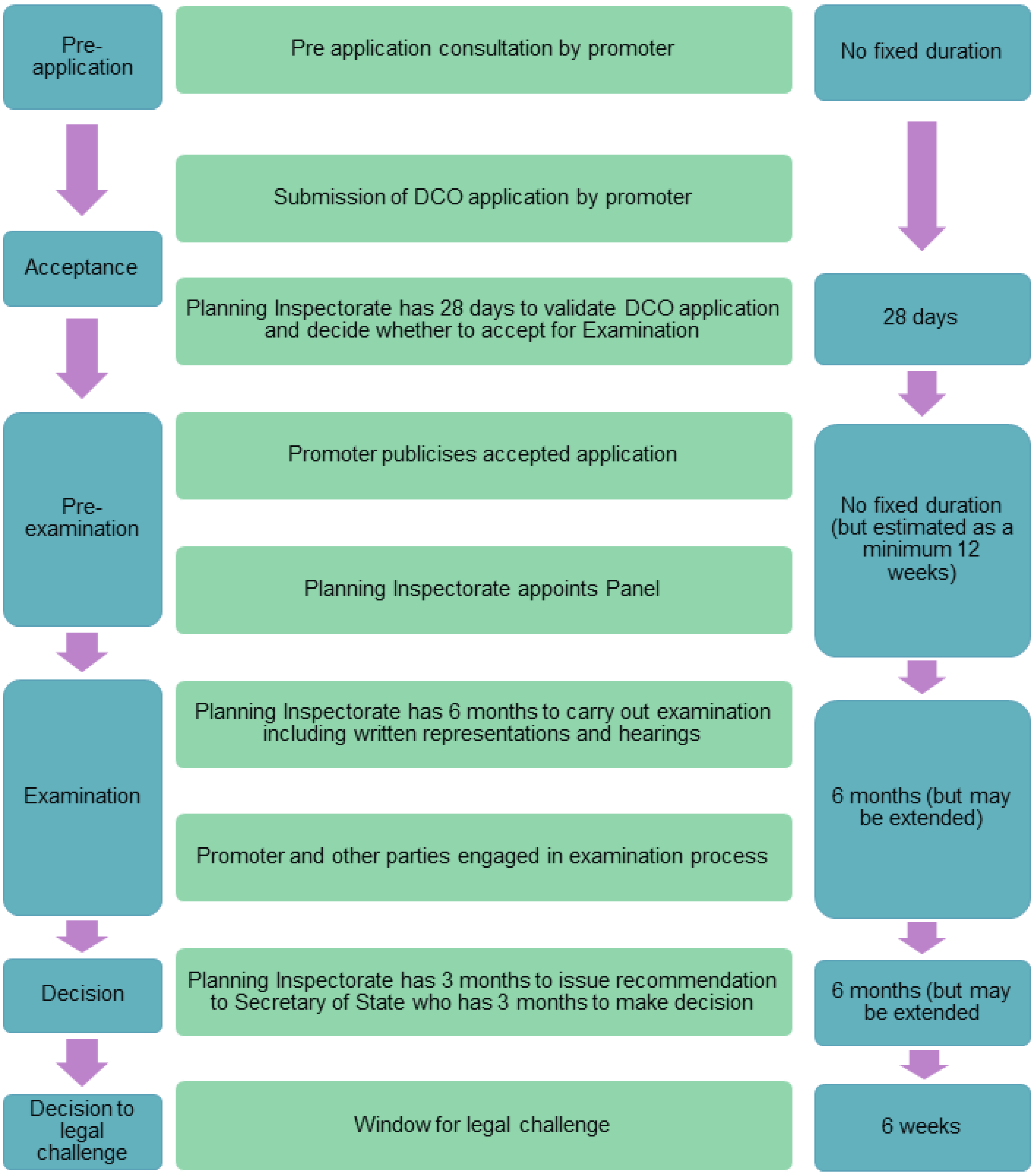


Figure 1.3 – DCO application process

MARINE AND COASTAL ACCESS ACT 2009

1.5.6 The Marine and Coastal Access Act received Royal Assent on 12 November 2009. It introduced new planning and management systems for overseeing the marine environment, most notably through the requirement to obtain marine licences for works at sea (including the deposition or removal of any substance or object from the sea below Mean High Water). It created a strategic marine planning system that seeks to promote the efficient, sustainable use and protection of the marine environment, guided by the MPS and a series of Marine Plans.

1.5.7 The Marine and Coastal Access Act 2009 provides the framework for a marine licencing system, which is administered by the Marine Management Organisation (MMO), a statutory consultee within the DCO application process. The Marine and Coastal Access Act 2009 also amended certain provisions of the Planning Act 2008.

1.5.8 The Marine and Coastal Access Act 2009 also enabled the designation of Marine Conservation Zones (MCZs). MCZs are a type of Marine Protected Area (MPA) which seek to protect a range of nationally important marine wildlife, habitats, geology and geomorphology. A MCZ assessment will be undertaken as part of the DCO application.

MARINE LICENCING

1.5.9 Licensable marine activities of relevance to VE include constructing and maintenance works in the sea or on the seabed and the deposition of any substance or object in the sea or on or under the seabed (such as the disposal of dredged material).

1.5.10 The marine licence application will require EIA to be carried out under the 2017 EIA Regulations. The competent authority will be required to undertake an HRA, under the Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations). The responsibility for marine licensing in England lies with the Department for Environment, Food and Rural Affairs (DEFRA), but day-to-day authority has been delegated to MMO.

1.5.11 The marine environment will be assessed in accordance with the UK MPS, the Marine and Coastal Access Act 2009 and East offshore, the East inshore and the South East Inshore marine plans and policies. A marine licence is required under the Marine and Coastal Access Act 2009 before carrying out any licensable marine activity. The marine licence for VE will be deemed within the DCO through provisions in Section 149A of the Planning Act 2008.

THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

1.5.12 EIA is a tool for systematically examining and assessing the impacts of a development on the physical, biological and human environment. This process allows management and mitigation measures to be identified to ensure the development is sustainable.

1.5.13 The legislative framework for EIA was provided by European Council Directive 2014/52/EU[5] (the 'EIA Directive') which codified the earlier Directives 85/337/EEC, 97/11/EC and 2009/31/EC. The EIA Directive 2014/52/EU and were transposed into English law for NSIPs by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) 2017. These came into force on 16 May 2017 and are the relevant EIA regulations for VE. Key changes which are of note in the 2017 EIA Regulations relate to:

- A requirement to provide a description of the likely significant effects of the development on the environment resulting from impacts on climate change, risks to human health and use of natural resources;
- Ensuring EIA quality by requiring that those who undertake the work are competent experts;
- More detailed demonstration of the consideration of reasonable alternatives to the proposed project; and
- Further consideration of how to avoid, prevent, reduce and / or offset significant adverse effects where possible and develop monitoring strategies.

1.5.14 It should be noted that the Environmental Assessments and Miscellaneous Planning (Amendment) (EU Exit) Regulations 2018[6] made under the European Union (Withdrawal) Act 2018 (as amended), made the necessary changes to domestic legislation which governs EIA as a result of the UK leaving the EU, and ensures that the 2017 EIA Regulations continue to apply in substantially the same way as they did before the UK's departure from the EU.

HABITATS REGULATION ASSESSMENT

1.5.15 European Council Directive 92/43/EEC[7] on the conservation of natural habitats and of wild fauna and flora ('the Habitats Directive') was intended to protect biodiversity by requiring EU member states to take measures to maintain and restore natural habitats and wild species listed at a Favourable Conservation Status. In England and Wales, the Habitats Directive is implemented under the Habitats Regulations[8] and the Offshore Marine Conservation (Natural Habitats, & c.) Regulations 2017[9].

1.5.16 The provisions of the Birds Directive are implemented through the Wildlife and Countryside Act 1981[10], the Habitats Regulations and the Conservation of Offshore Marine Conservation (Natural Habitats & c.) Regulations 2017, as well as other legislation related to the uses of land and sea.

[5] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0052
[6] https://www.legislation.gov.uk/uksi/2018/1232/contents/made
[7] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0147
[8] https://www.legislation.gov.uk/uksi/2017/1012/regulation/14/made
[9] https://www.legislation.gov.uk/uksi/2017/1013/schedule/4
[10] https://www.legislation.gov.uk/ukpga/1981/69/contents

1.5.17 Under these Regulations a network of protected areas (the National Site Network) in the UK has been established. The sites were formerly known as Natura 2000 sites prior the UK's departure from the EU. The National Site Network includes Special Areas of Conservation (SACs), for habitats and species, and Special Protection Areas (SPAs), for birds. The Habitats Regulations require that, where the possibility of a likely significant effect on a National Site Network site cannot be excluded (either alone or in-combination with another plan or project), a competent authority must undertake an Appropriate Assessment as part of the Habitats Regulations Assessment (HRA) process. The Habitats Regulations state that it is the developer's responsibility to provide sufficient information to the competent authority to enable them to assess whether there are likely to be any significant effects and to enable them to carry out the appropriate assessment, where necessary.

1.5.18 A HRA Screening report has been prepared in addition to this Scoping Report for consultation with the relevant stakeholders. Further assessment will be undertaken (as required) in the form of a Report to Inform Appropriate Assessment (RIAA) and will be included with the DCO application. The RIAA will provide sufficient information to enable the competent authority to carry out an Appropriate Assessment should it determine that one is required.

UK ENERGY POLICY AND THE ROLE OF RENEWABLE ENERGY

1.5.19 The first National Infrastructure Assessment by the National Infrastructure Commission (NIC, 2018) recommended that half of the UK's power is provided by renewables by 2030. This represented a substantially more ambitious target compared to the Renewable Energy Directive 2018/2001/EU[11] ('EU Renewables Directive') and UK Renewable Energy Strategy and is partly driven by the cost competitiveness of offshore wind energy generation.

THE CLIMATE CHANGE ACT 2008

1.5.20 The Climate Change Act 2008[12] commits the UK to a net reduction in greenhouse gas emissions against the 1990 baseline by 2050. This is implemented through a system of carbon budgets, which are set by the Government for a period of five years each. The UK Government has legislated for the first four carbon budgets to cut emissions as presented in Table 1.1

Table 1.1 – Carbon budget figures (TSO, 2009b, 2011, 2016 (respectively))

YEAR	CARBON BUDGET CUT
2012	23% below 1990 levels
2017	29% below 1990 levels
2022	35% below 1990 levels
2027	50% below 1990 levels
2032	57% below 1990 levels

[11] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC

[12] https://www.legislation.gov.uk/ukpga/2008/27/contents

1.5.21 The first target, 23% below 1990 levels by 2012, was met by the UK. Currently, the UK is on track to outperform the targets and with UK emissions were 42% below 1990 levels in 2019 (BEIS, 2020).

1.5.22 The Climate Change Act 2008 also established the Committee on Climate Change. The Committee on Climate Change advises the UK and devolved administration governments on setting and meeting the carbon budgets, and on preparing for climate change. In May 2011, the Committee published the Renewable Energy Review, which sets out a detailed vision of the role of renewable energy in meeting longer term emissions targets. The Renewable Energy Review concludes that the development of renewable energy is a potentially significant contributor to delivering decarbonisation of the power sector by 2030 at reasonable cost. It also underlined that firm commitments of support for offshore wind and marine generation through to the 2020s should be made.

THE ENERGY ACT 2013

1.5.23 The Energy Act 2013[13] received Royal Assent on 18 December 2013. The Energy Act 2013 makes provisions to incentivise investment in low carbon electricity generation, ensure security of supply, and help the UK meet its emissions reduction and renewables targets. In particular, the Energy Act 2013 contains provisions from then Department of Energy and Climate Change (DECC) (now BEIS) for Electricity Market Reform (EMR).

1.5.24 The EMR sets out the framework for replacing Renewables Obligation Certificates (ROCs) with Contracts for Difference (CfD) to provide stable financial incentives to encourage investment in low carbon electricity generation. CfDs are private contracts between a low carbon electricity generator and the UK Government owned Low Carbon Contracts Company (LCCC). Under a CfD, the electricity generating party is paid the difference between the strike price (the price for electricity reflecting the cost of investment in low carbon technology) and the reference price (a measure of the average market price for electricity in the Great Britain market).

1.5.25 The aim of CfDs is to give greater certainty and stability of revenues to electricity generators by reducing exposure to volatile wholesale prices, whilst at the same time protecting the consumer from paying for higher generation support costs when electricity prices are high (BEIS, 2016).

[13] https://www.legislation.gov.uk/ukpga/2013/32/contents

CLEAN GROWTH STRATEGY

1.5.26 The Clean Growth Strategy (2017) promotes 'clean growth' as growing national income while cutting greenhouse gas emissions. Clean growth forms one of the four 'grand challenges' within the UK's Industry Strategy (2017). The UK has been one of the most successful countries in the developed world in growing its economy while reducing emissions. This success has been aided by the falling costs of many low carbon technologies including solar and offshore wind. The Strategy aims to promote further growth of offshore wind by holding auctions of CfDs, working with the industry to develop a Sector Deal for offshore wind, and to provide further funding for innovation in offshore wind.

1.5.27 In October 2020, the UK Government announced further commitments to progress towards net zero emissions by 2050 (BEIS, 2020). These commitments included:

- Boosting the target for offshore wind to 40 GW by 2030 (enough to power every household in the UK);
- Creation of a target for 1 GW by 2030 from floating offshore windfarms; and
- Increasing the capacity of renewable energy in the next round of CfDs (anticipated in late 2021).

1.6 DOCUMENT STRUCTURE

1.6.1 The structure of this report is presented in Table 1.

Table 1.2 - Scoping Report structure

CHAPTER NUMBER	CHAPTER TITLE	PREPARED BY
N/A	Executive Summary	GoBe Consultants Ltd
N/A	Glossary	GoBe Consultants Ltd
1	Introduction	GoBe Consultants Ltd
2	Project Need	GoBe Consultants Ltd
3	Project Description	GoBe Consultants Ltd
4	Environmental Impact Assessment Approach and Methodology	GoBe Consultants Ltd
5	Site selection and alternatives	GoBe Consultants Ltd
6	Consultation Process	GoBe Consultants Ltd
Offshore Environment		
7	Physical Processes	ABPmer
8	Marine Water and Sediment Quality	GoBe Consultants Ltd
9	Benthic and Intertidal Ecology	GoBe Consultants Ltd
10	Fish and Shellfish Ecology	GoBe Consultants Ltd
11	Marine Mammals	SMRU Consulting
12	Ornithology	McArthur Green
13	Commercial Fisheries	Poseidon
14	Shipping and Navigation	Anatec
15	Military and Civil Aviation	Osprey
16	Seascape, Landscape and Visual Impact Assessment	Optimised Environments
17	Archaeology and Cultural Heritage	Maritime Archaeology
18	Other Marine Users and Activities	GoBe Consultants Ltd
Onshore Environment		
19	Terrestrial Ecology and Nature Conservation	SLR Consulting
20	Archaeology	SLR Consulting
21	Airbourne Noise and Vibration	SLR Consulting
22	Traffic and Transport	SLR Consulting
23	Air Quality	SLR Consulting

CHAPTER NUMBER	CHAPTER TITLE	PREPARED BY
24	Hydrology and Flood Risk	SLR Consulting
25	Geology and Ground Conditions	SLR Consulting
26	Landscape and Visual	SLR Consulting
27	Socioeconomics and Tourism	SLR Consulting
28	Public Health	GoBe Consultants Ltd
29	Proposed structure of the EIA	GoBe Consultants Ltd
30	References	GoBe Consultants Ltd

2. PROJECT NEED

2.1 INTRODUCTION

2.1.1 Offshore wind, as a source of renewable energy, offers the UK a wide range of benefits from an economic growth, energy security and decarbonisation perspective. VE will make a significant contribution to renewable energy supply and consequently help provide these benefits to the UK and globally. The strategic development of VE will increase this contribution to UK energy supply and help fulfil future increasing demand for renewable energy.

2.1.2 The primary drivers for the development of offshore wind energy are:

> The need to reduce greenhouse gas emissions;
> The need for national energy security;
> The need to maximise economic opportunities from energy infrastructure investment for the UK; and
> The need to produce affordable energy.

2.1.3 Chapter 1 of this Scoping Report provides details on the relevant policy and legislation including but not limited to:

> The Climate Change Act 2008
> The Energy Act 2013
> The Clean Growth Strategy (2017); and
> The UK Renewable Energy Strategy (2009).

2.1.4 In October 2020, the UK Government announced further commitments to progress towards net zero emissions by 2050 (BEIS, 2020). These commitments included:

> Boosting the target for offshore wind to 40 Gigawatt (GW) by 2030 (enough to power every household in the UK);
> Creation of a target for 1 GW by 2030 from floating offshore windfarms; and
> Increasing the capacity of renewable energy in the next round of Contract for Difference (CfDs) (anticipated in late 2021).

2.1.5 In November 2020, the UK Government published 'The Ten Point Plan for a Green Industrial Revolution' which detailed ambitious policies and new public investment to reduce UK emissions by 180 million tonnes of carbon dioxide equivalent (MtCO2e) between 2023 and 2032. This paper supported the generation of renewable electricity through construction and operation of new offshore wind farms.

2.2 THE NEED TO REDUCE GREENHOUSE GAS EMISSIONS

2.2.1 In the Overarching National Policy Statement for Energy (EN-1) (DECC, 2011d), predictions are made that a continuation of global emission trends, including emissions of greenhouse gases such as carbon dioxide, could lead average global temperatures to rise by up to 6°C by the end of this century. The potential impacts associated with such a global temperature rise include (DECC, 2014):

> 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.

2.2.2 A commitment by the UK was made during the 21st Conference of the Parties (COP) in Paris in 2015 to pursue efforts to limit the global temperature increase to within 2°C of the pre-industrial average temperature, with an aspiration for an improved limit of 1.5°C.

2.3 THE NEED FOR NATIONAL ENERGY SECURITY

2.3.1 The UK has been a net importer of electricity since 2010 and imported around 5.5 Terawatt-hour (TWh)[14] of its electricity in Q3 2019 (BEIS, 2020). There were reduced imports on all interconnectors which were operational in 2018, with a particularly large decrease for the Ireland-Wales interconnector of approximately 41%. Renewable electricity generation was 29 TWh in Q3 2019, representing 38.9% of total electricity generation.

2.3.2 Key issues associated with energy security in the UK are:

> The decline in fossil fuel reserves (in particular North Sea oil and gas):

> The required ongoing closure and decommissioning of existing elderly fossil fuel and nuclear electricity generating infrastructure, and

> The need for replacement sources:

2.3.3 Reliance on global markets for imported energy leaves the UK vulnerable to spikes in world energy market prices, political pressure and potentially, to physical supply disruptions.

2.3.4 It is widely considered that a transition to a low carbon energy will provide greater energy security. Though it is acknowledged that low carbon energy may require more complex electricity systems that require new approaches to balancing supply and demand or increasing risks of cyber-attacks due to the widespread use of digital technologies (UK Energy Research Centre, 2018). Therefore, the relationship between energy security and low carbon energy generation should not be considered linear.

[14] One terawatt-hour is equivalent to 10^{12} watt-hours

2.4 THE NEED TO MAXIMISE ECONOMIC OPPORTUNITIES FROM ENERGY INFRASTRUCTURE INVESTMENT FOR THE UK

2.4.1 A key commitment within the UK's Industrial Strategy (developed by BEIS in 2017) is to "*lead the world in delivering clean energy technology*" and to support innovation in this area. The aim is for "*the UK to be a global leader in innovation, science and research and our Industrial Strategy will help us to deliver our ambitious CO_2 reduction targets while, creating jobs and opportunities for people across the country*" (HM Government, 2017). The energy sector in the UK plays a central role in the economy and renewable energy can play a major part in boosting the economy and providing new jobs and skills.

2.4.2 The Centre for Economics and Business Research (CEBR, 2012) estimates that by 2030, offshore wind could increase the Gross Domestic Product (GDP) value by 0.6% and support 173,000 jobs. In contrast, The Stern Report (Stern, 2006) concludes that if no action is taken to prevent climate change, the economic impacts could be equivalent to losing at least 5% of global GDP each year.

2.4.3 According to the 2017 Report on Offshore Wind UK Content (RenewableUK, 2017), 48% of the total expenditure associated with UK offshore wind farms was spent in the UK in 2015.

2.4.4 The Offshore Wind Sector Deal (HM Government, 2020) seeks to maximise the advantages for UK industry from the global shift to clean growth, consistent with the Clean Growth Grand Challenge. The deal sets out to achieve this with five commitments' including the CfD third allocation round (results publish in October 2019), energy export targets by 2030 and collaborative working. The Sector Deal included the following commitment (HM Government, 2020):

"The government will work collaboratively with the [the offshore wind] sector and wider stakeholders to ensure that up to 30GW of offshore wind can be delivered by 2030, delivering 1-2GW of new offshore wind per year, in a sustainable and timely way. This will address strategic deployment issues including aviation and radar, onshore and offshore transmission, cumulative environmental impacts (both in the marine and onshore areas) and impacts on other users of the sea space, such as navigation and fishing."

2.4.5 The Sector Deal report states that up to 30 GW of offshore wind is anticipated to be constructed in the UK by 2030. These developments could account for over £40bn of infrastructure spending in the next decade.

2.4.6 The offshore wind industry presents an opportunity to utilise and further develop the UK's maritime engineering skills as other industries decline (such as shipbuilding and North Sea oil) in order to secure supply chain and other employment opportunities in the UK. The importance of maximising opportunities for the involvement of local businesses and communities in offshore wind has been highlighted as a key success factor for the sector in the UK (The Crown Estate, 2014).

2.5 THE NEED TO PRODUCE AFFORDABLE ENERGY

2.5.1 Energy from offshore wind has often been described as being an expensive alternative to more conventional forms of energy generation such as coal, gas and nuclear. However, ORE Catapult (2016) shows that UK projects reaching Final Investment Decision (FID) in 2015/16 achieved an average Levelised Cost of Energy (LCOE) of £97/MWh; a 32% reduction since 2010/11. This means that the industry has beaten its target of £100/MWh by 2020 four years early. There is also high industry confidence of continued rapid cost reduction in LCOE for offshore wind (ORE Catapult, 2016), as is being demonstrated in Europe.

2.5.2 The Clean Growth Strategy (2017) promotes 'clean growth' as growing national income while cutting greenhouse gas emissions. Clean growth forms one of the four 'grand challenges' within the UK's Industry Strategy (2017). The Strategy aims to promote further growth of offshore wind by holding auctions of CfDs, working with the industry to develop a Sector Deal for offshore wind, and to provide further funding for innovation in offshore wind.

2.5.3 A strike price of £105/MWh for offshore wind in 2021-22 was announced by the UK Government in 2016 which represents the maximum price that will be paid, however with competitive bidding between developers, the final winning Contract for Difference (CfD) price is expected to be less than that of nuclear power at £92.5/MWh over a longer contract of 35 years versus 15 years for the CfD. As widely expected, the results of Allocation Round 2 CfD (September 2017) showed a dramatic fall in the cost of offshore wind. The cost of offshore wind, as measured by the CFD auction prices, has therefore reduced by almost 50% (from £105 to £57.50/MWh) in 2 years. This trend continued in the CfD Allocation Round 3 (September 2019) further reducing the strike price by approximately 30% (from £57.50 to £41.61/MWh for English OWF projects ranging from 1,200 to 1,400 MW capacities). This trend has made offshore wind one of the most attractive and cost-effective methods of generating large quantities of low carbon energy.

3. PROJECT DESCRIPTION

3.1 GENERAL

3.1.1 This chapter provides an overview of the proposed development. It sets out the design and main components for both offshore and onshore of VE. It also describes the key activities that will be undertaken during construction, operations and maintenance (O&M) and decommissioning, including key parameters and indicative timescales.

3.1.2 Detailed project design will be developed throughout the DCO application process and the pre-construction phase. Therefore, the description of the project provided in this Scoping Report is indicative, designed to provide context and to set out information sufficient to inform the scoping of impacts as detailed within this Scoping Report. The project design envelope will be developed in parallel with the EIA process and will be influenced by the results of environmental and technical studies, stakeholder consultation (including the Evidence Plan process) and public consultation.

3.1.3 It should be noted that at the time of writing, the cable routes and precise locations for infrastructure have not yet been defined. The Scoping Boundary has therefore been defined based on ongoing site selection work to accommodate preferred substation and onshore and offshore cable routes. Details of the Site Selection Study and the development of the search areas (for the purposes of scoping) are presented in Chapter 5 of this Scoping Report. Following the refinement of the project design and the search areas, draft Order Limits will be defined for assessment in the ES. All project infrastructure will be installed within the Order Limits (as defined in the DCO – subject to consent being granted).

3.1.4 All parameters provided in this Scoping Report chapter are subject to change throughout the design process and are anticipated to be refined for the subsequent PEIR (and ES). However, the parameters provided are sufficient for the purposes of scoping.

3.2 NEED FOR FLEXIBILITY

3.2.1 Where necessary (or appropriate), a range of parameters for each aspect of the project have been defined to assist in defining the scope of the EIA. These parameters will be refined further where required to inform detailed assessment within the PEIR and the ES that supports the DCO application, when this is made. For each relevant parameter, a worst case scenario for a particular receptor and/or impact will be identified and applied for each receptor/impact. This is known as the project design envelope approach or the 'Rochdale Envelope' approach (The Planning Inspectorate, 2018).

3.2.2 As noted in the Planning Inspectorate Advice Note Nine (PINS, 2018) the "Rochdale Envelope" approach may be employed where the developer may not know the full or exact specifications of infrastructure that will comprise the proposed project. The note states that:

" The 'Rochdale Envelope' approach is employed where the nature of the Proposed Development means that some details of the whole project have not been confirmed (for instance the precise dimensions of structures) when the application is submitted, and flexibility is sought to address uncertainty."

3.2.3 The Rochdale Envelope also provides flexibility to address uncertainties inherent to NPSs (The Planning Inspectorate, 2018). The use of the design envelope approach has been recognised in the Overarching NPS for Energy (NPS EN-1) (DECC, 2011a) and the NPS for Renewable Energy Infrastructure (NPS EN-3) (DECC, 2011b). This approach has been used in the majority of offshore wind farm applications.

3.2.4 In the case of offshore wind farms, NPS EN-3 (paragraph 2.6.42) recognises that:

"Owing to the complex nature of offshore wind farm development, many of the details of a proposed scheme may be unknown to the applicant at the time of the application, possibly including:

- *Precise location and configuration of turbines and associated development;*
- *Foundation type;*
- *Exact turbine tip height;*
- *Cable type and cable route; and*
- *Exact locations of offshore and/or onshore substations."*

3.2.5 NPS EN-3 (paragraph 2.6.43) (DECC, 2011b) continues:

"The Secretary of State should accept that wind farm operators are unlikely to know precisely which turbines will be procured for the site until sometime after any consent has been granted. Where some details have not been included in the application to the Secretary of State, the applicant should explain which elements of the scheme have yet to be finalised, and the reasons. Therefore, some flexibility may be required in the consent. Where this is sought and the precise details are not known, then the applicant should assess the effects the project could have to ensure that the project as it may be constructed has been properly assessed (the Rochdale [Design] Envelope). In this way the maximum adverse case scenario will be assessed and the IPC should allow for this uncertainty in its consideration of the application and consent. ".

3.2.6 NPS EN-3 (footnote 23) also states that:

"The 'Rochdale [Design] Envelope' is a series of maximum extents of a project for which the significant effects are established. The detailed design of the project can then vary within this 'envelope' without rendering the ES [Environmental Statement] inadequate".

3.2.7 At this early phase, the project description is indicative and the 'envelope' has been designed to include sufficient flexibility to accommodate further refinement during detailed design. This chapter therefore sets out a series of options and/or parameters for which maximum values are used to constitute a realistic Maximum Design Scenario (MDS) for VE.

3.2.8 A more detailed project design envelope will be presented in the PEIR and subsequently the ES (which will accompany the developer's application for a DCO to the SoS). This detailed project design envelope will therefore provide the maximum envelope of the consent sought, allowing appropriate flexibility to enable the refinement of the project design after consent (if granted).

3.3 KEY PROJECT COMPONENTS

3.3.1 A geographical overview of the proposed offshore and onshore scoping boundaries is presented in Figure 1.1 and Figure 1.2 respectively. All of the key components and works will be undertaken within the draft Order Limits.

3.3.2 The key components of VE are presented in Table 3.1.

Table 3.1 – Key infrastructure components

INFRASTRUCTURE	COMPONENT	DETAIL	DETAILS INCLUDED IN
Array	Wind Turbine Generators (WTGs)	The WTGs convert wind energy to electricity. Key components include rotor blades, gearboxes (in some cases), transformers, power electronics and control equipment. Offshore turbine models are continuously evolving and improving, therefore the exact wind turbine model will be selected post-consent from the range of models available at the point of procurement. The wind turbines will be permanently attached to the seabed with foundation structures. These are typically fabricated from steel or concrete. A limited number of foundation designs are under consideration.	Table 3.3 to Table 3.10
Array	Offshore Substation Platform (OSP)	Offshore substation platforms are the systems that collect and export the power generated by WTGs through the inter-array cables. The OSPs will be attached to the seabed with foundation structures.	Table 3.11 to Table 3.16
Array	Inter-array cables	Cables will connect the WTGs to one of the offshore substation platforms, typically in branched strings. Cables will be buried and where not buried may require a hard protective layer (such as rock or concrete mattresses) to ensure that the cables remain secure and do not become a	Table 3.17

INFRASTRUCTURE	COMPONENT	DETAIL	DETAILS INCLUDED IN
		hazard to other sea users and are not damaged by waves and currents.	
Array	Scour and cable protection	In order to protect the seabed around foundation structures and cables from scour, rock and/ or other materials may be placed on the seabed to protect from current and wave action.	See section 3.4
Offshore export cable route	Export cables	Cables connecting the offshore substations to the Transition Joint Bays (TJBs) at the landfall. Cables will be routed to avoid major seabed obstacles and minimise electrical losses.	Table 3.18
Offshore export cable route	Scour and cable protection	In order to protect the seabed around foundations and cables from scour, and where cable or pipeline crossings are required, rock and/ or other materials may be placed on the seabed to offer protection from current and wave action.	See section 3.4
Landfall	Landfall and TJBs	The landfall is the area where the export cables are brought ashore and connected to the onshore export cables. Techniques at the landfall(s) may include either trenchless (for example Horizontal Directional Drilling (HDD)) or open-cut trenching techniques. TJBs will be installed onshore and is an underground structure within which the joint between the offshore and onshore export cables will be made.	See section 3.5
Onshore export cable route	Onshore export cables	Cables connecting from the TJB to the onshore substation and then on to the National Grid East Anglia Coastal Substation (EACS).	Figure 1.2 and Table 3.19

INFRASTRUCTURE	COMPONENT	DETAIL	DETAILS INCLUDED IN
		The onshore export cables will be installed within the onshore Order Limits (as defined in the DCO - if consent is granted). This Scoping Report presents the area of search for the onshore cable route (see Figure 2) as the onshore cable route has not yet been defined. The cables will be installed within a cable duct underground. The key parameters for the onshore export cables are presented in Table 3.19.	
Onshore export cable route	Onshore substation	The onshore substation will be located within the onshore Scoping Boundary (see Figure 1.2 and Chapter 5) and will include all necessary electrical plant to meet the requirements of the National Grid.	Table 3.20
Onshore export cable route	Grid connection	The grid connection is anticipated to be at the National Grid Electricity Transmission (NGET) substation at EACS (see Chapter 5 for further details).	See section 3.6

3.4 KEY PROJECT PARAMETERS - OFFSHORE

3.4.1 The effects of removal of unexploded ordnance (UXO) will be assessed in the ES and HRA. However, a marine licence will be sought post consent (if granted) when further details of potential UXO are known for the removal activities. Further details on the potential requirements for ancillary infrastructure, such as navigational aids, will be included in the PEIR (and subsequent ES).

3.4.2 The key characteristics of the array area are presented in Table 3.2. No met masts are proposed as part of VE.

3.4.3 The construction of the offshore infrastructure will be supported by both UK and overseas ports, hereafter referred to as “offshore construction hubs”. The port facilities required for construction and operations and maintenance are unknown at this stage and agreements with ports are typically finalised post DCO consent.

Table 3.2 - Key array site characteristics

PARAMETERS	DESIGN ENVELOPE
Array area (km^2)	149
Closest distance to shore (km)	37

WIND TURBINE GENERATORS

3.4.4 The maximum design scenario for the WTGs for this Scoping Report is presented in Table 3.3. VE is likely to consist of up to 79 wind turbine generators (WTGs). Note that it is the physical parameters of the WTGs which drive the EIA, for example the tip height or hub height which are important for the assessments (see Table 3.3). The WTGs will incorporate tapered tubular towers and three blades attached to nacelle housing mechanical and electrical generating equipment (see Figure 3.1). All WTGs will be located within the array areas, which will be defined in the DCO at the point of application (see Figure 1.2).

Table 3.3 – WTG maximum design scenario

PARAMETERS	DESIGN ENVELOPE
Maximum number of WTGs	79*
Minimum lower blade tip above Mean High Water Springs (MWHS) level (m)	22
Maximum blade tip height above MHWS level (m)	397
Maximum rotor diameter (m)	337

*The exact number will vary based on WTG size, i.e. either a greater number (79) of smaller WTGs or a smaller number (up to 48) of larger WTGs.

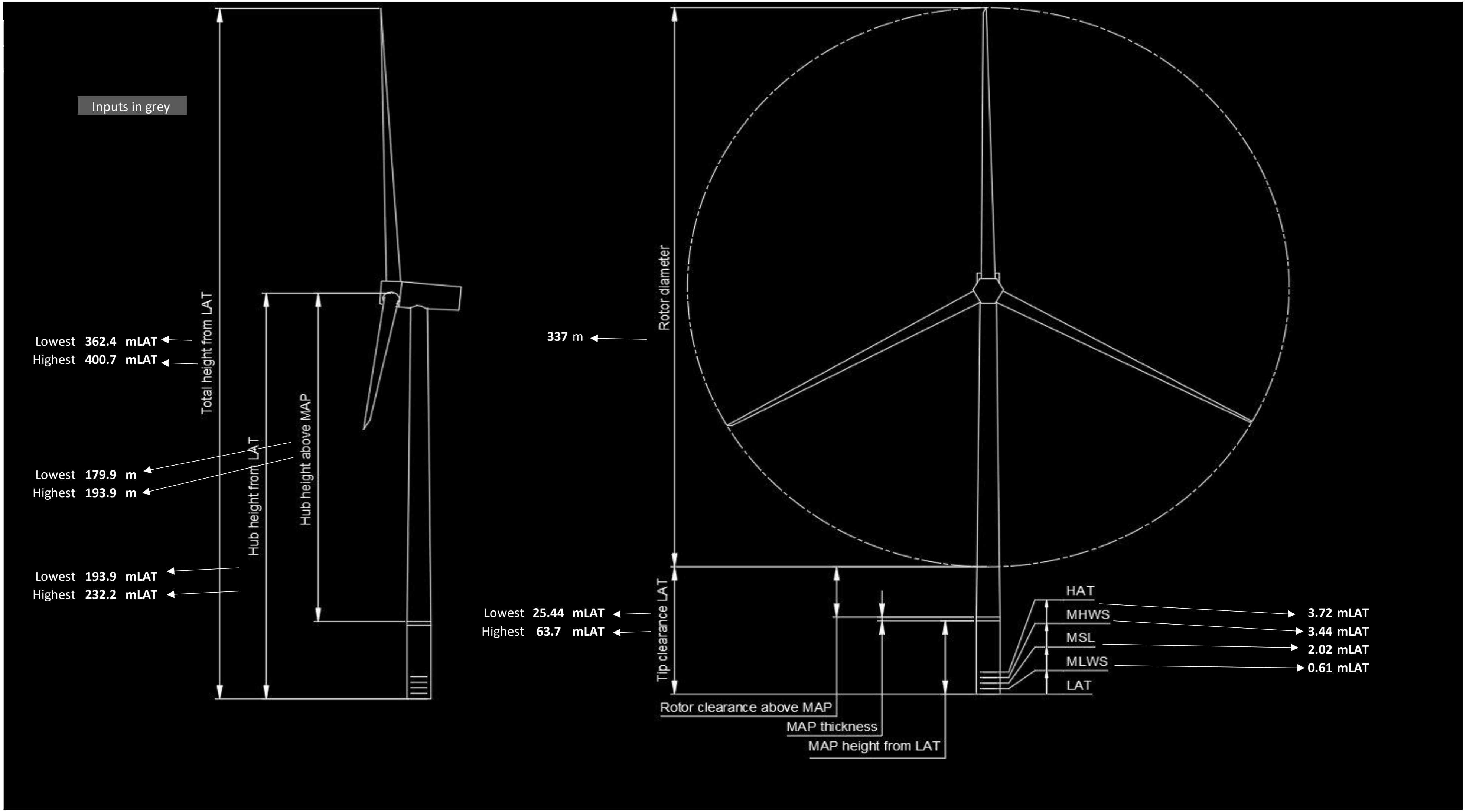


Figure 3.1 – Maximum parameters of the proposed Wind Turbine Generators

FOUNDATIONS

3.4.5 The factors influencing the choice of foundation for a specific project include the type of wind turbine to be used, the nature of the ground conditions on the site, the water depth and sea conditions (i.e. prevailing wave and current climate), as well as supply chain constraints. The foundation type selected in the final design for the WTGs and OSP will be dependent upon the final site investigations (undertaken post consent (if granted)) and project procurement processes.

3.4.6 As such, a range of foundation types have been considered in this Scoping Report and this will also be the case for the EIA, as many of these uncertainties and the need to ensure competitive procurement during the final project design (as noted above) will remain throughout the consent application process. The types of foundations being considered within this scoping report are presented in Table 3.4.

3.4.7 The foundations, wind turbines and OSPs, are likely to be installed using specialist installation vessels using either jack-up, anchors or dynamic positioning (DP) technology. Different methods will be required for installation of foundations dependent upon the type(s) chosen as listed in Table 3.4. The different methods may include piling, drilling or a non-piling alternative.

3.4.8 Seabed preparation may be required prior to the installation of foundations, including the working construction area. Depending on the seabed conditions at any given location, a variety of seabed preparation methods may be required, including levelling and clearance of boulders and debris.

SCOUR PROTECTION

3.4.9 Based on VE OWFL's experience of other developments, scour could occur around the base of foundations; this is when seabed sediment is winnowed away as a result of the flow of water around the structure. Several methods of scour protection can be used to reduce scour, including rock and gravel placement, concrete mattresses or flow dissipation devices. Scour protection installation may involve some seabed preparation prior to installation. The following methods of scour protection may be used around the bases of the WTG and OSP foundations:

- Rock or gravel placement;
- Concrete mattresses;
- Flow energy dissipation devices;
- Protective aprons or coverings (solid structures of varying shapes, typically prefabricated in concrete or high-density plastics; and
- Bagged solutions.

WTG FOUNDATIONS

3.4.10 All footprints of WTG foundations presented in Table 3.5 to Table 3.10 exclude the potential requirement for scour protection. Full details of the areas, volumes and assumptions for the requirement for foundation scour protection are not available for inclusion within this Scoping Report. These will be based on the review of the offshore geophysical data and ongoing foundation design studies. Full details for assessment will be included in the Project Description within the PEIR.

3.4.11 Following foundation installation the WTGs will be installed. Commonly, towers and nacelles are pre-erected or erected individually at the site using a suitable installation vessel. Blades are subsequently fitted to the tower nacelle structure as individual components or in a part assembled state.

Table 3.4 - Foundation types for WTGs

TYPE	DESCRIPTION	EXAMPLE FIGURE	DETAILS PROVIDED IN:
Monopile foundation	Monopile foundations typically consist of a single tubular section, consisting of a number of sections of rolled steel plate welded together. In many cases a Transition Piece (TP) is fitted over the monopile and secured via bolts, grout, or combination of both. In other cases the monopile will connect directly to the wind turbine tower (a TP-less solution).	Figure 3.2	Table 3.5
Suction bucket monopile foundation	Suction bucket monopile foundations consist of a single tubular structure fixed to the seabed by a suction caisson. The suction buckets are typically hollow steel cylinders, capped at the upper end.	Figure 3.3	Table 3.6
Gravity base monopile foundation	Gravity base foundations are typically concrete structures which are floated to site and then ballasted when in the correct location. The stability of the foundation is achieved by its weight.	Figure 3.4	Table 3.7
Pin-piled jacket foundation	Piled jacket foundations are formed of a steel lattice construction (comprising tubular steel members and welded joints). The foundation is secured to the seabed by hollow steel pin-piles which sit within a sleeve or leg which is part of the jacket. Piling may take place once the jacket is in position, or alternatively it may be pre-piled. The piles rely on frictional and end bearing properties of the seabed for support. Unlike monopiles, there is no separate TP; the TP and ancillary structure is fabricated as an integral part of the jacket. Pin-piles will typically be of a smaller diameter than monopiles.	Figure 3.5	Table 3.8
Suction bucket jacket foundation	Suction bucket jacket foundations are formed of a steel lattice construction (comprising tubular steel members and	Figure 3.6	Table 3.9

TYPE	DESCRIPTION	EXAMPLE FIGURE	DETAILS PROVIDED IN:
	welded joints) fixed to the seabed by suction caissons. The suction buckets are typically hollow steel cylinders, capped at the upper end, which are fitted in a horizontal position underneath the legs of the jacket structure. Unlike monopiles, but similar to piled jacket foundations, there is no separate TP; the TP and ancillary structure is fabricated as an integrated part of the jacket structure and is not installed separately offshore.		
Gravity base jacket foundation	Gravity base jacket foundations are formed of a steel lattice construction (comprising tubular steel members and welded joints) with heavy masses at the base. The foundation is secured to the seabed by the weight of the foundation.	Figure 3.7	Table 3.10

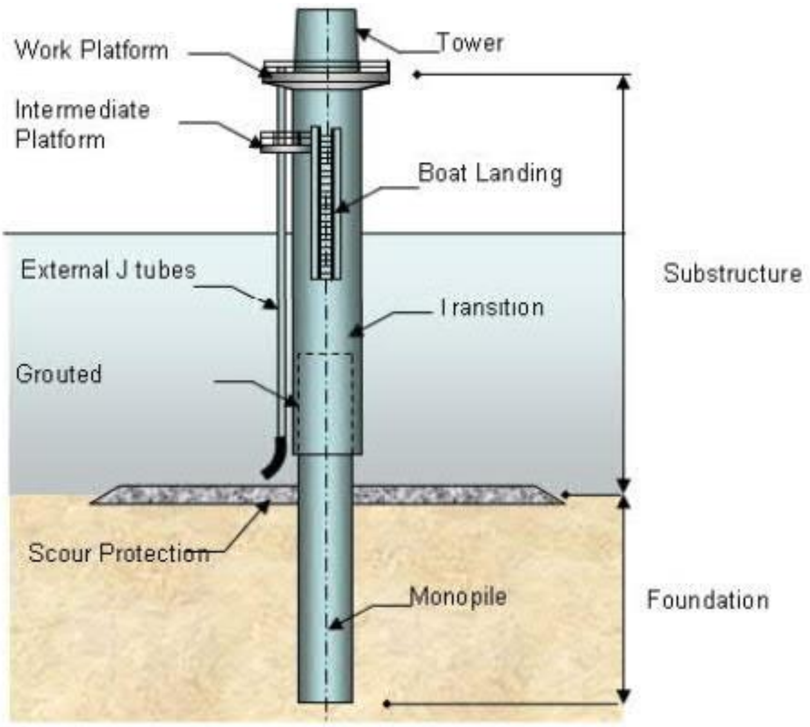


Figure 3.2- Examples of monopile foundation types

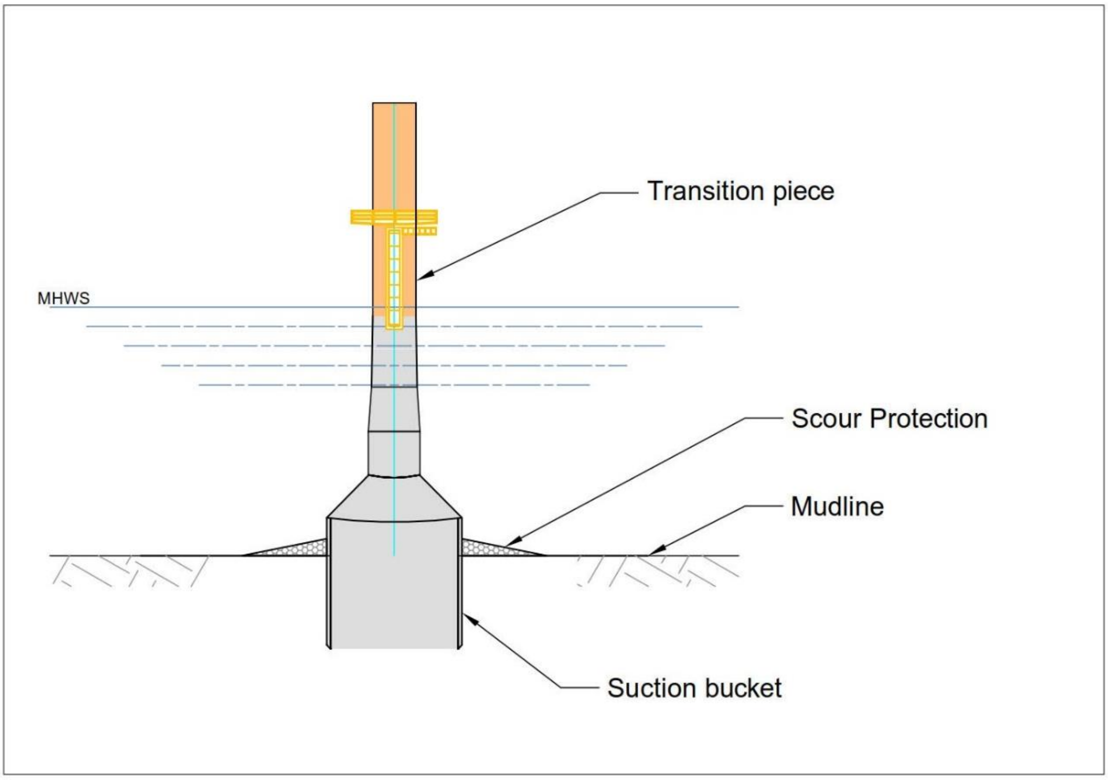


Figure 3.3 - Examples of suction bucket monopile foundation types

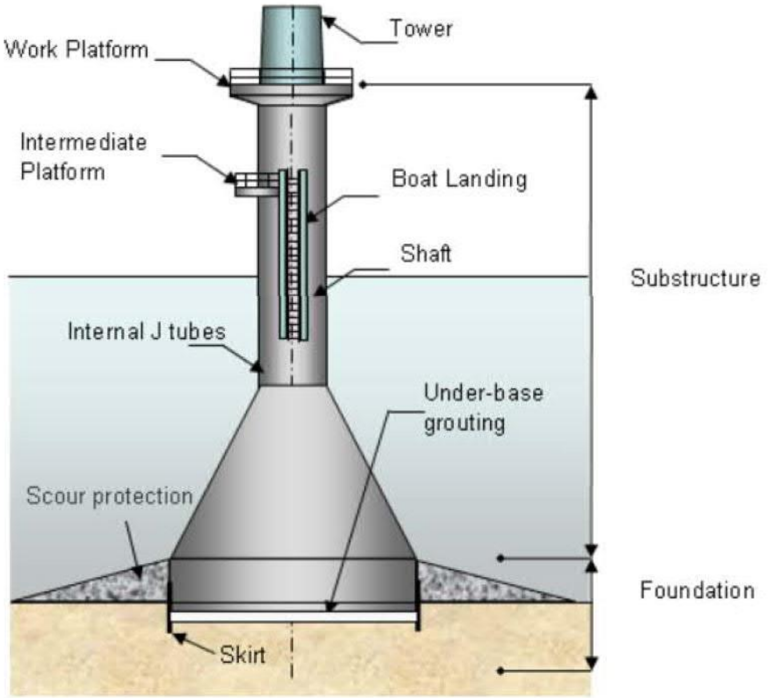


Figure 3.4 - Examples of gravity base monopile foundation types

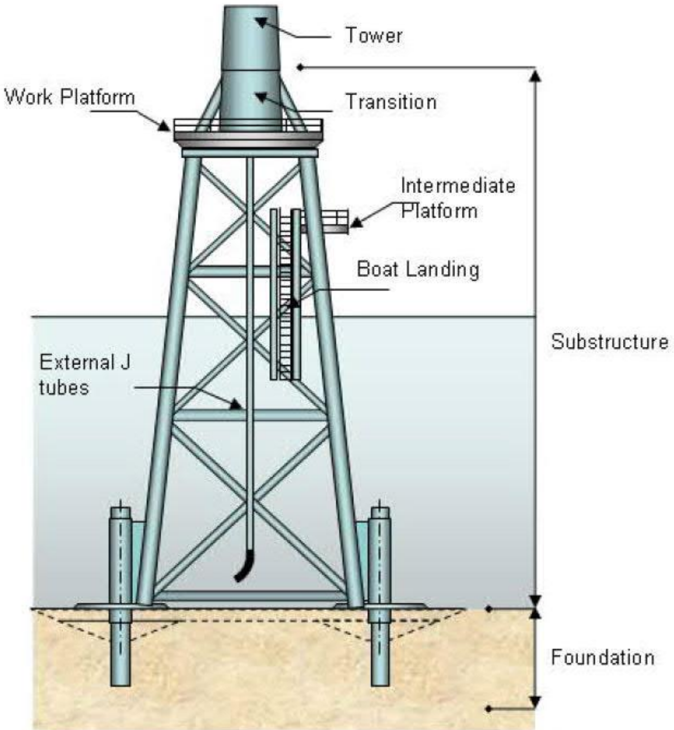


Figure 3.5 - Examples of pin piled jacket foundation types

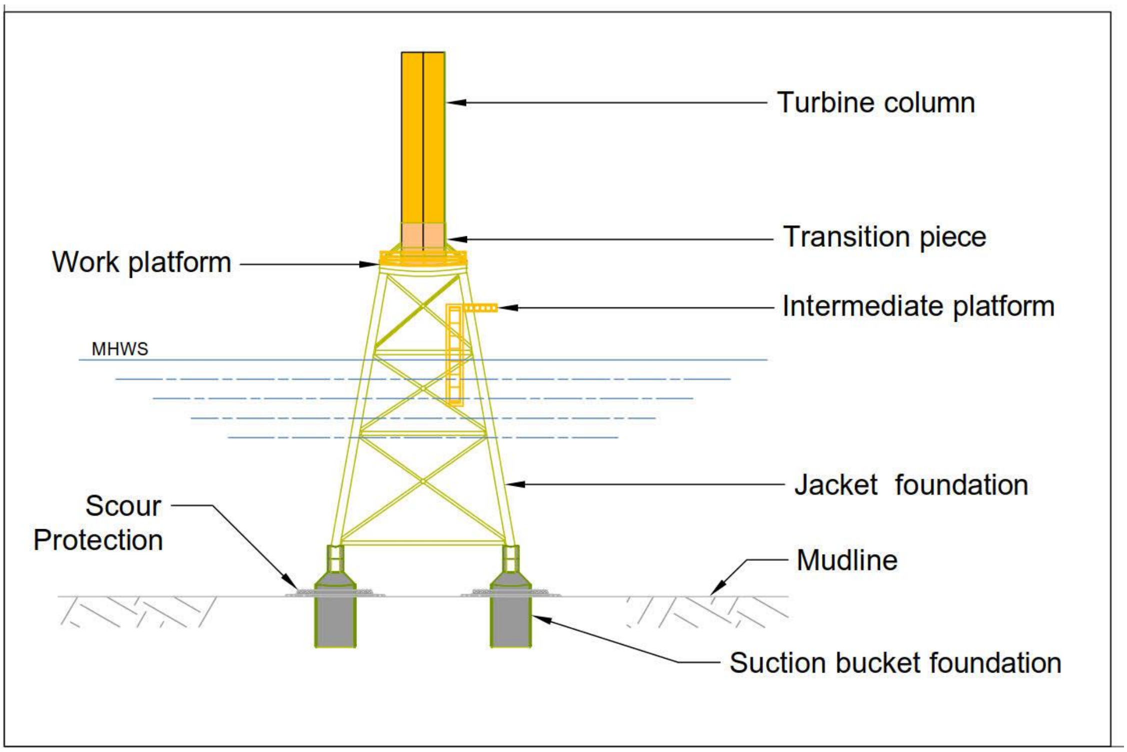


Figure 3.6 - Examples of suction bucket jacket foundation types

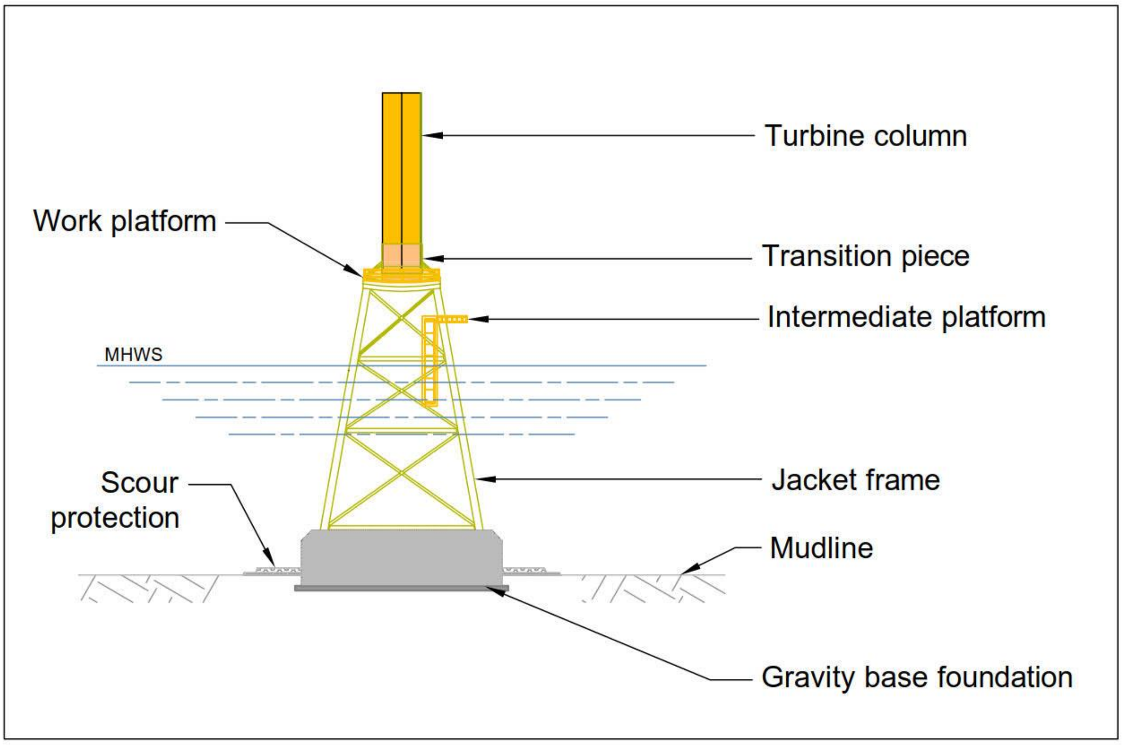


Figure 3.7 - Examples of gravity base jacket foundation types

Table 3.5 - Key parameters for WTG monopile foundations

PARAMETERS	DESIGN ENVELOPE
Maximum number of WTG foundations	79 (1 per WTG)
Maximum column diameter (m)	15
Maximum footprint per foundation (m^2)	177
Maximum footprint for all foundations (m^2)	13,983 (177m^2 x 79 WTGs[15])
Maximum hammer energy (kJ)	5,000

Table 3.6 - Key parameters for WTG suction bucket monopile foundations

PARAMETERS	DESIGN ENVELOPE
Maximum number of WTG foundations	79
Maximum bucket diameter (m)	40
Maximum footprint per bucket (m^2)	1,257
Maximum footprint for all foundations (m^2)	99,274 (1,257 m^2 x 79 WTGs[16])
Suction bucket height above seabed (m)	8

Table 3.7 - Key parameters for WTG gravity base monopile foundations

PARAMETERS	DESIGN ENVELOPE
Maximum number of WTG foundations	79 (1 per WTG)
Maximum base diameter (m)	55
Maximum diameter of base and seabed preparation (m)	60
Maximum footprint per base (m^2)	2,827
Maximum footprint for all bases including seabed preparation (m^2)	223,333 (2,827m^2 x 79 WTGs)

[15] Maximum footprint is based on fewer of the larger WTGs
[16] Maximum design scenario is based on the maximum number of smaller WTGs

Table 3.8 - Key parameters for WTG pin-piled jacket foundations

PARAMETERS	DESIGN ENVELOPE
Maximum number of WTG foundations	79 (1 per WTG)
Maximum number of legs per WTG	4
Maximum total number of legs	316 (79 foundations x 4 legs)[16]
Maximum leg diameter (m)	3.5
Maximum separation of adjacent legs at seabed level (m)	45
Maximum separation of adjacent legs at Lowest Astronomical Tide (LAT) level (m)	35
Maximum pin pile diameter (m)	3.5
Maximum footprint per pin-pile (m^2)	9.6
Maximum number of pin-piles	316 (79 foundations x 4 legs) [16]
Maximum footprint for all foundations (m^2)	3,040 (9.6 m^2 x 316 legs) [16]
Maximum hammer energy (kJ)	3,000

Table 3.9 - Key parameters for WTG suction bucket jacket foundations

PARAMETERS	DESIGN ENVELOPE
Maximum number of WTG foundations	79 (1 per WTG)
Maximum number of legs per WTG	4
Maximum number of buckets per WTG	4 (1 per leg)
Maximum total number of buckets	316 (79 foundations x 4 legs) [16]
Maximum bucket diameter including seabed preparation (m)	25
Maximum footprint per bucket (m^2)	491
Maximum footprint for all foundations (m^2)	155,116 (diameter of 491 m x 316 buckets)[15]
Maximum separation of adjacent legs at seabed level (m)	40
Maximum separation of adjacent legs at LAT (m)	30

Table 3.10 - Key parameters for WTG gravity base jacket foundations

PARAMETERS	DESIGN ENVELOPE
Maximum number of WTG foundations	79 (1 per WTG)
Maximum number of legs per WTG	4
Maximum number of bases per WTG	4 (1 per leg)
Maximum total number of bases	316 (79 foundations x 4 bases)
Maximum base diameter (m)	20
Maximum base diameter including seabed preparation	25
Maximum footprint per base (including seabed preparation)(m^2)	491
Maximum footprint for all foundations (including seabed preparation (m^2)	155,156 (diameter of 491 m x 316 bases)

OFFSHORE SUBSTATION PLATFORMS

3.4.12 OSPs are the systems that collect the power generated by WTGs (from the inter-array cables) and export power (through the export cable) to shore. They also stabilise and step up the voltage of power generated offshore and reduce the potential electrical losses. Table 3.11 presents the maximum design parameters for the OSPs.

Table 3.11 - Key OSP parameters

PARAMETERS	DESIGN ENVELOPE
Maximum number of OSPs	2
Foundation Options	> Monopile (see Table 3.12); > Suction bucket monopile (see Table 3.13); > Pin-piled jacket foundations (see Table 3.14); > Suction bucket jacket foundation (see Table 3.15); or > Gravity base (see Table 3.16).
Maximum topside height (m) (including crane)[17]	+ 195 m above LAT
Maximum topside height (m) (excluding crane)	+ 105 m above LAT
Maximum topside width (m)	100 x 2
Maximum topside length (m)	125 x 2

OSP FOUNDATIONS

3.4.13 As noted for the WTGs, a range of foundation types have also been considered in this Scoping Report (and EIA) for the OSPs (see Section 3.2). The types of foundations being considered (and which will be assessed) are presented in Table 3.11. The maximum design parameters for each foundation type, for the OSPs, are presented in Table 3.12 to Table 3.16. All footprints of foundations presented in Table 3.12 to Table 3.16 exclude the potential requirement for scour protection. Full details of the areas, volumes and assumptions for the requirement for foundation scour protection are not available for inclusion within this Scoping Report. These will be based on the review of the offshore geophysical data and ongoing foundation design studies. Full details for assessment will be included in the Project Description within the PEIR.

[17] Indicative OSP topside dimensions includes the provision for helicopter landing facilities. The maximum OSP dimensions for the purposes of assessment will be confirmed at PEIR.

Table 3.12 - Key parameters for OSP monopile foundations

PARAMETERS	DESIGN ENVELOPE
Maximum number of OSP foundations	2 (1 per OSP)
Maximum column diameter (m)	15
Maximum footprint per foundation (m^2)	177
Maximum footprint for all foundations (m^2)	354 (177 m^2 x 2 OSPs)
Maximum hammer energy (kJ)	5,000[18]

Table 3.13 - Key parameters for OSP suction bucket monopile foundations

PARAMETERS	DESIGN ENVELOPE
Maximum number of OSP foundations	2 (1 per OSP)
Maximum number of buckets per OSP	1
Maximum bucket diameter (m)	28
Maximum footprint per foundation (m^2)	616
Maximum footprint for all foundations (m^2)	1,232 (616 m^2 x 2 OSPs)
Maximum suction bucket height above the seabed (m)	3

Table 3.14 - Key parameters for OSP pin-piled jacket foundations

PARAMETERS	DESIGN ENVELOPE
Maximum number of OSP foundations	2 (1 per OSP)
Maximum number of legs per OSP	6
Maximum total number of legs	12 (2 foundations x 6 legs)
Maximum leg diameter (m)	3.5
Pin-pile diameter (m)	3.5
Maximum footprint per pin-pile (m^2)	10
Maximum number of pin-piles	24 (2 foundations x 6 legs (two per leg))
Maximum footprint for all foundations	240 (10 m^2 x 24)
Maximum hammer energy (kJ)	3,000

[18] Note a drill-drive solution may be employed to install monopiles for the OSPs.

Table 3.15 - Key parameters for OSP suction bucket jacket foundations

PARAMETERS	DESIGN ENVELOPE
Maximum number of OSP foundations	2 (1 per OSP)
Maximum number of buckets per OSP	6 (1 per leg)
Maximum total number of buckets	12 (2 foundations x 6 legs)
Maximum bucket diameter (m)	20
Maximum footprint per bucket (m^2)	314
Maximum footprint for all foundations	3,768 (314 m^2 x 12)
Maximum suction bucket height above the seabed (m)	5

Table 3.16 - Key parameters for OSP gravity base foundations

PARAMETERS	DESIGN ENVELOPE
Maximum number of OSP foundations	2 (1 per OSP)
Maximum base diameter (m)	55
Maximum seabed preparation diameter	65
Maximum footprint per foundation (including seabed preparation) (m^2)	7,000
Maximum footprint for all foundations (including seabed preparation) (m^2)	14,000 (7,000 m^2 x 2 OSPs)

INTER-ARRAY CABLES

3.4.14 The inter-array cables will connect the WTGs to each other and to the OSPs. A number of platform link cables will be required between OSPs. Table 3.17 outlines the general parameters for inter-array cables.

3.4.15 Inter-connector cables between the two array areas will be required. At the time of writing the design envelope for inter-connector cables has been included in the envelopes of inter-array and offshore export cables. Further details will be provided in the PEIR (and subsequent ES).

Table 3.17 - Inter-array maximum design scenario

PARAMETERS	DESIGN ENVELOPE
Maximum external cable diameter (mm)	220
Minimum target burial depth (m)	0.5
Maximum length of inter-array cables (km)	228
Maximum width of seabed disturbed during installation (m)	12
Total footprint of disturbance during installation of inter-array cables (km^2)	3 (228 km x 12 m)

3.4.16 The following installation methodologies may be used for the installation of inter-array cables, including but not limited to:

- Ploughing
- Jet-trenching;
- Pre-cut and post-lay;
- Mechanical trenching;
- Dredging (Trailing hopper suction Dredger (THSD) and backhoe dredger);
- Mass flow excavation;
- Rock cutting; and
- Burial sledge.

3.4.17 The cables will either be directly buried using the above techniques or pulled into a duct/pipe[19] that will be installed using the above techniques.

3.4.18 Full details of proposed methodology (and associated design parameters) for seabed preparation (for the potential removal of debris, boulders and sandwaves) for inter-array cable installation will be provided in the PEIR and subsequently within the ES for the purposes of assessment.

[19] As a form of cable protection

OFFSHORE EXPORT CABLES

3.4.19 The transmission technology proposed for VE is High Voltage Alternating Current (HVAC). Table 3.18 presents the design envelope for the offshore export cables.

Table 3.18 - Offshore export cables maximum design scenario

PARAMETERS	DESIGN ENVELOPE
Maximum number of export circuits	4
Maximum number of cables per circuit	1
Cable technology	XLPE insulation (Cross-linked polyethylene) or similar[20]
Maximum cable voltage (kV)	400
Maximum offshore cable length per cable (km)	92.5
Maximum number of ducts offshore (at landfall) including spare	5
Indicative cable corridor width (km)	1
Total offshore cabling length (km)	370 (92.5 km x 4 cables)
Minimum target burial depth (m)	0.5[21]
Minimum burial depth (m)	0 (i.e. surface laid where burial is not possible)
Width of seabed disturbed during installation (m)	12
Total footprint of disturbance during installation of export cables (km^2)	4.44 (370 km x 12 m)

3.4.20 Consent will be sought for the following seabed preparation and/ or installation methodologies for export cables:

- Ploughing;
- Jet-trenching;
- Pre-cut and post-lay;
- Mechanical trenching;
- Dredging (THSD and backhoe dredger);
- Mass flow excavation;
- Rock cutting; and
- Burial sledge.

[20] These cables are composite and include 3 power cores and separate multiple bundles of fibre optic cables.
[21] Note: this depth may be increased, such as if crossings of the shipping channels are required or decreased if it is necessary to cross other cables/assets.

3.4.21 The cables will either be directly buried using the above techniques or pulled into a duct/pipe (at landfall) that will be installed using the above techniques.

3.4.22 Full details of proposed methodology (and associated design parameters) for seabed preparation for offshore export cable installation will be included in the Project Description within the PEIR/ ES.

CABLE PROTECTION

3.4.23 As far as practicable, all cables will be buried. Where it is not reasonably possible to bury cables (inter-array and export) it will be necessary to install cable protection to prevent scour and minimise the risk of damage to the cable. Full details of the areas, volumes and assumptions for the requirement for cable protection (for both export and inter-array cables) are not available for inclusion within this Scoping Report. These will be based on the review of the offshore geophysical data and ongoing cable design studies. Full details for assessment will be included in the Project Description within the PEIR. The PEIR assessment will consider the use of cable protection to be laid anywhere within the Scoping Boundary (as defined in the PEIR), i.e. within the array and export cable corridor.

3.4.24 An analysis of the requirement for the cables to cross existing infrastructure (such as cables and pipelines) will be provided within the PEIR along with realistic worst case design parameters to enable a detailed assessment to be undertaken.

UNEXPLODED ORDNANCE

3.4.25 Consent for UXO removal will be sought in a future Marine Licence application, post consent (if granted), when geophysical survey data of suitable spatial resolution is available to identify and quantify UXO and the location of infrastructure associated with the project are confirmed. The effects of removal of UXO will nevertheless be considered in the ES and therefore have been included within this Scoping Report.

3.5 LANDFALL

3.5.1 A landfall zone, on the shoreline at Holland Haven, is presented within this Scoping Report (see Figure 1.2 and Chapter 5). This area will be refined and draft Order Limits will be presented in the PEIR.

3.5.2 Techniques at landfall may include either trenchless (for example HDD) or open-cut trenching techniques. VE OWFL is committed to considering trenchless technologies such as HDD at the landfall to protect sensitive features and minimise the extent of direct interaction with the intertidal areas and coastal features. The maximum length of the HDD is anticipated to be up to 1.1 km with an estimated depth up to 25 m; and up to five HDD bores may be undertaken. The offshore cables will be jointed to the onshore cables at TJB(s) on the landward side of the landfall site. One TJB will be required for each export cable plus fibre optic link boxes utilising distributed temperature sensing and supervisory and control data acquisition (SCADA) systems.

3.5.3 Landfall installation may also require beach access for particular construction vehicles, equipment and materials. This will depend on the preferred method of installation identified and the preferred landfall location.

3.5.4 Full details of each the landfall location and method(s) will be included in the Project Description within the PEIR. Details of the TJB are provided in Table 3.19.

3.6 KEY PROJECT PARAMETERS - ONSHORE

ONSHORE EXPORT CABLES

3.6.1 The onshore export cables will be installed within the onshore Order Limits (as defined in the DCO - if consent is granted). This Scoping Report presents the area of search for the onshore cable route (see Figure 1.2). The onshore cable route has not yet been defined and is subject to ongoing studies and consultation including confirmation on the location of the EACS.

3.6.2 The cable circuit will be installed within a cable duct. The key parameters for the onshore export cables are presented in Table 3.19.

3.6.3 Cable installation is a well-established technique and incorporates environmental management and mitigation measures as standard practice. Precise installation methods will differ according to the nature of the environment through which the cable is being installed. Most of the cable route will be constructed using an open trench method of cable construction. However, non-trenching techniques may be employed, such as HDD to avoid obstructions (e.g. a major road or watercourse).

3.6.4 During construction of the cable trenches the topsoil and subsoil will be stripped and stored on site within the temporary working corridor of the project onshore cable corridor. The procedures followed will be in line with best practice and agreed through the Code of Construction Practice or an appropriate management plan.

3.6.5 Jointing bays (underground structures holding the joint between sections of the onshore export cables) will be required. The detailed design of these components will be defined post-consent (if granted).

3.6.6 A design envelope for the proposed cable corridor, jointing bays and installation methods (and parameters) will be included within the PEIR and ES.

Table 3.19 - Onshore export cables maximum design scenario

PARAMETERS	DESIGN ENVELOPE
Maximum number of export circuits	4
Maximum number of cables per circuit	3 (power cores per circuit) and up to 4 (communications and earthing cables)
Cable technology	XLPE insulation
Maximum cable voltage (kV)	400
Maximum onshore cable length per cable (km)	30
Total onshore cable circuit length (km)	120 (30 km x 4 circuits)[22]
Indicative external cable diameter (mm)	150
Maximum number of TJBs at Landfall	4 (one per circuit)
Total construction area for TJBs (m)	100 x 200
Max Number of joint bays	240 (one per circuit every 500 m apart, which is cable design and route length dependent)
Maximum cable trench depth (m)	2
Maximum corridor width topsoil affected excluding trenchless crossings (m)	62
Maximum number of cable construction compounds	3[23]

ONSHORE SUBSTATION

3.6.7 VE will require an onshore substation, for the VE specific equipment, to be built. The onshore substation will contain the electrical components for transforming the power supplied from the wind farm to 400 kV and to adjust the power quality and power factor, as required to meet the UK System-Operator Transmission-Owner Code (STC) for supply to the National Grid.

3.6.8 Grading, earthworks and drainage will be undertaken initially within the onshore substation footprint. Foundations will then be installed which will either be ground-bearing or piled, based on the prevailing ground conditions.

[22] The maximum onshore cable circuit length does not include for an onward connection from the VE substation to the EACS substation due to uncertainty over the final location of the substations. The maximum cable lengths incorporating this additional cable will be confirmed within PEIR.
[23] Working areas along the cable corridor may also be required. Further details will be provided in the PEIR.

3.6.9 The proposed building substructures are typically predominantly composed of steel and cladding materials although brick/block and modular structures are sometimes employed. The structural steelwork is likely to be prepared off site and delivered to site for erection activities. The steelwork may be erected with the use of cranes. Cladding panels (typically composite) may also be delivered to site ready to erect and be fixed to the steelwork. In addition, there could be unhoused equipment, such as compensation transformers, water tanks and a distribution network operators substation. Noise enclosers and lightning masts may also be constructed.

3.6.10 A key aspect of the substation installation will be the delivery of the transformers. Due to their size and weight, these items will be delivered as abnormal indivisible loads (AIL) by special vehicles and offloaded with the use of cranes, Self Propelled Modular Transporters (SPMTs) or skids. The majority of the remaining equipment is anticipated to be erected with the use of small mobile plant and lifting apparatus.

3.6.11 The onshore substation will be required throughout the lifetime of the project. The key parameters for the offshore substation are presented in Table 3.20.

Table 3.20 - Onshore VE substation maximum design scenario

PARAMETERS	DESIGN ENVELOPE
Maximum site area (up to the permanent fencing) (m^2)	50,000
Number of buildings	5
Type of substation being considered	Air Insulated Substation (AIS) or Gas insulated Substation (GIS)
Maximum building height (m)	15
Maximum external equipment height (m)	18
Proposed substation location	The proposed area in which the substation is to be located will be presented in the PEIR (and subsequently in the ES).

3.7 OPERATIONS AND MAINTENANCE

3.7.1 During the operational period, scheduled and unscheduled monitoring and maintenance activities will be required. The maintenance activities will be categorised as either preventative or corrective maintenance. Preventive maintenance will be undertaken according to scheduled services whereas corrective maintenance will be needed to cover unexpected repairs, component replacements, retrofit campaigns and breakdowns.

3.7.2 A detailed breakdown of O&M activities (both onshore and offshore) which VE OWFL is seeking consent for will be provided in the ES. The EIA will seek to assess expected maintenance activities based on VE OWFL's experience and best practice, however if during the life of the proposed project, further consents or licences are required then these will be applied for.

3.7.3 The O&M base (onshore, offshore or both) will be determined by the O&M strategy; following final decision (i.e. post consent) when the technical specifications of the development are known, such as the location of the O&M base(s) and the WTG type.

OFFSHORE

3.7.4 A number of different vessel types will be required for O&M activities.

3.7.5 During the operational phase of the project there will be no planned maintenance or replacement of the subsea cables, however repairs could be required should the cable fail or be damaged. Periodic surveys will be required to ensure the cables remain buried and if they do become exposed then corrective maintenance will be undertaken (such as deployment of cable protection or reburial).

3.7.6 The wind farm could be maintained from shore using a fleet of O&M vessels (e.g. crew transfer vessels, supply vessels) or potentially from a Service Operation Vessel (SOV). The vessels and marine co-ordination will operate out of a O&M base in a local port (such as along the Suffolk or Essex Coastline). The O&M base, O&M vessels and SOV may be independent to VE or may be shared with another OWF including but not limited to Galloper OWF and/ or North Falls OWF.

ONSHORE

3.7.7 Onshore, the O&M requirements will be largely corrective, accompanied by infrequent on-site inspections of the onshore transmission infrastructure. However, the onshore infrastructure will be consistently monitored remotely, and there may be O&M staff visiting the onshore substation to undertake works on a regular basis (expected to be once per week). The onshore substation will not be manned; and security at the substation will be provided through the use of perimeter fencing and CCTV. Periodic access to transition joint bays may also be required for inspection.

3.8 DECOMMISSIONING

3.8.1 At the end of the operational lifetime of VE, it is anticipated that all structures above the seabed level will be completely removed. The decommissioning sequence will generally be the reverse of the construction sequence (reverse lay) and involve similar types and numbers of vessels and equipment. Closer to the time of decommissioning, it may be decided that removal of infrastructure will lead to greater environmental impacts than leaving components *in situ*, in which case certain components may be cut at or below the seabed (e.g. piles) or left buried (e.g. cable ducts). Any final decommissioning methodology will adhere to industry best practice, rules and regulations at the time of decommissioning. A Decommissioning Programme will be prepared which will set out the proposals for decommissioning.

3.9 PROGRAMME

3.9.1 It is anticipated, that if granted consent, then construction is anticipated to commence in 2028 and the OWF be operational in 2030. A more detailed programme will be provided in the PEIR and ES to inform the detailed assessments (including to inform the in-combination and cumulative assessments).

4. ENVIRONMENTAL IMPACT ASSESSMENT APPROACH AND METHODOLOGY

4.1 INTRODUCTION

4.1.1 This chapter considers the manner in which the EIA will be undertaken. A brief description is also provided of the approach used to prepare the technical chapters of this Scoping Report (Chapters 7 to 28).

4.1.2 This chapter sets out common matters that are relevant to all technical chapters of this Scoping Report and should therefore be read in conjunction with those chapters. Where known at this stage, any proposed divergence from the standard EIA methodology set out below is explored within the technical chapters themselves.

4.1.3 The information provided in the following sections of this chapter explains the purpose of, and proposed approach to the EIA; in this case including the manner in which impacts and effects are proposed to be addressed. Transboundary considerations, cumulative and in-combination effects as well as mitigation and monitoring are also explored in this chapter.

4.1.4 At this early phase, the project description is indicative and the 'design envelope' has been designed to include sufficient flexibility to accommodate further refinement during detailed design. Chapter 3 (of this Scoping Report) sets out a series of options and/or parameters for which maximum values are used to constitute a realistic MDS for VE.

4.1.5 The purpose of EIA is to provide a systematic analysis of the impacts of a proposed development in relation to the existing (baseline) environment. This is summarised in an ES, which provides information to those from whom consents and authorisations are sought, to enable them to assess the environmental impact of the project. Information in the ES is also used by stakeholders to evaluate the acceptability of the development and its potential impact.

4.1.6 The EIA will address the three stages of the proposed development:

- Construction - all those works, activities and processes that will be required to build the proposed development, including preparatory works;
- Operation and Maintenance - all works after the developed scheme construction works are completed and in operation; and
- Decommissioning - all works and processes required to undertake the closure, dismantling and removal of the development.

4.1.7 The EIA process typically comprises a series of phases, which are shown in Table 4.1. The EIA for VE will comprise desk studies and baseline surveys, assessment of impacts, development of mitigation measures, and identification of residual impacts. The EIA will satisfy the requirements of Schedule 4 of the 2017 EIA Regulations (see Section 1.3), and will include a description of the development comprising information on the site, design and size of the development, a description of the aspects of the environment likely to be significantly affected by the development, the likely significant effects of the development on the environment, and mitigation measures required to minimise potentially significant effects.

4.1.8 The technical topic areas identified for assessment as part of the EIA for the proposed offshore and onshore elements are:

- Offshore:
  - Physical Processes;
  - Water and Sediment Quality;
  - Benthic Subtidal and Intertidal Ecology;
  - Fish and Shellfish Ecology;
  - Marine Mammals;
  - Offshore Ornithology;
  - Commercial Fisheries;
  - Shipping and Navigation;
  - Military and Civil Aviation;
  - Seascape, Landscape and Visual Impact Assessment;
  - Archaeology and Cultural Heritage; and
  - Other Marine Users and Activities (including tourism).
- Onshore:
  - Terrestrial Ecology and Nature Conservation (including intertidal birds);
  - Archaeology and cultural heritage;
  - Airbourne Noise and Vibration;
  - Traffic and Transport;
  - Air Quality;
  - Hydrology and Flood Risk;
  - Geology and Ground Conditions;
  - Landscape and Visual;
  - Socioeconomics and Tourism; and
  - Public Health.

4.1.9 Table 4.1 presents an overview of the proposed approach for undertaking the EIA for VE. Each of the technical chapters presents the potential impacts associated with VE which may result in significant effects in EIA terms. Where, significant effects are not anticipated or no impact-receptor-pathways (see Section 4.4) have been identified then these impacts have been proposed to be scoped out of the VE EIA. This approach is to ensure that the EIA remains proportionate and focused on the key environmental issues. This Scoping Report has been prepared to set out the proposed approach to EIA for VE. The Scoping Report includes the identification of assessment methodologies for each of the environmental aspects to be assessed. All representations received during the scoping process will be considered and used to inform the EIA process.

Table 4.1 - Overview of proposed EIA process

DATA GATHERING	**PROJECT DATA GATHERING** Collection of information regarding the site's physical characteristics, environmental constraints and engineering requirements to identify methods of construction, O&M and decommissioning of VE, including identification of the project components, proposed activities and expected programme. ↓	**STAKEHOLDER ENGAGEMENT IS TO BE CARRIED OUT AT EACH STAGE**
	ENVIRONMENTAL DATA GATHERING Collection of information within the array area(s), offshore and onshore cable corridor(s), landfall zone(s) and substation site(s). ↓	
SCOPING	**IDENTIFICATION OF ENVIRONMENTAL SENSITIVITIES** Identification of receptors and the key environmental sensitivities, which could potentially be affected by the proposed wind farm development; consultation with regulatory authorities to discuss aspects associated with VE activities. ↓	
ASSESSMENT	**SITE SURVEY WORK** Surveys of the baseline environmental conditions to fill gaps in data, identify and confirm potential constraints identified as part of the desk-based assessment, and assist in the determination of impacts. Surveys may also provide information regarding presence/ absence of potential sensitive receptors and provide site specific details regarding spatial distribution, abundance/ density and seasonal patterns. ↓	
	EIA A detailed assessment of the identified potential effects associated with project activities, including consideration of built-in/designed-in mitigation where appropriate. ↓	

	EVALUATION OF SIGNIFICANCE Evaluation of significance, including qualitative estimation of magnitude and severity of impacts. 🡣	
MANAGEMENT	**MITIGATION MEASURES** Identification and definition of mitigation measures to be applied to eliminate, minimise or manage the identified potential significant environmental effects 🡣	
COMPILATION OF ENVIRONMENTAL STATEMENT	Presentation of the findings of the baseline studies and mitigation measures in a systematic way to determine the significance of the residual effect on the environment; schedule of environmental commitments and monitoring requirements	

4.2 EIA BEST PRACTICE

4.2.1 The approach to the EIA and the production of the ES will closely follow numerous relevant guidance and industry best practice documents, including but not limited to:

- The Planning Inspectorate advice notes (3,7, 9, 10,11,12,17 and 18);
- National Policy Statements (EN-1. EN-3 and EN-5) (see Chapter 1);
- Industry EIA guidance documents:
  - Assessment of the environmental impact of offshore wind-farms (OSPAR Commission, 2008);
  - Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of Food and Environment Protection Act 1985 and Coastal Protection Act 1949 requirements (Cefas, 2004);
  - Cumulative Impact Assessment Guidelines - Guiding Principles For Cumulative Impact Assessment in Offshore Wind Farms (RenewableUK, 2013); and
  - Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects (Cefas, 2012).
- Professional EIA guidance documents:
  - Guidelines for Environmental Impact Assessment (IEMA, 2004);
  - Guide to Shaping Quality Development (IEMA, 2016); and
  - Delivering Proportionate EIA, A Collaborative Strategy for Enhancing UK Environmental Impact Assessment Practice (IEMA, 2017).

4.3 DATA GATHERING

4.3.1 A basic description of the construction, operation and decommissioning of VE is provided in Chapter 3 of this report.

4.3.2 Data gathering for VE has already commenced. Environmental information has been collected from publicly available data sources and will be supplemented with information as agreed with relevant consultees during the EIA through the Evidence Plan process (see Chapter 6). Baseline surveys will be undertaken to fill gaps in the available data that has been collated as part of desk-based work including any available third party field surveys. Baseline information will be collected and analysed in accordance with best practice and agreed with the appropriate stakeholders (see Chapters 7 to 28 for details of topic specific guidance).

4.3.3 VE OWFL has collated a significant amount of existing data from a number of sources including the surveys undertaken to support the EIA for the Galloper Offshore Wind Farm project as well as subsequent studies undertaken for pre-construction and construction monitoring and operational monitoring. In addition, VE OWFL will also undertake new surveys both offshore and onshore to ensure that the baseline is up to date.

4.3.4 Where further surveys will be undertaken, this is covered in more detail in the receptor topic sections of this report. The specific approach to establishing a robust baseline. (upon which impacts can be assessed) is set out under each topic within this Scoping Report. It is envisaged that this approach will be subject to review following the receipt of the Scoping Opinion from the Planning Inspectorate and subsequent consultation with statutory bodies. It is also recognised that this approach may evolve over time with the collection of new data from the study areas established for the individual technical topics and as the design of the project advances.

4.3.5 The relevant data currently available and a gap analysis are provided in each technical chapter of this Scoping Report.

4.3.6 Information gathered as part of the VE EIA will also be utilised to inform the HRA which will be produced to accompany the PEIR and DCO Application.

4.4 EIA APPROACH

4.4.1 The EIA will be undertaken within a consistent framework that will facilitate transparency in the assessment and its conclusions. The definition of terms and assessment processes that will be adopted by each of the specialist assessors is described below.

4.4.2 In general, the EIA will identify, describe and analyse the potential impacts of the proposed development using a source-pathway-receptor model. For instance, a project activity may entail a predicted change in environmental conditions affecting either directly or indirectly (the pathway) on a sensitive receptor in a positive or negative manner (the impact). Figure 4.1 presents this model (green shading) with a specific example (green outline) to illustrate how this will be applied in the EIA.

4.4.3 For the purposes of this Scoping Report, a zone of influence (ZoI) is defined as the maximum area over which a pathway could occur on sensitive receptors with the potential to result in a measurable change to the baseline environment. For example, the ZoI for increased suspended sediment and associated deposition on sensitive receptors has been defined based on analysis of prevailing wave direction and the tidal excursion distance over one mean spring tidal cycle. The ZoI is used to identify an appropriate study area specific to each technical discipline considered within this scoping report and which will be used for EIA.

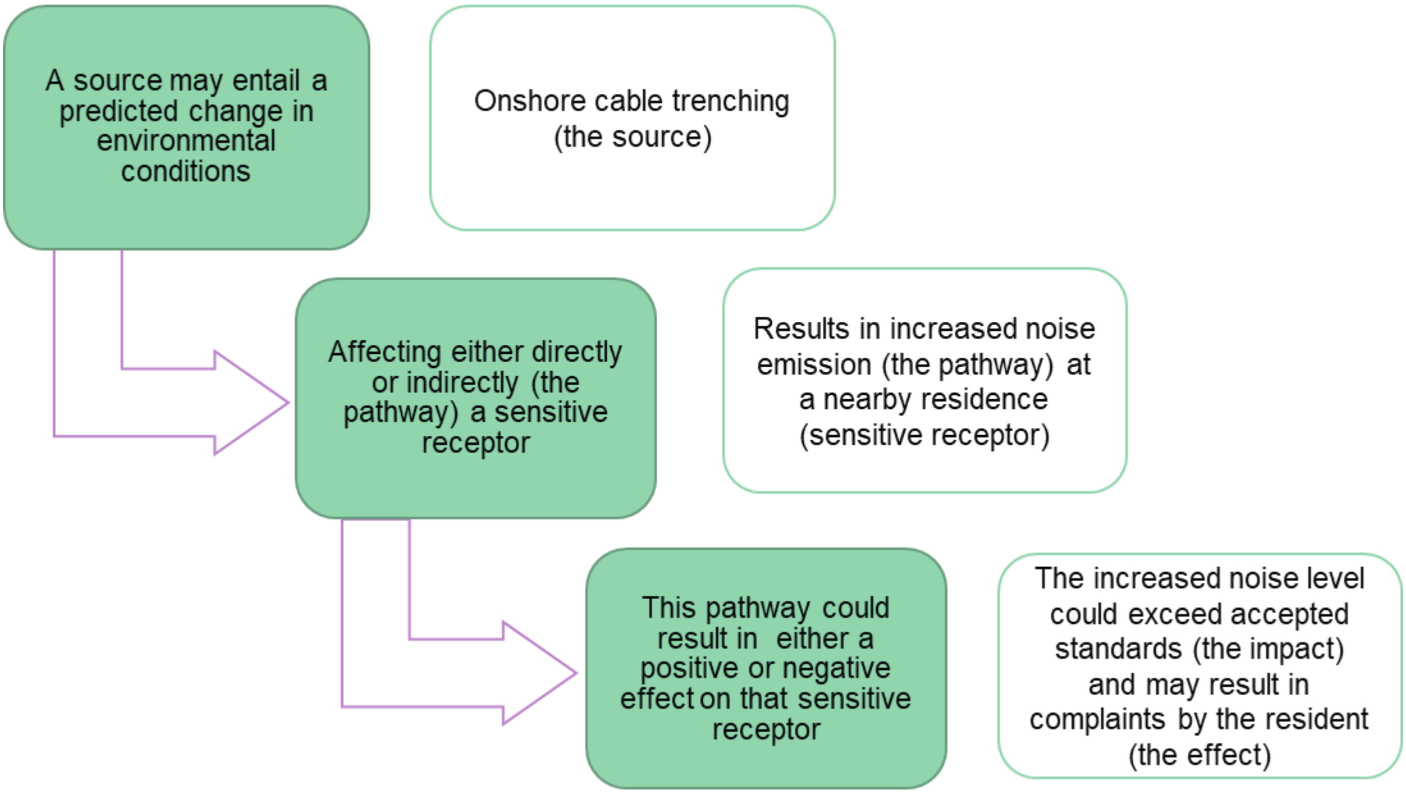


Figure 4.1 - Source-pathway-receptor model (shaded) and example (non-shaded)

EVIDENCE BASED APPROACH

4.4.4 The evidence-based approach to EIA involves not only utilising data collected specifically for the purposes of the development but also data and information from sufficiently similar investigations to inform the understanding of the baseline and/ or impact assessments for the development that is the subject of the EIA.

4.4.5 VE neighbours the existing Galloper Offshore Wind Farm, Greater Gabbard Offshore Wind Farm and is proximal to the proposed East Anglia TWO Offshore Wind Farm and North Falls Offshore Wind Farm. Therefore, extensive data from the EIA process and baseline and post-construction monitoring for Galloper Offshore Wind Farm (and other relevant OWFs) are available, which provide both raw data and also modelling that can be used to help inform the assessments for VE. Where possible, appropriate, and agreed with the relevant stakeholders, VE OWFL intend to use this existing data to aid in the characterisation of the baseline environment, where data are sufficient and appropriate to do so; scope out impacts where there is a clear evidence base; and provide evidence for assessments where impacts are scoped in.

4.4.6 The use of existing data is encouraged as part of the offshore wind industry's response to Government drivers to reduce the cost of offshore wind energy, such as those outlined in the ‘Offshore wind industrial strategy: business and government action’ (BEIS, 2013). Collaborative Offshore Wind Research into the Environment has provided best practice principles for documentation and dissemination of data (COWRIE, 2008).

4.4.7 Each topic chapter will identify where the data used for the baseline and the assessments have been sourced to inform the EIA. A gap analysis has also been undertaken to identify any requirement for additional data to be collected. Each topic chapter provides the methodology for any new data collections (if required), including surveys. Adequate data collection will be undertaken for the purposes of the EIA, to enable the receiving environment to be appropriately characterised. The Evidence Plan process will provide details of datasets for agreement with stakeholders for the purposes of characterisation and assessment for each of the technical expert panels (see Chapter 6).

4.4.8 This Scoping Report sets out to provide a detailed justification that is anticipated will facilitate the scoping out of certain of issues/impacts from further assessment. This is in line with recent the Planning Inspectorate Advice Note 7: EIA: Process, Preliminary Environmental Information, and Environmental Statements[24] (PINS, 2020).

4.4.9 Mitigation that is embedded (designed-in) within the project will be described in the ES. Any modification of the standard approach and definitions will be fully described and justified within each section where necessary.

KEY PARAMETERS

4.4.10 The VE EIA, in line with the Planning Inspectorate Advice Note Nine: Rochdale Envelope, will be based on identifying the 'worst-case' scenario (PINS, 2018) (see Chapter 3 for further details on the Rochdale Envelope). This ‘worst-case scenario’ will be referred to throughout the EIA as the 'maximum design scenario' (MDS). A MDS will be presented in the impact assessment for each topic area in the ES. This approach ensures that the scenario that will have the greatest impact (i.e. largest footprint, longest exposure, or tallest dimensions, depending on the topic) is assessed; it can then be assumed that any other (lesser) scenarios will have an impact that is no greater than that assessed.

4.4.11 The design information (as presented in Chapter 3) is based on the best available information and the parameters outlined in the project description chapter are realistic, yet conservative estimations of future design parameters. Therefore, each chapter will assess the 'realistic worst-case' scenario for each of the identified potential impacts.

4.4.12 This approach is required for developments, including offshore wind, where it is not possible to identify the exact components to be used within the final development as it provides for flexibility in design and construction within maximum extents and ranges assessed within the EIA. Therefore, the consent permits the use of any components so long as they are within the maxima assessed, rather than limiting the development to existing technology at the time of assessment, which may not be economically viable at the point of construction. This is of particular relevance to offshore wind development, where the technology is constantly improving, with larger and more powerful turbines being developed.

4.4.13 More detailed design information will be provided in the ES.

[24] Paragraph 4.10 to 4.11 of PINS advice note 7 (https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2017/12/Advice-note-7.pdf)

ASSESSMENT OF EFFECTS

4.4.14 Confusion can arise whilst reading an ES due to a lack of clarification around the words 'impact' and 'effect'. Throughout the VE EIA process, the term 'impact' will be used to define a change that is caused by a source. For example, pile driving of foundations during construction (the source) results in increased levels of subsea noise (the impact) (see Figure 4.1). Impacts can be direct, indirect, secondary, cumulative, inter-related or transboundary. They can also be beneficial or adverse. The term 'effect' is used throughout this assessment (and in the ES) to express the outcome of an impact, i.e. the increased levels of noise (impact) from the piling of foundations (source) has the potential to disturb marine mammals or fish (the effect).

4.4.15 The 'significance of effect' will be presented in the ES and will take into account the magnitude of an impact in combination with the importance and/ or the sensitivity of the receptor or resource, in line with defined significance criteria.

4.4.16 The impact assessment process will consider the following:

- The magnitude of the impact;
- The sensitivity of the receptor to the impact;
- The probability that the impact on the receptor will result in a given effect;
- The determination of the resulting likely environmental effects and their significance, given spatial and temporal extent of the potential impact, the potential for reversibility or recovery; and
- The level of certainty inherent within the assessment.

4.4.17 For each topic, the most relevant and latest guidance or best practice will be used and therefore definitions of magnitude and sensitivity of impact will be tailored to each receptor.

THE MAGNITUDE OF THE IMPACT

4.4.18 The magnitude of an impact provides a useful initial measure of the likelihood of an environmental effect arising. Magnitude is defined for the purposes of assessment via four factors:

- Extent - The area over which an impact occurs;
- Duration - The time for which the impact occurs;
- Frequency - How often the impact occurs; and
- Severity - The degree of change relative to the baseline level.

4.4.19 Each ES chapter will present a 'Magnitude of impact' table within the assessment chapter. This table will present how the magnitude of the identified impacts are defined based on the criteria above.

THE SENSITIVITY OF A RECEPTOR

4.4.20 The sensitivity of the receptor is a function of its capacity to accommodate change and reflects its ability to recover if it is affected. The sensitivity of the receptor is therefore quantified via the following factors:

> Adaptability - The degree to which a receptor can avoid or adapt to an impact;

> Tolerance - The ability of a receptor to accommodate temporary or permanent change without a significant adverse impact;

> Recoverability - The temporal scale over and extent to which a receptor will recover following an impact; and

> Value - A measure of the receptor's importance, rarity and worth.

4.4.21 Each ES chapter will present a 'Sensitivity/ importance of the receptor' table within the assessment chapter. This table will present how sensitivity is defined for the topic's receptors based on the criteria above.

4.4.22 For some assessments, such as Shipping and Navigation, the probability of an impact occurring will be taken into consideration when determining the significance of the effect (see below).

THE DETERMINATION OF EFFECT SIGNIFICANCE

4.4.23 The significance of an effect, either adverse or beneficial, will be determined using a combination of the magnitude of the impact and the sensitivity of the receptor. A matrix approach is proposed to be used throughout all topic areas to ensure a consistent approach within the VE ES.

4.4.24 The terms assigned to categorise the significance of effects, where they are predicted to occur, can be described as follows:

> Negligible: beneficial or adverse - where the development will cause no discernible improvement in or deterioration of the existing environment;

> Minor: beneficial or adverse - where the development will cause a barely perceptible improvement in or deterioration of the existing environment;

> Moderate: beneficial or adverse - where the development will cause a noticeable improvement or deterioration of the existing environment; or

> Major: beneficial or adverse - where the development will cause a considerable improvement or deterioration of the existing environment.

4.4.25 In general, the categories of Moderate and Major will be considered significant in EIA terms, however the exact definition of these terms will be defined further within each topic chapter.

4.4.26 For example, if the magnitude of the impact is assessed as High (negative) and the sensitivity of the receptor is assessed as Negligible, then the significance will be Minor adverse (see Table 4.2), and therefore will not be considered significant in EIA terms.

4.4.27 Predictions of impact will be based on the best available data using a combination of professional judgement, expert knowledge and modelling where appropriate. The precautionary principle will be applied to ensure that potential effects are not ascribed unduly low probability of occurrence or low levels of significance.

Table 4.2 - Proposed matrix for determining the significance of effects

		SENSITIVITY			
		HIGH	**MEDIUM**	**LOW**	**NEGLIGIBLE**
NEGATIVE MAGNITUDE	**HIGH**	Major	Major	Moderate	Minor
	MEDIUM	Major	Moderate	Minor	Negligible
	LOW	Moderate	Minor	Minor	Negligible
	NEGLIGIBLE	Minor	Minor	Negligible	Negligible
BENEFICIAL MAGNITUDE	**LOW**	Moderate	Minor	Minor	Negligible
	MEDIUM	Major	Moderate	Minor	Negligible
	HIGH	Major	Major	Moderate	Minor

ACKNOWLEDGING LEVELS OF CERTAINTY

4.4.28 The assessment needs to be robust and so will seek to describe and account for the degree of uncertainty inherent in, for instance, the data used in the assessment, the identification of activities and impacts, the confidence in determining impact magnitude and receptor sensitivity, and in assigning significance levels to predicted effects arising.

4.5 MITIGATION & MONITORING

4.5.1 Appropriate mitigation measures will be explored to eliminate, minimise or manage identified potentially significant effects on the environment. Best practice strategies for mitigation are widely practiced and accepted within EIA and will be followed when considering the methods of dealing with the environmental impacts of the proposed development. The strategy comprises the components listed in Table 4.3.

4.5.2 Where changes are required to be made to the design of the project during the iterative EIA process, these measures will be clearly identified within the ES. The clear inclusion of these measures within the ES will demonstrate the commitment of VE OWFL to these measures. Where required these measures will be secured by the DCO. By employing this method, the significance of effect presented for each identified impact may be presumed to be representative of the maximum residual effect that the development will have, should it be approved and constructed absent any specific mitigation.

4.5.3 The assessment is then repeated for the revised 'maximum adverse scenario' until:

- The effect has been reduced to a level that is not significant in EIA terms; or
- No further changes may reasonably be made to the development parameters in order to reduce the magnitude of the impact, thereby permitting the presentation of an effect that is still significant in EIA terms.

4.5.4 In some instances, additional mitigation measures will be outlined in the topic ES chapters. The extra mitigation measures may be deemed necessary where:

- An effect is significant in EIA terms, even with embedded mitigation, but additional mitigation measures are available to reduce the level of effect; or
- Mitigation has been proposed but has not yet been agreed with regulators, stakeholders, etc. or it is unproven.

4.5.5 Where relevant, these additional mitigation measures will be outlined in the topic chapters, after the assessment of significance section. Table 4.3 outlines the proposed mitigation hierarchy to be adopted in the VE EIA. This hierarchy is based on the 'Guidelines For Ecological Impact Assessment In The UK And Ireland' (CIEEM, 2018) and is a sequential process to minimise the residual effects through the various potential stages until adverse significant effects are appropriately mitigated or remediated.

Table 4.3 – Mitigation hierarchy

AVOIDANCE ↓	Where viable, the project will be redesigned to avoid impacts. Avoidance will also be considered during the assessment of alternative sites/routes.
REDUCTION ↓	Reduction will be considered when all options for the avoidance of impacts have been exhausted or deemed to be impractical. For example, alternative technologies could be considered to reduce impact.
COMPENSATION[25] ↓	Where the potential for avoiding and reducing impacts has been exhausted, consideration will be given to providing compensation for residual impacts to make the proposal more environmentally acceptable such as through application of Biodiversity Net Gain (BNG).
REMEDIATION	Where adverse significant effects are unavoidable, consideration will be given to limiting the level of impact by undertaking remedial works.

[25] Note, compensation is described here in the context of the Guidelines For Ecological Impact Assessment In The UK And Ireland' (CIEEM, 2018) in relation to the mitigation hierarchy with regards to the EIA process. Compensation in respect of the HRA process will be dealt with separately through the HRA process.

MITIGATION PLANS

4.5.6 This Scoping Report refers to the following key mitigation plans:

- Code of Construction Practice (CoCP) will set out the management measures which will be taken by VE OWFL and their contractors to minimise the potential environmental impacts of onshore construction of VE and limit the disturbance from construction activities such as site preparation, material delivery and removal, work activities and site reinstatement as far as reasonably practicable. The CoCP also sets out the principal measures that will be secured in the Construction Environmental Management Plan (CEMP) and associated onshore subject specific management plans (SSMPs) for each stage of works in the post-consent phase. The CoCP and associated documents will be submitted to the relevant planning authorities for approval post consent (if granted) prior to construction commencing. Consideration of SSMPs are detailed within relevant technical chapters where appropriate, in support of the relevant scoping determinations .
- A Project Environment Management Plan (PEMP) will be produced to manage and mitigate the potential impacts associated with offshore construction activities. The PEMP will outline the requirements and control measures in line with good industry practice that will be adhered to by all contractors engaged on the project. The PEMP will include a Marine Pollution Contingency Plan (MPCP) which will set out control measures to minimise the risk of accidental spills, potential contaminant release and include key emergency response measures and contact details (e.g. MMO, Maritime Coastguard Agency and the project site co-ordinator). The PEMP will be secured as a condition in the deemed Marine Licence and produced post consent (if granted).
- A Decommissioning Programme will be developed to cover the decommissioning phase as required under Section 105 of the Energy Act 2004. As the decommissioning phase will be a similar process to the construction phase but in reverse the embedded mitigation measures will be similar to those for the construction phase. The final decommissioning procedures and associated mitigation measures will be circulated for approval in line with statutory requirements. The Decommissioning Programme will also be secured as a condition in the deemed Marine Licence.

4.6 CUMULATIVE EFFECTS

4.6.1 A Cumulative impact Assessment (CIA) is required under the 2017 EIA Regulations (Schedule 4, Paragraph 5(e)). Cumulative effects are defined as those effects on a receptor that may arise when the development is considered together with other existing and/ or approved projects.

4.6.2 The need to consider cumulative effects is also outlined in NPS EN-1 (DECC, 2011a), which states:

> *'When considering cumulative effects, the ES should provide information on how the effects of the applicant's proposal will combine and interact with the effects of other development (including projects for which consent has been sought or granted, as well as those already in existence)'.*

4.6.3 The approach to the CIA will be based on the Planning Inspectorate Advice Note 17 (PINS, 2019) A detailed search to produce a longlist and a shortlist (as described below) will be undertaken as part of the EIA to identify projects for which cumulative impact considerations will be applicable. These projects will be included in the cumulative impact assessments of the relevant PEIR and ES chapters.

4.6.4 Cumulative impacts of VE will be assessed to identify where there could be an accumulation of impacts on a sensitive receptor, which could result in the need for further mitigation (for instance a large number of minor effects may coincide to result in an adverse effect of greater severity/ harm overall).

4.6.5 It is proposed that projects that are built and operational at the time that survey data were collected have been classified as part of the baseline conditions. For those projects that were/ are only partially constructed or have only recently been completed, the full extent of the impacts arising from the development(s) may not be known and therefore will be included within the CIA. In assessing the potential cumulative impact(s) for VE, it is important to bear in mind that some projects, predominantly those 'proposed' or identified in development plans etc. may or may not actually be taken forward. There is thus a need to build in some consideration of certainty (or uncertainty) with respect to the potential impacts which might arise from such proposals. For this reason, all relevant projects/ plans considered cumulatively alongside VE will be allocated into 'Tiers', reflecting their stage within the planning and development process. This allows the cumulative impact assessment to present several future development scenarios, each with a differing potential for being ultimately built out.

LONGLIST PROCESS

4.6.6 Cumulative impacts consider other proposed development within the context of the site and any other reasonably foreseeable proposals in the vicinity. For the development of a longlist for both onshore and offshore, this will include:

> Proposals under construction;
> Permitted application(s), but not yet implemented;
> Submitted application(s) not yet determined;
> Projects on the Planning Inspectorate's Programme of Projects;
> Proposals identified in the relevant Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited; and
> Proposals identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.

4.6.7 The offshore and onshore longlists (see below) will be made available to stakeholders in writing via the Evidence Plan process (see Chapter 6), in order to seek agreement on the planned developments included within the assessment of cumulative impacts.

OFFSHORE PLANS AND PROJECTS

4.6.8 In order to generate the offshore longlist, marine projects, plans and activities will be screened based on their proximity to VE. This approach enables a precautionary list to be generated and maintained during the EIA process. The screening criteria[26] for the production of the longlist includes the following developments:

- Relevant renewable energy developments (up to 500 km from VE);
- Relevant offshore oil and gas developments (up to 200 km from VE);
- Relevant pipelines and cable developments (up to 50 km from VE);
- Relevant port and harbour activities and developments (including capital and maintenance dredging) (up to 200 km from VE);
- Relevant marine dredging and disposal sites (up to 50 km from VE); and
- Relevant coastal developments (up to 200 km from VE).

ONSHORE PLANS AND PROJECTS

4.6.9 The longlist for onshore plans and projects will be generated through the collation of planning consents granted within the last three years, or applications that have been made and have yet to be determined. These projects will be identified within a search area, for the onshore longlist, based on the largest ZoI identified by the onshore EIA assessments. This check will be made in conjunction with the relevant local authorities, in order that any planned developments that are the subject of lodged planning applications are included within the assessment of cumulative impacts for the onshore VE components.

4.6.10 Onshore plans or projects that may be considered include (but not limited to):

- Other energy generation infrastructure;
- Building/housing developments;
- Any large scale developments of relevance;
- Installation or upgrade of roads and/ or railways;
- Installation or upgrade of cables and pipelines;
- Coastal protection works; and
- National Grid enabling works.

SHORTLIST PROCESS

4.6.11 The onshore and offshore longlists will be screened to generate EIA topic specific shortlists of potential projects and plans to be considered cumulatively. The shortlisting process will be undertaken when the onshore and offshore longlists have been finalised. The shortlisting process screens, for each of the EIA topic, which projects, plans and activities there is a conceptual impact-receptor pathway for potential cumulative effect (see Figure 4.1).

[26] Any receptors identified that have the potential to be affected by more distant projects, than those presented, will result in projects being screened into the longlist from greater distances.

4.6.12 The shortlisting process will account for whether the plan, project or activity:

- Has the potential for temporal overlap:
  - If activities associated with an ongoing project or plan are considered to be part of the existing baseline environment or not, i.e. existing projects that have ongoing effects may also be screened in; or
  - If not yet constructed, has the potential for a temporal overlap (i.e. activities occurring concurrently).
- Has the potential for spatial overlap (i.e. activities occurring within a certain distance from one another):
  - This will be defined for each topic based on the defined ZoI for each potential cumulative impact.

4.6.13 Following the shortlisting process, for each of the projects, plans or activities screened in the level of confidence will be assigned based on the data and detail that is publicly available.

4.6.14 Ultimately, this screening produces EIA topic-specific shortlists of projects to be considered and refined further within the cumulative effects assessment as part of each PEIR/ES chapter. The topic-specific shortlists will be presented (or provided in writing on request) to stakeholders via the Evidence Plan process (see Chapter 6) with the intention of seeking agreement on the shortlists.

NOTABLE CUMULATIVE PROJECTS

4.6.15 In advance of the long- and shortlisting processes, VE OWFL notes the following key developments which will be considered in the PEIR/ ES for the relevant EIA topics:

- North Falls OWF (including onshore, landfall and offshore infrastructure);
- EACS (including associated enabling works);
- South and East Anglia (SEA) Link project (onshore and offshore infrastructure subject to availability of project information);
- Neuconnect interconnector (offshore infrastructure only);
- Nautilus Interconnector (offshore infrastructure only); and
- East Anglia Two and One North OWF (offshore infrastructure only).

4.7 INTER-RELATED EFFECTS

4.7.1 Consideration of inter-relationships accounts for impacts of the proposals on the same receptor. These occur where a number of separate impacts, e.g. noise and air quality, affect a single receptor such as fauna.

4.7.2 Inter-related effects are proposed to be assessed through consideration of all effects on a receptor by the Project. The assessment will consider the potential for all effects on that receptor to interact, whether that be spatially or temporally, results in the identification of inter-related effects on a receptor (for example all effects on human amenity - noise and air quality, access, and traffic - these might be short-term, temporary or transient effects or incorporate longer term effects).

4.8 TRANSBOUNDARY EFFECTS

4.8.1 The Espoo Convention[27] sets out the obligations of Parties to assess the environmental impact of certain activities that have the potential to have transboundary effects at an early stage of planning and to notify and consult other States in cases where there is likely to be significant adverse environmental impact on those States. This duty is encapsulated in Regulation 32 of the 2017 EIA Regulations, with procedural advice provided in the Planning Inspectorate Advice Note 12 (PINS, 2020).

OFFSHORE

4.8.2 The proposed consideration of marine transboundary effects includes:

- Impacts that may occur in/ on the environment of another State (i.e. their territory or territorial waters but not including the UK Exclusive Economic Zone (EEZ)); and
- Impacts that may occur to interests of another State (for instance commercial fishing taking place with the UK EEZ).

4.8.3 The limits of the Dutch, Belgian and French Exclusive Economic Zones (EEZs) are located approximately 16 km (southeast), 25 km (south) and 18 km (north east) from the VE array areas respectively. Figure 4.2 presents VE's proximity to each of these State's EEZs.

4.8.4 With regard to the offshore elements of the VE, it is acknowledged that certain works comprising installation of submarine cables will take place within the UK EEZ. the Planning Inspectorate Advice Note 12 recommends that:

"As part of their request to the Secretary of State for a scoping opinion, developers are strongly encouraged to identify both the possible significant transboundary impacts or, where applicable, why they consider that there will not be any significant impacts on the environment of another EEA State."

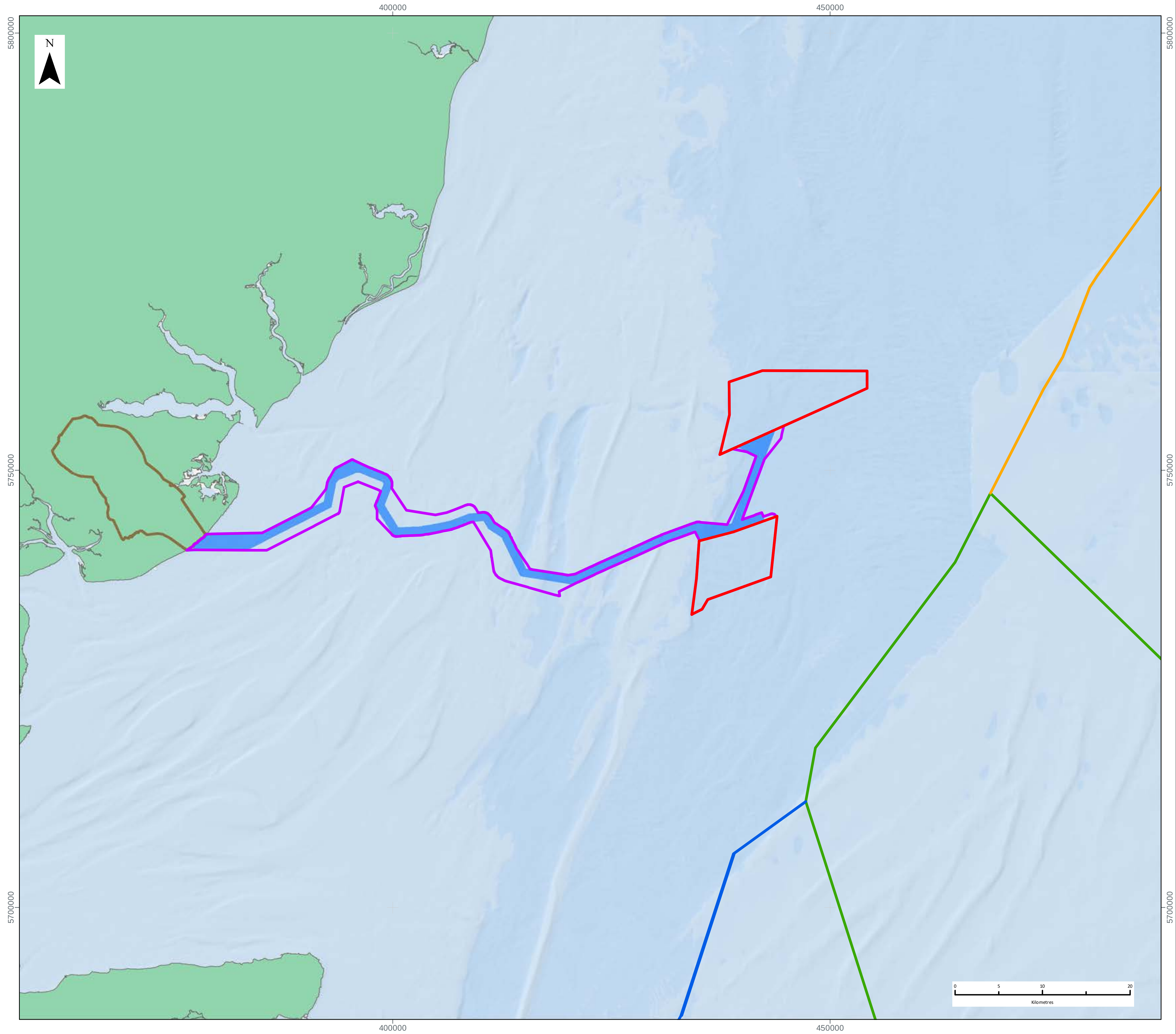
4.8.5 Each of the technical assessments presented in this Scoping Report (see Chapters 7 to 18) provide consideration for the potential of significant transboundary impacts and present VE OWFL's position of whether these impacts should be scoped in (or out) from further consideration in the EIA. A screening matrix for transboundary impacts will be provided in the ES.

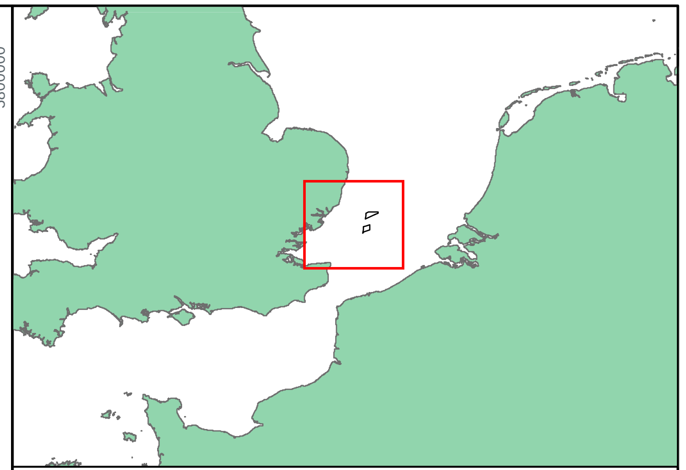
4.8.6 It is considered that there are not likely to be any significant effects on other States, either directly or indirectly on their interests. The issues will be taken up and assessed fully in the relevant parts of the ES, where relevant to the consideration of (non-transboundary) project impacts.

ONSHORE

4.8.7 No potential transboundary construction, operation or decommissioning effects or cumulative effects are predicted to arise from any part of the proposed onshore development. Thus, the technical chapters of this Scoping Report relating to the onshore elements of VE do not seek to repeat this fact.

[27] The Convention on EIA in a Transboundary Context. United Nations Economic Commission for Europe (UNECE), signed at Espoo, Finland, 1991





LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search

EEZs:

- Belgium
- France
- Netherlands

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

VE in relation to Other State's Exclusive Economic Zones

VER	DATE	REMARKS	Drawn	Checked
1	27/09/2021	For Issue	SWM	FM

DRAWING NUMBER:

4.2

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:450,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\WORKING_FIGURES\VE_EIA_FIG_4_2_EEZs.mxd

5. SITE SELECTION AND ALTERNATIVES

5.1 INTRODUCTION

5.1.1 Schedule 4 (paragraph 2) of the 2017 EIA Regulations requires developers to outline how chosen options have been selected and the reasonable alternatives considered by the Applicant. The EIA will set out the options considered for VE and the rationale for selecting particular options, taking into consideration environmental effects, technical feasibility and the overall objectives of the project. This chapter provides an overview of the considerations and principles of the site selection (both offshore and onshore) and of alternatives (locations and methodologies) considered to date for the VE.

5.1.2 At the time of writing a Site Selection Study (SSS) is currently being finalised by Royal Haskoning DHV (RH DHV) on behalf of VE OWFL. This chapter describes the scope of the study, its findings to date and remaining work to be completed. Some early desk based assessments have been completed as part of the SSS to inform the preliminary design of VE. One of the outputs of this early study was the definition of the Scoping Boundary on which this EIA Scoping exercise has been undertaken. Figure 1.1 and Figure 1.2 provides a geographical overview of this area (within which the project and electrical infrastructure are proposed be located, including the temporary work areas). Further details of this study and the proposed future studies are provided in Section 5.4.

5.1.3 This chapter also seeks to demonstrate that reasonable alternatives have been, and will continue to be, considered during development of VE.

5.1.4 The site selection process undertaken to date for the EIA offshore Scoping Boundary (the offshore Area of Search (AoS)), has adhered to The Crown Estate's Cable Route Protocol (TCE, 2019), see Section 5.4. In addition, best practice and guidance has also been applied to define the EIA onshore Scoping Boundary (the onshore AoS), including National Grid's Guidelines on Substation Siting and Design ('The Horlock Rules').

5.1.5 The overall aim of the process is to ensure that the final design will be an environmentally acceptable option from a physical, biological or human perspective whilst ensuring that the lowest costs of energy be passed to consumers. The process has sought to minimise interaction with sensitive receptors through avoidance in the first instance as far as is feasible and practicable. For locating infrastructure within the identified scoping boundaries (Chapter 1), public health and safety, including navigational risk to other marine users will be considered further.

5.1.6 It should be noted that the Applicant is unable to utilise the existing export cables (and substation) for the Galloper OWF for VE as these were installed and rated to the capacity specifically required for that project. As such there is no capacity to transmit the electricity generated from VE to the National Grid through the Galloper OWF infrastructure.

5.1.7 It should be noted that all information in this chapter is based on the best available information at the time of writing.

5.2 POLICY AND LEGILSATION

5.2.1 Full details of the key policy and legislative drivers which underpin and support the development of VE are provided in Chapter 1.

5.2.2 The following legislation and guidance provides the framework of the site selection and consideration of alternatives process:

- Environmental Impact Assessment Regulations 2017 (see Chapter 1 of this Scoping Report);
- Marine Works EIA Regulations (2007) (as amended) (see Chapter 1 of this Scoping Report);
- Habitats Regulation 2017 (see Chapter 1 of this Scoping Report);
- National Policy Planning Framework 2019;
- Habitats Regulations 2017;
- Offshore Habitats Regulations 2017;
- The Planning Act 2008;
- Overarching National Policy Statement for Energy (EN-1) (see Chapter 1 of this Scoping Report);
- National Policy Statement for Renewable Energy Infrastructure (EN-3) (see Chapter 1 of this Scoping Report);
- National Policy Statement for Electricity Networks Infrastructure (EN-5) (see Chapter 1 of this Scoping Report);
- Planning Inspectorate Advice Note Nine: Rochdale Envelope;
- Planning Inspectorate Advice Note Seven: EIA;
- The Crown Estate's Cable Route Protocol (2019) (see below);
- Marine Policy Statement (2011);
- East Inshore and Offshore Marine Spatial Plan (2014)
- East Inshore and Offshore Marine Spatial Plan (2020)
- Institute of Environmental Management and Assessment's (IEMA) EIA Guide to Shaping Quality Development (IEMA, 2015); and,
- The Holford Rules (see below)

5.2.3 Further detail on the key policy and legislation drivers for the site selection and consideration of alternatives process is provided below.

EIA REGULATIONS

5.2.4 Schedule 4 of the EIA Regulations 2017, at paragraph 2, 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". The EIA will set out the options considered for VE and the rationale for selecting particular options, taking into consideration environmental effects, technical feasibility and the overall objectives of the project.

5.2.5 Further information is provided in Section 1.4 of this Scoping Report.

HABITATS REGULATIONS 2017

5.2.6 Furthermore, under the Habitats Regulations (2017) and Offshore Habitats Regulations (2017), 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 the integrity of the site. The requirements under the Habitats Regulations and the Offshore Habitats Regulations will be addressed in the Habitat Regulation Assessment Report(s) which will be submitted alongside the DCO (and deemed Marine Licence) application.

5.2.7 The SSS has aimed to minimise the interaction with National Site Network designations and Ramsar sites as far as possible. Consultation with Natural England has been undertaken to identify key concerns over interactions with relevant designations. See Chapter 6: Consultation (Section 6.6) for details on consultation undertaken to date. VE OWFL have taken into account feedback received from stakeholders in driving route selection particularly in respect of the offshore AoS. A detailed consideration of alternatives has been completed. Details of the consideration of alternatives will be set out in the HRA document that will accompany the DCO application.

5.2.8 Further information is provided in Section 1.4 of this Scoping Report.

NATIONAL POLICY STATEMENTS

5.2.9 The Overarching NPS for Energy (EN-1) is clear that “from a policy perspective this NPS EN-1 does not contain any general requirement to consider alternatives or to establish whether the proposed project represents the best option”. However, in the execution of a competent EIA “applicants are obliged to include in their ES, as a matter of fact, information about the main alternatives they have studied.” Additionally, paragraph 4.4.1 of NPS EN-1 states:

"As in any planning case the relevance or otherwise to the decision making process of the existence (or alleged existence) of alternatives to the proposed development is in the first instance a matter of law, detailed guidance on which falls outside the scope of this NPS. ***From a policy perspective this NPS does not contain any general requirement to consider alternatives or to establish whether the proposed project represents the best option*** *(emphasis added)".*

5.2.10 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 cables 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."

5.2.11 The information and considerations under NPS EN-1 and EN-3 will be presented in the PEIR and ES. The EIA and DCO application will take account of the requirements of any revised NPS when formally adopted within the meaning of section 104 of the Planning Act 2008.

CROWN ESTATE'S CABLE ROUTE PROTOCOL

5.2.12 The Crown Estate's Cable Route Protocol (CRP) (2019) comprises a set of principles and requirements for offshore wind developers in the planning of offshore export cable routes. Compliance with these requirements must be demonstrated within the Corridor Identification and Approval for Linear Activities (CIAL) document which will accompany an application to The Crown Estate for a transmission assets AfL. 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.

5.2.13 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.

5.2.14 Table 5.1 sets out how these key principles and requirements of the CRP have been taken into account during the SSS.

Table 5.1 - Consideration of the key CRP principles and requirements in VE OWFL's site selection study

PRINCIPLE/ REQUIREMENT NUMBER	REQUIREMENT DETAIL	CONSIDERATION OF CRP WITHIN THE SSS
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 (inter alia) MCZs and SSSIs.	The CRP has been applied to the SSS to minimise interaction with all national designations as well as international designations 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. Consequently, the offshore AoS overlaps with the Margate and Longsands

PRINCIPLE/ REQUIREMENT NUMBER	REQUIREMENT DETAIL	CONSIDERATION OF CRP WITHIN THE SSS
		SAC at the northern periphery. This overlap has been necessary to maintain a buffer distance from a pilotage area to the north. Similarly, shipping and navigation stakeholders flagged that reduction of 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.
Requirement 9	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: > 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	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. The SSS has also considered the status and sensitivity of the relevant designated features to the installation of cables.

PRINCIPLE/ REQUIREMENT NUMBER	REQUIREMENT DETAIL	CONSIDERATION OF CRP WITHIN THE SSS
	> Habitats that are known to be irreplaceable or very difficult to replace (e.g. chalk reef).	Therefore, sensitive routeing and the 'avoid, reduce, mitigate' hierarchy has been adopted to reduce the impact on these habitats as far as is practicable.
Requirement 10	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 cables with their indicative spacing requirements and the additional structures (e.g. substations and converter stations) which the project is likely to require. 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).	Details of the possible cable infrastructure requirements including spacing, cable protection and likely preparation works have been considered. Chapter 3 outlines the key details that have been considered in line with the Rochdale Principle approach. The design information has considered the realistic worst case scenario. Offshore survey work is programmed for Q3 and Q4 2021 and will be used to further refine the Rochdale Envelope for consideration in the PEIR and ES.

HORLOCK RULES

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

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

THE HOLFORD RULES

5.2.17 National Grid employs the guidelines on overhead line routing known as the Holford Rules. Since the formulation of the original Holford Rules, formal requirements for environmental assessment have been introduced. 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 the 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, as such they have been considered within the site selection process.

5.3 PROJECT ALTERNATIVES AND EARLY DESIGN COMMITMENTS

5.3.1 A number of alternatives have been considered as part of the decision-making process. The early strategic project objectives which have fed directly into the site selection process are detailed below.

- Firstly, to minimise the need for new infrastructure required for the VE from the outset, VE OWFL has considered the use of the existing Galloper OWF export cables and substation. However, as 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 OWFL has 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 permanent landscape effects associated with overhead lines.

5.3.2 VE OWFL has committed to considering trenchless technologies, such as HDD at the landfall, in order to bring cables from the marine environment onshore. The HDD is required so that the existing sea defences are not compromised and it will also help protect sensitive features and minimise the extent of direct interaction with coastal features subject to further ground investigations and associated feasibility studies.

5.4 SITE SELECTION PROCESS

5.4.1 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.

5.4.2 The location for the proposed arrays were selected by VE OWFL on the basis of a number of environmental and engineering constraints (described in Section 5.5) pursuant to The Crown Estate issuing an opportunity for operating offshore wind farms to apply for extensions in 2017.

5.4.3 Following identification of the array areas, VE OWFL submitted a grid connection application to National Grid. VE OWFL were originally offered a grid connection at Friston in Suffolk. This grid offer was revoked in 2020 and a revised grid offer was accepted to connect to a new substation to be called the East Anglia Costal Substation (EACS). The location of the EACS substation is currently subject to an ongoing National Grid site selection exercise. VE OWFL developed the onshore area of search (AoS) presented in this Scoping Report based on discussions with National Grid in relation to the area being considered for the EACS substation.

5.4.4 In parallel VE OWFL has commissioned RH DHV to undertake a Site Selection Study (SSS) to identify locations for the onshore and offshore export cable routes (ECR), landfall and a project specific substation location, in order to connect the arrays to the EACS. The VE SSS has been progressed based on information provided by National Grid in relation to their ongoing process for identifying a location of the EACS. The SSS follows best practice guidance as set out in Section 5.2. The process followed within the SSS will be subject to formal consultation in in Q1/2 2022 and will be detailed in full within the PEIR (see Section 5.10 below) and the ES submitted with the DCO application.

5.4.5 At the time of writing, the SSS is being finalised following the process outlined in Figure 5.1. The first stage of the study has been to define the search area within which the onshore and offshore ECRs, landfall and onshore substation could be located. The search area has been identified, following consideration of the guidance and requirements set out in Section 5.2. The search area was refined by applying high level engineering and environmental constraints to the area between the array and the coastal area of Essex adjacent to the area where National Grid have indicated that they are considering for the EACS.

5.4.6 The constraint mapping exercise identified a preferred OECR and a wider offshore AoS as described in Section 5.6. The wider offshore AoS forms the extent of the Scoping Boundary in relation to the offshore export cable. The offshore AoS was developed in consultation with a number of key stakeholders to take account of any key concerns around the proposed offshore route options. Further details of the consultation undertaken to date are detailed in Chapter 6 (Section 6.6).

5.4.7 Onshore constraints mapping was undertaken as part of the SSS and will be used to develop feasible routing options from the landfall location to potential EACS locations and to identify a location for the onshore VE substation within this AoS. This onshore AoS forms the onshore component of the Scoping Boundary as detailed within Section 5.7 and 5.8. VE OWFL's SSS will not conclude until National Grid have identified the final location of the EACS study area.

5.4.8 Figure 1.1 and Figure 1.2 provides a geographical overview of the onshore AoS and the offshore AoS that comprises the EIA Scoping Boundary.

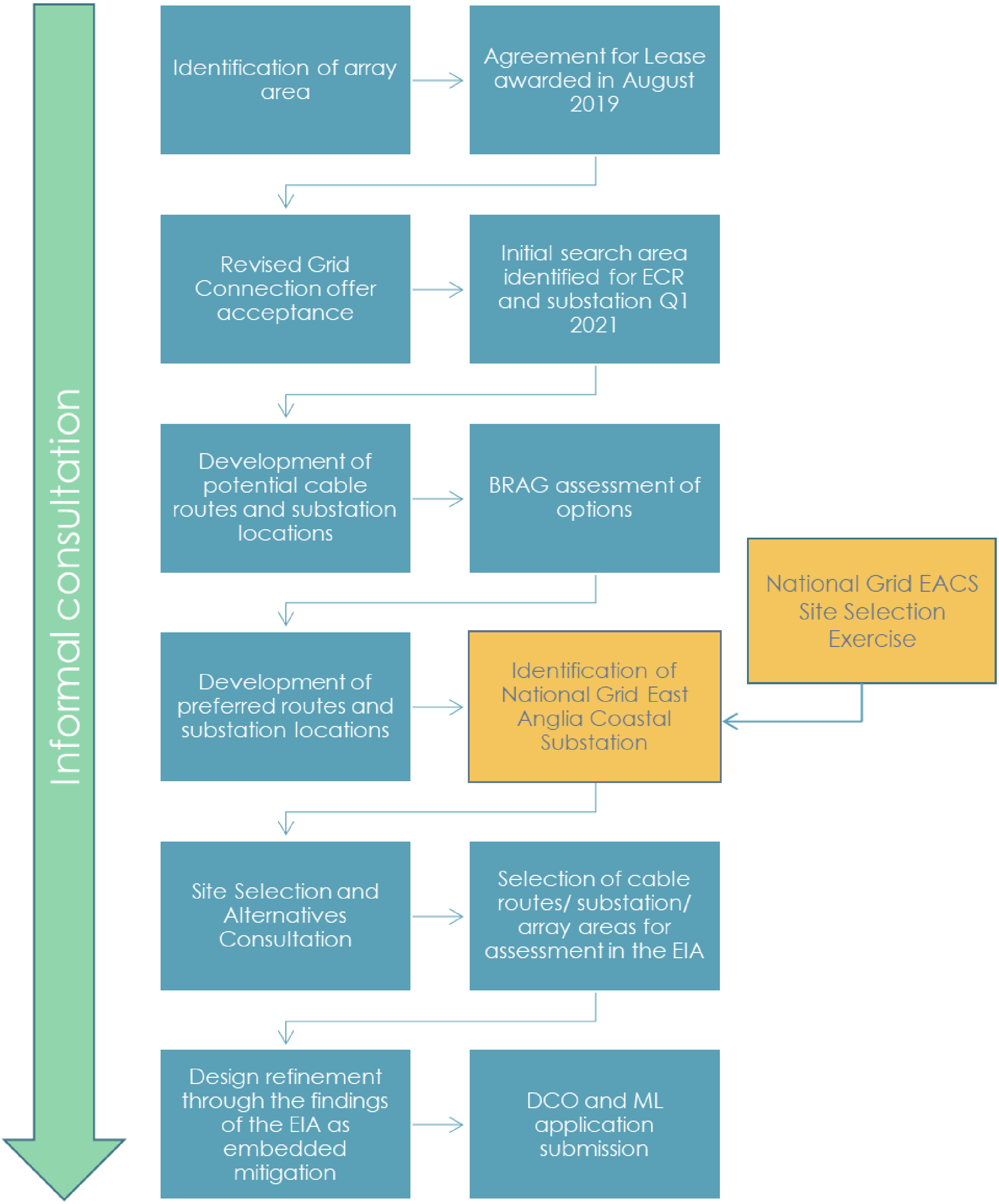


Figure 5.1 - Simplified diagram of the VE site selection process

5.5 ARRAYS

5.5.1 In February 2017, The Crown Estate (TCE) announced the opportunity to apply for project extensions to existing OWFs. Eight applications were received, including VE (as an extension to Galloper OWF), which met the specified application criteria.

5.5.2 The boundaries for the proposed array were initially chosen by delineation of the Galloper OWF farm site boundary combined with existing GIS constraints data. The preliminary site boundary was considered the maximum buildable area for placement of turbines, pending further survey and consultation. Key considerations were the additional OWFs already proposed (under the consenting process, under construction or constructed in the area), shipping constraints, presence of statutory designated sites and the potential for seascape, landscape and visual effects.

5.5.3 In August 2019, TCE published the plan level Habitats Regulation Assessment (HRA) which assessed the potential impacts of the proposed extension projects on relevant nature conservation sites of European importance (then Natura 2000 sites). The production of the plan level HRA was supported by expert independent advisors, and consulted with the statutory marine planning authorities, the statutory nature conservation bodies and a number of non-governmental stakeholders.

5.5.4 Seven of the eight extension projects, including VE, were permitted to continue to seek planning consent (through the DCO process) and proceed to the award of the leasing rights as part of the 2017 extensions round.

5.5.5 An Agreement for Lease (AfL) was signed in August 2020 with The Crown Estate. The array areas were identified following review of shipping and navigational constraints and routing measures such as the International Maritime Organisations (IMO) Traffic Separation Scheme (TSS). This resulted in identification of a northern and southern array area. This AfL comprises the array areas being considered within this Scoping Report – see Figure 1.1. These are hereafter referred to as the VE array areas.

5.6 OFFSHORE EXPORT CABLE

5.6.1 The offshore export cable route (OECR) comprises the preferred area within which the offshore expert cables will be placed, however the Scoping Boundary has been widened to the offshore AoS to allow some flexibility in final routing options if required (see Chapter 1). The offshore AoS has been delineated alongside the array boundaries, and this incorporates options for cable routing between the VE arrays and landfall locations along the Essex coast, located between Holland-on-Sea and Frinton-on-Sea (Figure 1.2).

5.6.2 During the selection of the offshore AoS area, the following constraints were taken into account to avoid and / or minimise interaction with various offshore interests:

- Galloper OWF Array;
- Greater Gabbard OWF Array;
- North Falls OWF area;
- Location of the Traffic Separation Scheme (TSS) and other IMO navigational routeing 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;
- Aggregate extraction sites (the project has committed to ensure that when a cable route is selected that it does not overlap with occur to any 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); and
- Known wrecks and Archaeological Exclusion Zones.

5.6.3 The site selection is an iterative process and VE OWFL has engaged with a range of stakeholders to better understand how the construction and operation and maintenance of export cabling will affect various interests within the offshore AoS. Following multi-lateral workshops, VE OWFL received detailed feedback from shipping and navigation stakeholders which has been incorporated into route development and refinement of a preferred OECR within the offshore AoS. A key concern raised was the implication for navigational safety resulting from interactions with key routeing measures and pilot boarding stations and changes to navigable depth. The preferred OECR and wider offshore AoS has been developed to mitigate the navigational risk associated with the installed export cable. VE OWFL will continue to engage with stakeholders as the preferred OECR develops.

5.7 LANDFALL OPTIONS

5.7.1 The landfall is the area where the offshore export cables are brought ashore. The landfall location has been refined down from a longlist of locations which considered a range of options along the Tendring peninsula from Colne point to Dovercourt. The stretch of coast between Holland-on-Sea and Frinton-on-Sea has been selected for potential landfall following consideration within the SSS (see Figure 1.2).

5.7.2 The primary considerations for the selection of the landfall search area, were:

- The location of the arrays;
- The onshore AoS discussed with National Grid for the location of the EACS;

- The key ecological designations along the coast;
- The presence of other infrastructure assets and utilities;
- The presence of coastal settlements and other coastal development;
- Space requirements for the transition joint bays (TJBs);
- Ground conditions and potential contamination (e.g. landfills);
- Feasibility of Horizontal Directional Drilling (HDD).

5.7.3 During the refinement of the landfall search area, the following constraints have specifically been avoided:

- Hamford Water SPA, RAMSAR, Site of Special Scientific Interest (SSSI) and National Nature Reserve;
- Essex Estuaries SAC;
- The Blackwater, Crouch, Roach and Colne Estuaries Marine Conservation Zone (MCZ); and
- Clacton Cliffs and Foreshore SSSI.

5.7.4 It is noted that the selected landfall option and onshore AoS coincides with the Holland Haven Marshes SSSI.

5.7.5 Engineering feasibility, area refinement and further consideration of the presence of additional constraints (including but not limited to completion of an HDD feasibility study) will be explored further as part of the subsequent stages of the site selection work and project design refinement. This will include further consideration of the SSSI in order to progress an option that minimises any impacts that could arise as far as feasible, such as undertaking HDD underneath the SSSI and designated features. The findings of these studies will feed into the SSS and will be reported in the PEIR and subsequent ES where relevant.

5.8 ONSHORE EXPORT CABLE

5.8.1 The onshore AoS is the area in which the onshore export cables (and associated infrastructure) will be installed, which link the landfall to the VE onshore substation (see Sections 5.7 and 5.9) and then, if required, to the EACS (location to be confirmed by National Grid).

5.8.2 In order to minimise permanent visual impact during the operational life of the wind farm, the VE onshore cables between the landfall and the grid connection point will be underground (buried) rather than installation of new overhead lines.

5.8.3 The onshore AoS has been identified 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 can be accommodated.

5.8.4 The onshore AoS is presented in Figure 1.2.

5.8.5 Where practical the following key principles will be incorporated in the final site selection of the onshore cable route and associated onshore infrastructure, as far as feasible:

- 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.

5.9 GRID CONNECTION

5.9.1 VE has accepted a connection offer from National Grid for a future EACS location within Essex. The final location of the EACS is subject to ongoing National Grid site selection work which aims to identify the final substation location.

5.9.2 VE OWFL will identify a new substation location in the vicinity of the EACS taking into account onshore environmental constraints. The VE infrastructure will comprise a new substation that will connect into National Grid's EACS via a buried cable connection.

5.9.3 An exercise to account for the footprint of the operational infrastructure and available space within the search area is on-going at the time of writing. The siting of substation infrastructure will be determined and assessed as part of the SSS.

5.10 CONSULTATION ON SITE SELECTION AND ALTERNATIVES

5.10.1 Consultation has commenced with stakeholders through the Evidence Plan Process and bilateral meetings to introduce the proposed search areas. In addition, the proposed site selection criteria/ principles have been presented to consultees for the development of:

- The search areas;
- Refinement of these areas to the long list of options; and
- The methods for identification of a short list/ preferred options.

5.10.2 VE OWFL will continue to discuss the site selection process and ensure that stakeholders are consulted at key milestones in order to receive early feedback. In addition a formal consultation on the site selection and alternatives will be held in Q1/2 2022. Further details of the consultation held to date and the EIA Evidence Plan process are provided in Chapter 6.

5.10.3 The PEIR will be used to consult the local authorities and other persons/ bodies prescribed in Section 42 of the 2008 Act and Schedule 1 of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (the 'APFP Regulations'). The PEIR will contain detailed information on the site selection process undertaken and will enable stakeholders and public to provide comment on this process and its findings.

5.11 CO-ORDINATION WITH OTHER PROJECTS

5.11.1 As detailed in Chapter 1, VE OWFL will continue to explore opportunities to co-ordinate with the nearby North Falls Offshore Wind Farm project throughout project development. Co-ordination of stakeholder engagement, construction, infrastructure and operations plans are being explored for the project development phase and will be progressed where this is considered practicable and feasible. Site selection considerations will also be taken into account where feasible and practicable to optimise routes and minimise and manage environmental impacts.

5.11.2 More broadly, VE OWFL will also seek to engage with other projects and activities and where relevant information gathered from engagement with other developers will be considered within any future site selection and route refinement work.

5.11.3 Discussions are ongoing with National Grid in relation to the siting of the EACS and the VE onshore infrastructure.

5.12 NEXT STEPS

5.12.1 Following the identification of the offshore and onshore AoS there is a process of ongoing design refinement to reach a design which can be taken forward to the next stage of the EIA process and refinement of the development boundary. This process includes the following steps to create and refine the design:

- More detailed constraints mapping;
- Application of design and engineering requirements;
- Identification of a long list of options;
- Black, Red, Amber and Green (BRAG) assessment of the options, to compare the environmental, engineering, land management and cost constraints and opportunities of each option;
- Ongoing consultation with key stakeholders and the public to identify risks and opportunities with site selection options;
- Additional studies to address specific queries raised during the site selection process (for example, more detailed landfall feasibility assessment); and
- Selection of a preferred option (or options) to take forward to the next stage of EIA for the onshore and offshore export cable routes, onshore substation and the offshore infrastructure within the array areas.

5.12.2 Ultimately, a preferred option (or options) will be selected and consulted upon and refined further for the PEIR and ES.

5.12.3 VE OWFL has sought to consult, at the earliest stages possible of the process, with all relevant consultees to gain early feedback and input into the site selection process. This consultation will continue during development of the project (see Chapter 6 Consultation for further details).

6. CONSULTATION PROCESS

6.1 INTRODUCTION

6.1.1 Formal and informal consultation with stakeholders and the general public (prior to the submission of the DCO application) is an inherent part of the DCO Application processes. This chapter seeks to provide an overview of the consultation requirements, the consultation that has been carried out to date, and VE OWFL's proposed approach for further consultation.

6.1.2 During preparation of this Scoping Report, VE OWLF has consulted various statutory bodies including the Marine Management Organisation (MMO), Natural England, Historic England, the Environment Agency, and the Maritime and Coastguard Agency (MCA), and the relevant local planning authorities (Essex County Council, Tendring District Council, Suffolk County Council and East Suffolk District Council). Discussions have also been held with several non-governmental organisations including but not limited to the Essex Wildlife Trust, the Royal Society for the Protection of Birds (RSPB), various shipping and navigational stakeholders and operators, and East Suffolk Coast and Heaths Area of Natural Beauty (AONB). The consultation, which has been held under the auspices of an Evidence Plan (see Section 6.4), has primarily been in connection with the following:

- Site selection principles for the project;
- Proposed scope of the EIA including matters which VE OWFL is seeking to scope out;
- Proposed data and information[28] utilised to inform this Scoping Report; and
- Proposed assessment methods, surveys and data collection requirements for the EIA.

6.2 REQUIREMENT AND PROCESS

6.2.1 As outlined in The Planning Inspectorate's Advice Note 3 (PINS, 2017) it is the Applicant's responsibility to "ensure that their pre-application consultation fully accords with the requirements of the Planning Act 2008, including associated regulations, and that they have regard to relevant guidance". VE OWFL will undertake consultation in relation to expectations included in the relevant NPSs (see Chapter 1).

6.2.2 A particular emphasis of the Planning Act 2008 is prior consultation with all potentially affected stakeholders. As part of the DCO process, the Applicant is required to:

- Consult with the local authorities (as prescribed in Section 43 of the Planning Act 2008) on what information should be included in the Statement of Community Consultation (SoCC), which will set out how the Applicant proposes to consult with the local community, as prescribed in Section 47 of the 2008 Act;
- Make the SoCC available for public inspection, advertise where the SoCC may be inspected and carry out consultation in accordance with it;
- Consult the local authorities and other persons/ bodies prescribed in Section 42 of the 2008 Act and Schedule 1 of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (the APFP Regulations);

[28] Including requests for any additional relevant data / information held by the organisations consulted.

- Notify the Secretary of State (SoS), prior to consulting under Section 42, of a proposed DCO application in accordance with Section 46 of the 2008 Act; publicise the application in accordance with Section 48 of the 2008 Act and paragraph 4 of the APFP Regulations;
- Have regard to the relevant responses to publicity and consultation as required by Section 49 of the 2008 Act; and
- Prepare a consultation report to accompany the DCO application as required by Section 37(3) (c) of the 2008 Act.

6.2.3 Under Regulation 10 (6) of the 2017 EIA Regulations, The Planning Inspectorate must consult with consultation bodies prior to providing the Applicant with a Scoping Opinion.

6.2.4 As part of the consultation process an Evidence Plan Report will be prepared, to accompany the DCO Application, which will document the consultation activities undertaken as part of the Evidence Plan.

6.2.5 The 'Cable Route Protocol: 2017 Offshore Wind Extensions Plan' (TCE, 2019) sets out the process offshore wind developers shouldconsult with Statutory Nature Conservation Bodies (SNCBs) which is secured through the TCE agreement for lease (see Chapter 5). VE OWFL will adhere to this consultation process.

6.3 APPROACH TO STAKEHOLDER ENGAGEMENT

6.3.1 VE OWFL recognises that effective and meaningful consultation is an integral part of its development activities and is committed to ensuring that it maintains a transparent approach to consultation and stakeholder engagement. VE OWFL's engagement objectives are to:

- Identify and actively engage with those statutory bodies, non-governmental organisations, other national and international organisations, the local community and landowners who may be affected by its activities;
- Develop a transparent consultation and engagement strategy that meets the requirements for pre-application consultation under the Planning Act 2008;
- Prioritise consultation with those likely to be directly affected;
- Maintain open and honest communications with all stakeholders; and
- Recognise the interests and viewpoints of stakeholders and where appropriate use the feedback to inform the design and development activities.

6.4 THE EVIDENCE PLAN

6.4.1 Since September 2012, prospective applicants of Nationally Significant Infrastructure Projects (NSIPs) located in England, have been able to request and agree 'Evidence Plans' with the relevant statutory nature conservation bodies as a means to manage and record informal consultation with a range of stakeholders. The process followed in the preparation of the Evidence Plan is aimed at producing a non-legally binding agreement between the developer and the relevant statutory authority(ies) and advisers and other relevant stakeholders. This agreement covers those matters to be addressed by the EIA and HRA process (the scope), the data that will be used to support the assessments and the methods to be applied in analysing the data and assessing the potential impacts of a scheme.

6.4.2 The Evidence Plan process was initially developed by the Major Infrastructure Environment Unit (MIEU) of Defra to provide a formal mechanism to agree between Applicants and statutory bodies what information and evidence an Applicant for a NSIP should submit in support of an application, with a specific focus on HRA matters. However, in practice the MIEU advises that the topic areas that may be covered by an Evidence Plan can be expanded, at the request of the Developer, to include broader EIA issues as well as HRA issues.

6.4.3 Guidance on the preparation of Evidence Plans is provided within Annex H of the Planning Inspectorate Advice Note 11 (PINS, 2017). This guidance notes that Applicants are expected to:

- "Engage actively and constructively with SNCBs, the Inspectorate and other consenting bodies throughout the process.
- Collect the evidence and analyse it using agreed methodologies, adhering to agreed timelines.
- Accept that evidence requirements may change throughout the process, due to changes in the proposed NSIP application and/ or as a result of evidence highlighting new areas of concern."

6.4.4 Under the advice note SNCBs are expected to:

- "Seek pragmatic solutions (e.g. to uncertainties and/ or changing evidence).
- Take a proportionate approach, setting appropriate evidence levels, assessment methodologies and interpretation criteria, seeking evidence that is justified and consistent with the matters being considered.
    - Only change evidence requirements following:
    - The assessment of evidence provided by the Applicant identifying new areas of concern.
    - Relevant evidence, information or research coming to light that will have an impact on what information is required.
- A change to the NSIP proposal that is likely to change the potential impacts and therefore the evidence requirements to address these.
- Engage pro-actively, giving clear guidance and advice, aiming to resolve issues in pre-application and adhering to agreed timelines specified in the Evidence Plan.
- Be clear about the work they will charge for and the rate, or rates, they will charge and communicate these before costs are incurred by a developer."

6.4.5 For the purposes of the VE Evidence Plan, the remit has been widened, to include EIA topics in addition to HRA aspects. As a consequence, the Evidence Plan itself is to be titled an Evidence Plan to distinguish it from a solely HRA-related Plan. It should be noted that the Evidence Plan will not seek to duplicate or replace any existing consultation requirements as detailed in Section 6.2.

6.4.6 Agreement on a Terms of Reference document has been sought (by VE OWFL) from all parties engaging in the Evidence Plan. The document outlines general rules of working, roles and responsibilities; and engagement during the process which are in accordance with the guidance as detailed in Annex H of the Planning Inspectorate Advice Note 11. VE OWFL will be seeking to discuss the site selection and alternatives process, under the Evidence Plan, and will ensure that stakeholders are consulted at key milestones. HRA matters are proposed to be discussed under the relevant technical groups (namely onshore ecology, ornithology, marine mammals and marine ecology).

6.4.7 Table 6.1 identifies the Evidence Plan meetings that have been held to date.

Table 6.1 - Evidence Plan meeting groups, dates and summary (in chronological order)

TECHNICAL GROUP	MEETING DATE	MEETING TYPE
Onshore Ecology, hydrology and ground conditions	14th January 2020	Pre-scoping Evidence Plan Expert Topic Group (ETG) meeting
Traffic & Transport, Air Quality, onshore noise, public health; and Socio economics (including tourism)	14th January 2020	Pre-scoping Evidence Plan ETG
Seascape, marine archaeology, landscape; and onshore cultural heritage and archaeology	15th January 2020	Pre-scoping Evidence Plan ETG
Marine Processes and Ecology	10th February 2020	Pre-scoping Evidence Plan ETG
MMO, Cefas and Natural England	21st January 2021	Discussion on marine licencing of benthic surveys
Seascape Landscape Visual Impact (SLVIA)	15th July 2021	Discussion regarding the selection of viewpoints to inform the EIA.
Marine Mammals	20th July 2021	Pre-scoping Evidence Plan ETG
Hydrology, ground conditions and contamination	3rd August 2021	Pre-scoping Evidence Plan ETG
Shipping and navigation	9th August 2021	Pre-scoping Evidence Plan ETG
Seascape, marine archaeology, landscape;	11th August 2021	Pre-scoping Evidence Plan ETG

TECHNICAL GROUP	MEETING DATE	MEETING TYPE
and onshore cultural heritage and archaeology		
Traffic & transport, air quality, onshore noise, public health; and socio economics (including tourism)	11th August 2021	Pre-scoping Evidence Plan ETG
Marine processes and ecology	12th August 2021	Pre-scoping Evidence Plan ETG
Steering Group meeting	13th August 2021	Pre-scoping Evidence Plan ETG
Offshore ornithology	18th August 2021	Pre-scoping Evidence Plan ETG
Summary of ETGs held (Natural England only)	6th and 13th September 2021	Pre-scoping Evidence Plan ETG

6.4.8 The minutes and agreement logs from these meetings are available on request and will be included within the Evidence Plan Report to support the DCO application.

6.5 OTHER CONSULTATION TO DATE

6.5.1 Table 6.2 outlines relevant project meetings/phone calls held to reintroduce the project and where relevant identify additional constraints or concerns from stakeholders which have also been held outwith the Evidence Plan. VE OWFL have also been in regular communications with National Grid regarding the Connection and Infrastructure Options Note (CION) process and their substation location/ site selection process since 2019 (see Chapter 5). Engagement with National Grid will continue through the project development process to understand the location of the EACS substation and how cumulative impacts should be considered within the VE EIA.

Table 6.2 - Stakeholder meetings and dates

STAKEHOLDER	MEETING DATE(S)
STATUTORY	
MMO	> 29th March 2021; and > 25th June 2020.
Maritime and Coastguard Agency (MCA) [and Trinity House]	> 19th November 2019; > 26th February 2020; and > 30th March 2021.
Natural England	> 2nd March 2021; > 12th April 2021; > 10th May 2021; > 18th May 2021; and > 17th June 2021.
Environment Agency	> 17th December 2019; and > 17th March 2021.
Tendering District Council	> 16th March 2021; and > 20th April 2021.
Essex County Council	> 22nd March 2021.
Suffolk County Council	> 6th April 2021.
East Suffolk Council	> 7th April 2021; and > 20th April 2021.
Historic England	> 12th April 2021.
Ministry of Defence	> 26th April 2021.
NON-STATUTORY	
Chamber of Shipping	> 13th March 2020; and > 22nd April 2021.
Tarmac marine	> 21st May 2021.
BT Group	> 28th July 2021.
East Suffolk Coast and Heaths AONB	> 22nd March 2021.
Eastern Inshore Fisheries Conservation Authority (IFCA)	> 19th December 2019.
Harwich Harbour Authority	> 27th April 2021.
Kent and Essex IFCA	> 22nd April 2021.

STAKEHOLDER	MEETING DATE(S)
MCA, Trinity House, Port of London Authority and Chamber of Shipping	> 20th April 2021.
National Air Traffic Services	> 20th November 2019.
National Trust	> 19th December 2019; and > 22nd March 2021.
Port of London Authority	> 19th April 2021.
Royal Yachting Association	> 13th March 2020.
RSPB	> 12th December 2019; and > 4th May 2021.
Sunk VTS	> 29th January 2020; and > 6th May 2021.
Essex Wildlife Trust	> 15th March 2021; and > 29th April 2021.
The Wildlife Trust (including Essex Wildlife Trust)	> 29th April 2021.
Suffolk Wildlife Trust	> 13th December 2019.

6.6 PROPOSED CONSULTATION

6.6.1 VE OWFL will formally consult with the SNCBs at each of the steps (including the detailed planning and identification of the offshore cable corridor and submission of the Corridor Identification and Approval for Linear activities (CIAL)) required as outlined under The Crown Estate's Cable Route Protocol (TCE, 2019).

6.6.2 Further consultation by and on behalf of VE OWFL will take place prior to finalisation of the designs and submission of the DCO application with relevant parties. This further consultation will include (but not be limited to) discussions regarding the site selection and alternative process to ensure stakeholder feedback is received, in line with the best practice industry guidance.

7. PHYSICAL PROCESSES

7.1 INTRODUCTION

7.1.1 This chapter of the Scoping Report identifies the Physical Processes receptors of relevance to the VE array areas and offshore AoS. It describes the potential effects from the construction, operation and maintenance, and decommissioning of VE on Physical Processes and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

7.1.2 Physical processes is a collective term for the following:

- Water levels;
- Currents;
- Waves (and winds);
- Sediments and geology: (including seabed sediment distribution and sediment transport);
- Seabed geomorphology; and
- Coastal geomorphology.

7.1.3 Potential impacts arising from changes to physical processes on other receptors, such as water quality and marine ecology are covered in other topic chapters in this Scoping Report.

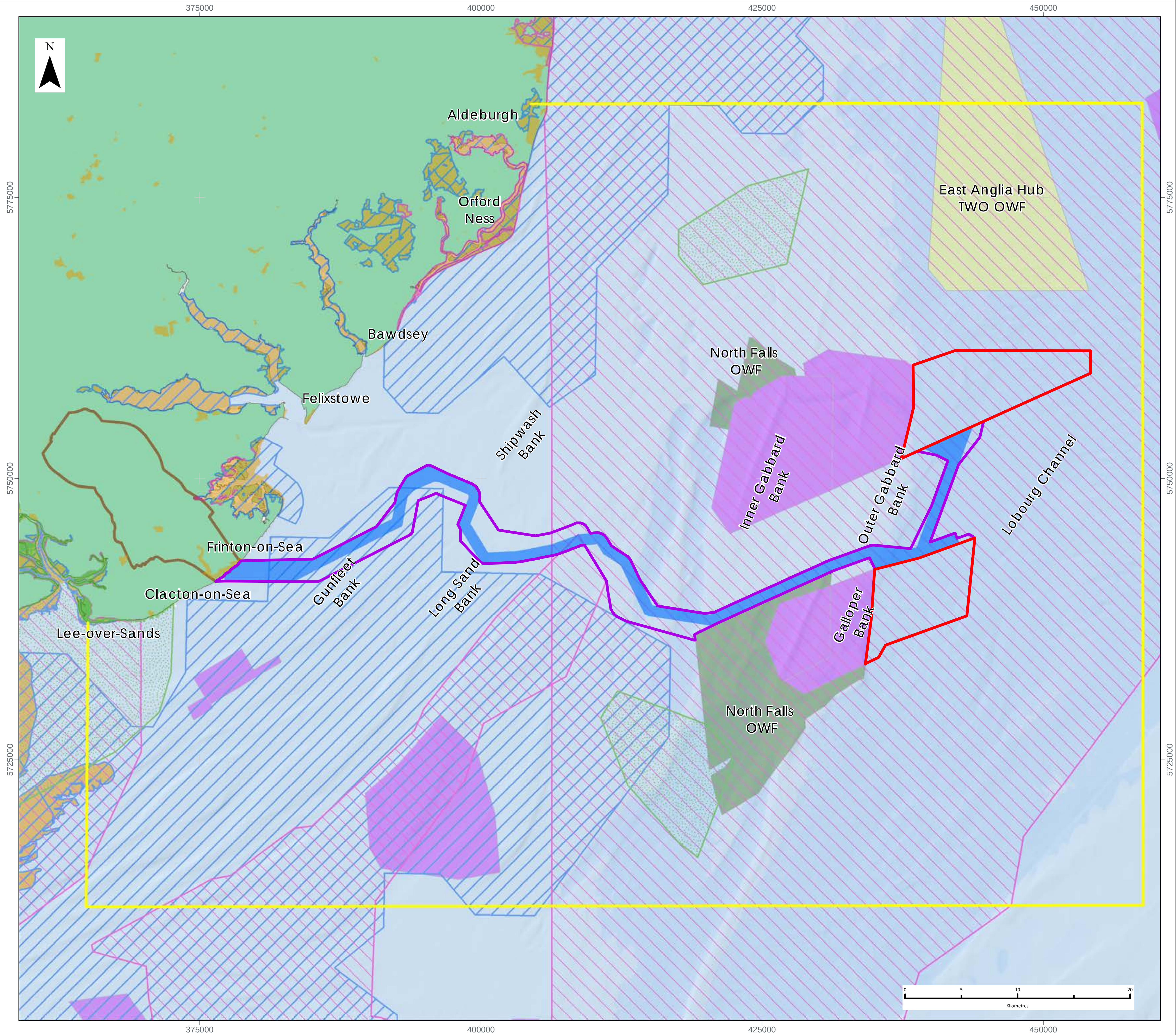
7.2 STUDY AREA

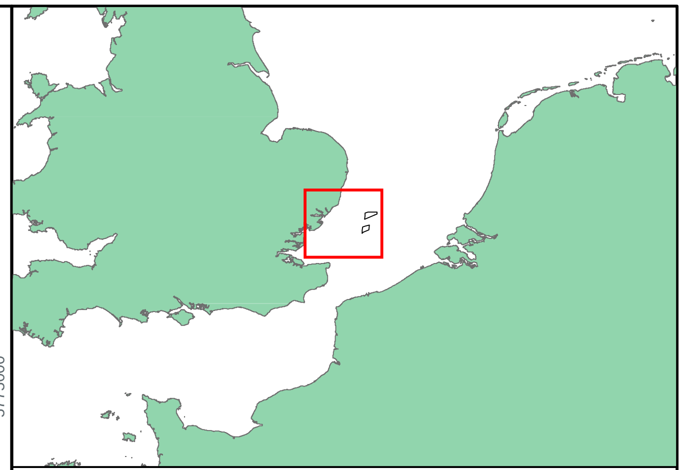
7.2.1 The study area is located within the Outer Thames Estuary and includes the VE array areas and offshore AoS (Figure 7.1). The offshore AoS has been determined following a process of detailed physical and environmental constraints mapping, also taking into consideration other seabed uses including the proposed North Falls OWF development (NFOWFL, 2021). The physical processes study area was defined based on a precautionary zone of influence informed by expert judgement, based on (amongst other things) physical process understanding developed from work undertaken for the nearby (operational) Galloper and Greater Gabbard OWFs and analysis of prevailing wave direction and tidal excursion distance. It also takes into consideration preliminary details relating to the proposed development in terms of design and offshore elements (Chapter 3). This includes indicative information on the number, size and spacing of WTG foundations.

7.2.2 The study area overlaps with a number of nationally and internationally designated nature conservation sites, some of which are designated on the basis of the geological and geomorphological features contained within them.

7.2.3 The landfall for the offshore AoS including the preferred offshore export cable route (preferred OECR) is to be located somewhere between Frinton-on-Sea and Clacton-on-Sea, on the Essex coast.

7.2.4 The study area will be reviewed and amended for future stages of the EIA in response to such matters as refinement of the onshore/ offshore AoS, feedback from consultees, and/ or the identification of additional constraints (environmental and/ or engineering).





LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Physical Processes Study Area
- Special Area of Conservation
- Special Protection Area
- Marine Conservation Zone
- Site of Special Scientific Interest
- Wind Farm (Active/In Operation)
- Wind Farm (In Planning)
- Wind Farm (Pre-planning)

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Physical Processes Study Area

VER	DATE	REMARKS	Drawn	Checked
1	23/09/2021	For Issue	AJB	NKD

DRAWING NUMBER:

7.1

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

FIVE ESTUARIES
OFFSHORE WIND FARM

N:\5031_Five_Estuaries\GIS\MXDs\SCO_Fig_Study_Area.mxd

7.3 BASELINE DATA

7.3.1 The main physical processes data sources which will be used to inform the assessment are summarised in Table 7.1.

Table 7.1 - Key sources of information for physical processes

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Galloper Wind Farm Project, Environment Statement – Chapter 9: Physical Environmental Document Reference – 5.2.9 Source: RWE Npower Renewables, SSE Renewables and Royal Haskoning (2011)	Characterisation and monitoring data for the existing operational Galloper OWF site (including geophysical, geotechnical, benthic and metocean data)	Partial coverage of the physical processes study area.
Outer Thames Estuary Regional Environmental Characterisation Source: EMU (2009)	Characterisation data (geophysical and benthic) from offshore and nearshore areas	Partial coverage of the physical processes study area.
Thames Marine Aggregate Regional Environmental Assessment (MAREA) Source: TEDA (2012)	Characterisation data (geophysical and benthic) from offshore and nearshore areas	Partial coverage of the physical processes study area.
National Tide and Sea Level Facility (NTSLF) Source: www.ntslf.org	Tidal water levels from point locations within the study area	Partial coverage of the physical processes study area.
British Oceanographic Data Centre (BODC) Source: www.bodc.ac.uk/	Hydrodynamic data (inc. current speed & direction) from point locations within the study area	Partial coverage of the physical processes study area.
Cefas WaveNet data Source: www.cefas.co.uk/cefas-data-hub/wavenet/	Wave records from point locations within the study area	Partial coverage of the physical processes study area.

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
ABPmer SEASTATES Source: www.seastates.net/	Modelled hindcast wave and hydrodynamic data from across the study area	This is a national dataset providing full coverage of the physical processes study area.
Hydrodynamic and wave data from the Marine Renewables Atlas Source: ABPmer et al. (2008a)	Modelled hindcast wave and hydrodynamic data from across the study area	This is a national dataset providing full coverage of the physical processes study area.
UKCP18 climate change projections Source: Palmer *et al*. (2018)	Sea level rise predictions for coastal locations within the study area	Partial coverage of the physical processes study area.
British Geological Survey (BGS) offshore geoindex [including seabed sediments and geology] Source: www.bgs.ac.uk/GeoIndex/offshore.htm	Seabed sediment maps (based on Folk classification) and borehole records from point locations within the study area	This is a national dataset providing full coverage of the physical processes study area.
United Kingdom Hydrographic Office (UKHO) Source: UKHO (2021)	Bathymetric data for the study area in the form of multibeam and single beam data, as well as Admiralty Charts	This is a national dataset providing full coverage of the physical processes study area.
Suspended Sediment Climatologies around the UK Source: Cefas (2016)	Monthly and seasonal Suspended Particulate Matter (SPM) maps for the study area	This is a national dataset providing full coverage of the physical processes study area.
Southern North Sea Sediment Transport Study Source: HR Wallingford (2002)	Information on observed and modelled longshore and seabed sediment transport in the study area	Partial coverage of the physical processes study area.
Anglian Coastal Monitoring (ACM) programme Source: https://coastalmonitoring.org/anglian/	Monitoring data to inform coastal characteristics and change including topographic survey data, aerial imagery and oceanographic data.	Partial coverage of the physical processes study area.

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Environment Agency Source: www.gov.uk/government/organisations/environment-agency	LiDAR and coastal monitoring reports from around the coastline in the study area	Partial coverage of the physical processes study area.
Shoreline Management Plan (SMP) 7: Lowestoft to Felixtowe Source: Suffolk District Council (2009)	Information on coastal characteristics and behaviour, as well as proposed future management strategies	Partial coverage of the physical processes study area.
SMP 8: Essex and South Suffolk Source: Environment Agency (2010)	Information on coastal characteristics and behaviour, as well as proposed future management strategies	Partial coverage of the physical processes study area.
(Various)	Public and grey literature considering coastal morphology and behaviour at sensitive coastal locations within the study area (e.g. The Crown Estate (2016), Natural England (2017)).	Partial coverage of the physical processes study area.

7.3.2 The above will also be augmented by geophysical data and survey reports from the operational Galloper and Greater Gabbard OWFs, including information from any scour monitoring surveys (if available). Any additional data available from other nearby proposed developments will also be examined if available.

7.3.3 Site specific geophysical surveys for the VE array areas and offshore AoS are being undertaken in 2021. Data derived from these surveys will provide a more detailed site characterisation, detailing the seabed and associated sediment properties.

7.4 BASELINE ENVIRONMENT

7.4.1 This section provides a high-level summary of the existing physical environment across the study area, with consideration given to bathymetry, water levels, currents, waves, seabed sediments and geomorphology.

BATHYMETRY

Bathymetry within the study area is highly variable, with large-scale bedforms interrupting the general increase in depth with distance offshore (Figure 7.2). Within the VE array areas, water depths are typically in the range -35 to -55 m below lowest astronomical tide (LAT), with the deepest areas generally found in the south array. Across much of the offshore AoS, water depths are more typically in the range -15 to -35 mLAT, although shallow to less than -10 m LAT where the route passes in close proximity to bank systems. Nearshore areas within the offshore AoS are typically characterised by a gradually sloping shelf, with water depths generally less than -10 mLAT within 2 km of the coast.

HYDRODYNAMIC REGIME

7.4.2 The VE array areas are in a region characterised by semi-diurnal tides, with a mean spring range of between (approximately) 2 and 2.5 m and a mean neap range of approximately half that of mean springs. Tidal range tends to increase to the south, but there is little variation in tidal range between the array area and the adjacent coast, approximately 40 km to the west. Tidal currents are relatively strong across the study area, with mean spring peak current speed in excess of 1 m/s in most areas. Within the offshore AoS, mean spring peak current speeds are relatively uniform, ranging between approximately 1.2 m/s and 0.9 m/s, with the weakest current speeds encountered close to shore, near the landfall.

7.4.3 Tidal flow is relatively rectilinear within the VE array areas, with tidal current direction to the northeast during the ebb and to the southwest during the flood. Across the wider study area, local departures to this general pattern are present, especially in the vicinity of bank systems and close to the coast.

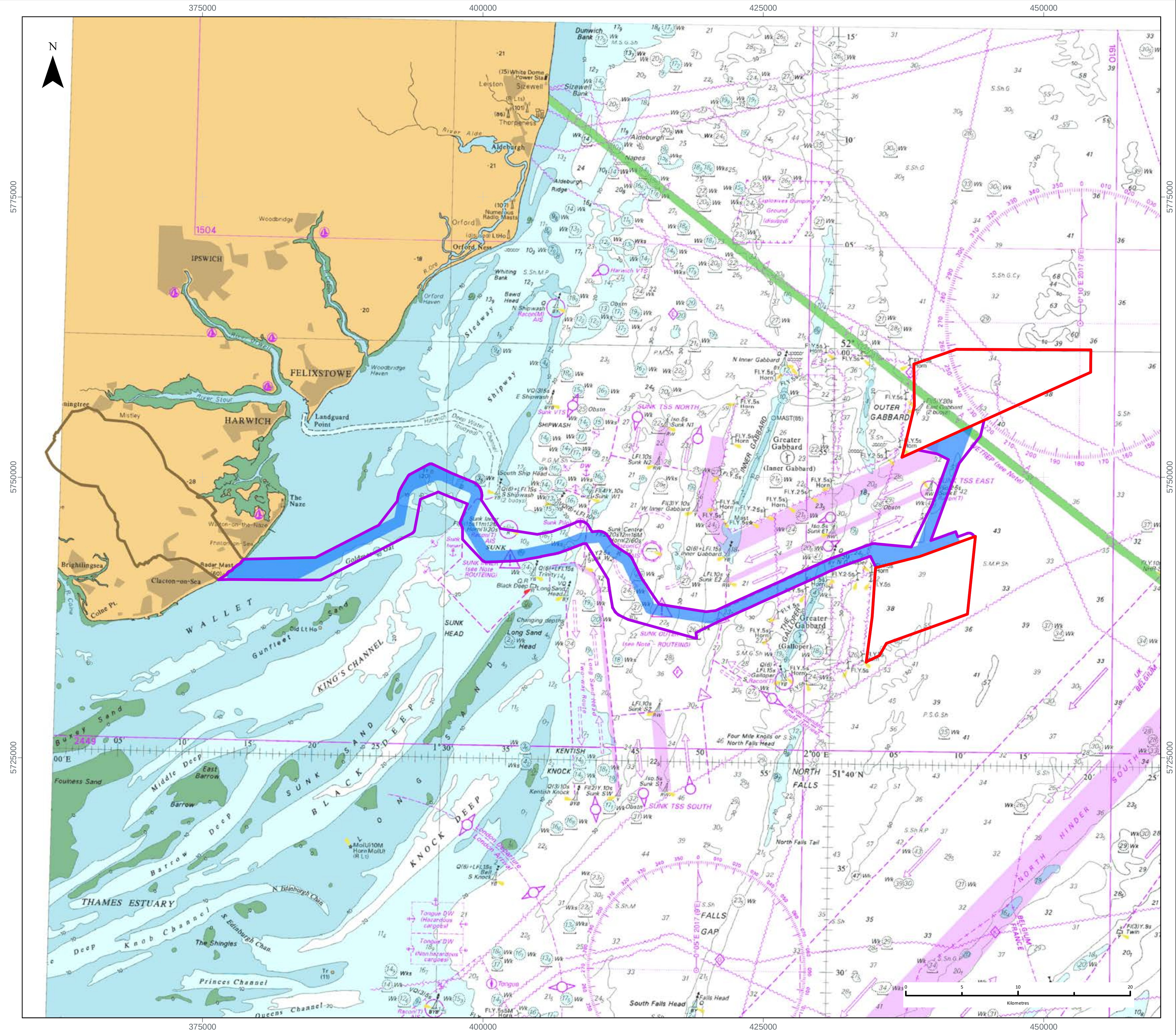
WAVE REGIME

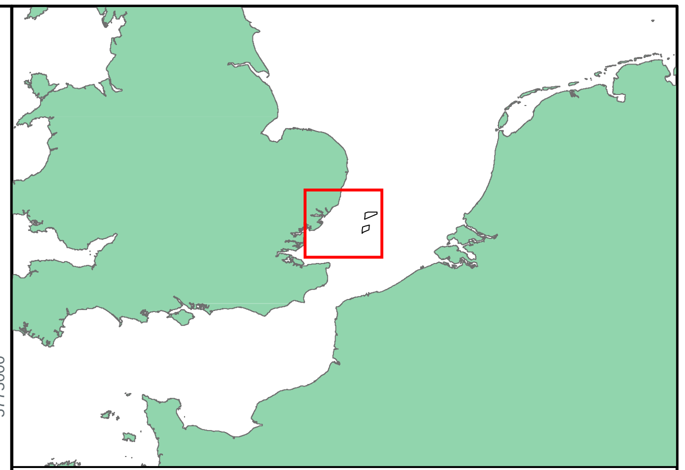
7.4.4 The wave climate within the study area is controlled by a combination of the wind regime and the relative position within the Outer Thames Estuary and wider North Sea basin.

7.4.5 Winds in the region most frequently come from the south west (up to 25% of the time) but may also come from any other direction (with an approximately uniform probability of occurrence). Stronger winds tend to come from south through westerly directions.

7.4.6 Waves within the study area are a combination of locally generated wind waves and waves generated elsewhere in the North Sea. Waves predominantly come from northerly and southerly directions (longer fetches to the site, ~25% of time each), and relatively frequently from south westerly and north easterly directions (intermediate fetches to the site, ~15% of time each),

7.4.7 Wave heights across the study area will tend to reduce with distance into the Outer Thames Estuary due to decreasing water depth, decreasing fetch length in the predominant wind direction, and generally greater protection from waves generated elsewhere in the North Sea. The associated local predominant wave direction will also vary accordingly.





LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- Onshore Area of Search

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Physical Processes Study Area

VER	DATE	REMARKS	Drawn	Checked
1	23/09/2021	For Issue	AJB	NKD

DRAWING NUMBER:

7.2

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

FIVE ESTUARIES
OFFSHORE WIND FARM

N:\5031_Five_Estuaries\GIS\MXDs\SCO_Fig_Bathymetry.mxd

GEOLOGY AND SEABED SEDIMENTS

7.4.8 The Outer Thames Estuary lies within the Cenozoic London Basin and is underlain by Upper Cretaceous chalk. The Cretaceous (145-65 Ma), Paleogene (65-23 Ma) and Neogene (23-2.5 Ma) sequences which are present have been either eroded and exposed at seabed or covered by sediments deposited during the Quaternary period (last 2.6 million years). These Quaternary deposits and eroded, relict land surfaces have formed in response to the growth and decay of Pleistocene ice sheets and associated changes in relative sea level (EMU, 2009). In particular, the Outer Thames Estuary has been greatly influenced by the migration of the Thames-Medway drainage system southwards, in response to changing sea levels and hydrological regimes (Bridgland, 1994).

7.4.9 Seabed sediments across the VE array areas are dominated by coarse sands, with varying contributions of gravel. Across the offshore AoS, the seabed is characterised by the presence of gravelly sands and sandy gravels with sand banks typically comprising fine/ medium grained sandy material. Close to the shore, muddy sands and gravels tend to predominate, with fine material originated from erosion of the Palaeogene London Clay beds.

GEOMORPHOLOGY AND SEDIMENT TRANSPORT

7.4.10 The VE array areas are in a distinctive north-south trough which is separated from the seabed to the west by a distinctive 10-15 m slope. The trough is the Lobourg Channel, a relict channel feature which drained into the southern North Sea at times of lower sea level during Pleistocene glacial episodes. Within the channel, there are a series of NW-SE trending sandwaves with wavelengths >100 m and amplitudes of up to 15 m (EMU, 2009). There are also two parallel, north-south trending troughs (termed the Inner Gabbard Deeps) which have been eroded into the bedrock and are interpreted as being formed at the margin of the Elsterian-Anglian glacial maximum ice limit.

7.4.11 Much of the offshore AoS to the west of the VE array areas consists of a bedrock platform typically overlain by a discontinuous, thin, gravelly lag deposit, dispersed sandy bedforms. Active sandbanks are a characteristic feature of this region, with the offshore AoS crossing the northern end of Galloper Bank immediately to the west of the VE array areas (Figure 7.2).

7.4.12 In general there is net southerly seabed sediment transport across most of the study area although localised departures from this generalised pattern occur in the vicinity of sandbanks and also close to the coast, where local wave processes have greater influence.

COASTAL CHARACTERISTICS

7.4.13 The coastline within the study area extends from Lee-over-Sands (in the south) to Thorpeness (in the north). It largely consists of soft cliffs, shingle or sand beaches and coastal lagoons, along with a series of estuary systems (including the Blackwater, Stour, Orwell, Deben, Ore and Alde). This stretch of coast has a long history of change with many erosion and flooding events recorded over the centuries. Longshore drift of beach material dominates although rates and directions of sediment transport are highly variable, both spatially and temporarily (HR Wallingford, 2002; Environment Agency, 2010).

7.4.14 The shoreline management policy for much of the coastline in the study area is ‘no active intervention’ although ‘hold the line’ and ‘managed realignment’ has been identified as the preferred policy for several areas. In places, coastal erosion is a major challenge and despite a long history of coastal defence works, accelerated erosion of the soft cliffs and denudation of beach material regularly occurs during high-tide and/or storm conditions (Environment Agency, 2015). This is expected to accelerate with rising sea levels and (possible) increases in storm intensity.

7.4.15 The offshore AoS reaches the coastline at the coastal town of Frinton-on-sea. This is located within Management Unit C ‘Tendring Peninsula’, as set out in the Essex and South Suffolk SMP 2 (Environment Agency, 2010). The frontage is protected by a sea wall (promenade) and groyne fields with a shoreline management policy of hold the line. Defences within the Tendring Peninsula are under pressure although are renewed as part of a rolling programme undertaken by Tendring District Council.

DESIGNATED SITES

7.4.16 The study area contains several nationally and internationally designated sites (Figure 7.1 and Table 7.2). Along the coast within the offshore AoS, there are several sites specifically designated for geological and geomorphological features of interest. In offshore areas, the sites are primarily designated for the habitats they contain rather than for the presence of geological and geomorphological features. However, changes to the physical characteristics of these sites has the potential to impact the habitats they support and therefore consideration will be given in the physical processes assessment.

7.4.17 The list of nature conservation designations with relevance to physical processes may be refined, should any refinements to the preferred offshore export cable route (offshore OECR) occur. Similarly, as further project design details become available, consideration will be given to any other designated sites outside of the VE array area and offshore AoS that should also be considered for assessment within the PEIR and ES.

Table 7.2 – Nature conservation designations with relevance to physical processes

SITE	CLOSEST DISTANCE TO VE	FEATURE OR DESCRIPTION
INTERNATION		
Alde, Ore and Butley Estuaries SAC	15.2 km	Network of three estuaries flanked by salt marsh and mudflats, with shingle bar at the mouth.
Essex Estuaries SAC	7.5 km	Large estuarine site typical of an undeveloped, coastal plain estuarine system with associated open coast mudflats and sandbanks
Hamford Water SAC/ SPA	3.2 km	Large, shallow estuarine basin comprising tidal creeks, islands, intertidal mud, sand flats and saltmarshes
Margate and Long Sands SAC	[Coincident]	Contains a number of Annex I Sandbanks composed of well-sorted sandy sediments, with muddier and more gravelly sediments in the troughs between banks
Orfordness - Shingle Street SAC	12.3 km	Extensive shingle spit containing series of undisturbed ridges with vegetated shingle, accompanied by coastal lagoons
Southern North SAC	[Coincident]	Site covers a very large area (36,951 km^2) and includes a mix of habitats, such as sandbanks and gravel beds
Alde-Ore Estuary SPA	12.3 km	Wide variety of habitats including intertidal mud-flats, saltmarsh, vegetated shingle and saline lagoons
Deben Estuary SPA	11.4 km	Estuarine setting characterised by saltmarsh and intertidal mud flats in most areas, along with reedswamp, unimproved neutral grassland and scrub
Foulness (Mid-Essex Coast Phase 5) SPA	18.8 km	Site characterised by the presence of extensive saltmarsh habitats
Outer Thames Estuary SPA	[Coincident]	Comprises areas of sand banks and inter-tidal sand/ mud flats. It also includes shallow and deeper water, high tidal current streams and a range of mobile mud, sand, silt and gravely sediments
Stour and Orwell Estuaries SPA	12.8 km	The estuaries include extensive mud-flats, low cliffs, saltmarsh and small areas of vegetated shingle on the lower reaches.

SITE	CLOSEST DISTANCE TO VE	FEATURE OR DESCRIPTION
Blackwater, Crouch, Roach and Colne Estuaries MCZ	4.2 km	Extensive areas of mudflats and saltmarsh, which support a wide range of species including internationally and nationally important numbers of waterfowl
Kentish Knock East MCZ	6.2 km	Sandbank setting, with the site characterized by predominantly mixed sediments with areas of sandy sediment and coarse gravel and pebbles
Orford Inshore MCZ	14.4 km	Habitats composed of subtidal mixed sediments which are important nursery and spawning grounds.
SITES OF SPECIAL SCIENTIFIC INTEREST		
Alde-Ore Estuary SSSI	12.3 km	Major shingle landforms with accompanying cliffs which are of scientific importance
Bawdsey Cliffs SSSI	11.1 km	The cliffs provide over 2km of section in the Butleyan division of the Early Pleistocene Red Crag
Clacton Cliffs & Foreshore SSSI	4,2 km	Site designated for its geological importance, with sediment filled channels containing rare fossils
Colne Estuary SSSI	9.4 km	A short branching estuary whose shingle spit is of geomorphological importance
Deben Estuary SSSI	11.4 km	Estuarine setting characterised by saltmarsh and intertidal mud flats in most areas, along with reedswamp, unimproved neutral grassland and scrub
Foulness SSSI	18.8 km	Site characterised by the presence of extensive saltmarsh and mudflat habitats
Hamford Water SSSI	3.7 km	Large, shallow estuarine basin comprising tidal creeks, islands, intertidal mud, sand flats and saltmarshes
Harwich Foreshore SSSI	11.9 km	Site contains designated exposures of Harwich Stone Bands
Holland on Sea Cliff SSSI	0.1 km	Site contains designated cliffs containing geologically important gravel sequences
Landguard Common SSSI	10.0 km	Sand and shingle spit consisting of a loose shingle foreshore backed by vegetated beach
Leiston-Aldeburgh SSSI	29.6 km	Contains a range of habitats including vegetated shingle

SITE	CLOSEST DISTANCE TO VE	FEATURE OR DESCRIPTION
The Naze SSSI	4.0 km	Geologically important site containing designated Pleistocene cliff exposures
Orwell Estuary SSSI	13.7 km	Long and relatively narrow estuary with extensive mudflats and some saltmarsh.
Stour Estuary SSSI	12.8 km	Estuarine site containing mud and saltmarsh habitats, along with geologically important exposures of early Eocene sediments

7.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

RELEVANT GUIDANCE AND BEST PRACTICE

7.5.1 It is expected that EIA studies should apply any relevant guidance and best practice. The following guidance documents will inform the choice of methodologies to be used in the EIA:

> 'Environmental impact assessment for offshore renewable energy projects.' (BSI, 2015).

> 'Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects'. (Cefas, 2011);

> 'General advice on assessing potential impacts of and mitigation for human activities on Marine Conservation Zone (MCZ) features, using existing regulation and legislation' (JNCC and Natural England, 2011);

> 'Coastal Process Modelling for Offshore Wind farm Environmental Impact Assessment: Best Practice Guide'. ABPmer & HR Wallingford for COWRIE, 2009, [http://www.offshorewindfarms.co.uk];

> 'Guidelines in the use of metocean data through the lifecycle of a marine renewables development'. (ABPmer et al., 2008b); and

> 'Offshore Windfarms: Guidance note for Environmental Impact Assessment in Respect of FEPA and CPA requirements'. (Cefas, 2004).

7.5.2 The following studies are also of relevance:

> 'Review of environmental data associated with post-consent monitoring of licence conditions of offshore wind farms'. MMO Project No: 1031. (Fugro-Emu, 2014);

> 'Further review of sediment monitoring data'. (COWRIE ScourSed-09).' (ABPmer, HR Wallingford & Cefas, 2010);

> 'Review of Cabling Techniques and Environmental Effects applicable to the Offshore Wind farm Industry'. Department for Business Enterprise and Regulatory Reform in association with Defra. (BERR, 2008);

> 'Review of Round 1 Sediment process monitoring data - lessons learnt. (Sed01)' (ABPmer et al., 2007);

- 'Dynamics of scour pits and scour protection - Synthesis report and recommendations. (Sed02)' (HR Wallingford et al., 2007); and
- 'Potential effects of offshore wind developments on coastal processes'. (ABPmer and METOC, 2002).

PROPOSED APPROACH

7.5.3 The project will utilise standard approaches (as used for recent UK OWF projects) for the assessment of changes to physical processes as a result of the construction, operation and decommissioning of VE. The methods to be used will be refined at a later stage if necessary, based on the project design information and the receptor assessment requirements of all relevant topics. The proposed methods to be used for the physical processes assessment will be discussed and confirmed with the relevant stakeholders as part of the development of the PEIR in advance of the final ES.

7.5.4 The assessment approach includes a range of desktop analyses and spreadsheet-based models.

7.5.5 The analyses are supplemented by the application of evidence from previous assessments and monitoring from offshore wind farm projects and other analogous activities. The adjacent Galloper and Greater Gabbard OWF projects were consented based on several project-specific studies which included the use of numerical modelling to quantify the environmental baseline, and the scheme impacts on the physical processes and environment for the realistic worst-case development options at the time. The modelling results remain valid, with the scheme scenarios providing a conservative representation of the as-built developments. As a broadly similar OWF development in a similar environmental setting, the Galloper and Greater Gabbard OWF EIAs will likely provide a sufficient range of existing evidence to inform similar assessments for VE. Other supporting evidence may also be drawn from existing assessments and monitoring of other sufficiently similar OWF developments.

7.5.6 New numerical modelling is presently considered not to be required (with reference to the relevant best practice guidance; ABPmer & HR Wallingford, 2009). A detailed rationale for this position will be provided to the relevant members of the Expert Topic Group following publication of this Scoping Report.

POTENTIAL PROJECT IMPACTS

7.5.7 In most cases, physical processes are not in themselves receptors but are, instead, 'pathways' which have the potential to indirectly impact other environmental receptors. Accordingly, although outputs from VE physical processes assessments will be reported in a stand-alone ES chapter, for the most part they will not be accompanied by statements of ‘effect significance.’ Instead, the information on changes to the physical processes pathways will be used to inform other EIA topic assessments, namely:

- Water and Sediment Quality;
- Benthic and Intertidal Ecology;
- Fish and Shellfish Resource;
- Marine Mammals;
- Ornithology (Offshore);

- Commercial Fisheries; and
- Archaeology and Cultural Heritage (Offshore).

7.5.8 Whilst physical processes can largely be considered as pathways, a small number of features have been identified as potentially sensitive physical processes receptors. These are:

- The coast;
- Nearby offshore sandbanks and sandwaves; and
- Seabed areas contained within nationally or internationally designated sites.

7.5.9 A range of potential impacts on physical processes have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 7.3, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses to enable an assessment of the impact.

7.5.10 Based on the baseline environment information currently available and the project description (outlined in Chapter 3: Project Description), no impacts have been scoped out at this stage, principally due to the potential for indirect impacts on other topic receptors.

Table 7.3 - Impacts proposed to be scoped into the assessment for physical processes

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
7.1	Potential changes to suspended sediment concentrations (SSC), bed levels and sediment type.	Activities such as foundation construction or cable laying can cause increases in SSC as a result of seabed disturbance. The transport of the disturbed material and the eventual deposition could in turn result in variations in the underlying bed levels and changes to the sediment type.	Spreadsheet-based models will be developed to quantitatively inform the assessment of potential changes to SSC and bed levels caused by construction activities. Results will be provided for a range of hydrodynamic conditions and sediment types, capturing the realistic worst case (in terms of plume extent, concentration and sediment deposition). The available baseline information and the planned site-specific surveys will provide the data inputs for this assessment.
7.2	Potential impacts to seabed morphology (sandbanks and sandwaves).	Sandwave levelling and cable trenching have the potential to directly disturb the morphology of sand banks and sand waves	Assessed as a semi-quantitative desktop exercise. This will be based on the local sediment transport potential and the dimensions of any bedforms present, also referring to a range of existing evidence that ABPmer has developed in relation to this assessment over the last ~3 years for other wind farm projects.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
7.3	Potential impacts to landfall morphology.	Where the offshore AoS makes landfall, it must transition through the intertidal and coastal zone. The methods available for installing cables in such environments may physically disturb or disrupt the coastal morphology to differing degrees. At the time of construction, any disturbance will be localised to the landfall site.	The short-term physical impact of cable installation at the landfall will be assessed as a desktop analysis, considering available relevant coastal processes data (e.g. LiDAR, inter-tidal topographic data, coastal monitoring reports etc.). The assessment will also draw upon observational evidence from other suitably analogous projects. The available baseline information and the planned site-specific surveys will provide the data inputs for this assessment.
OPERATION			
7.4	Potential changes to the tidal regime.	Interaction between the naturally present metocean regime (waves and currents) and the foundations of the wind farm infrastructure will result in patterns of change in current speed, wave energy, and turbulence. The effect of increased turbulence on sediment transport immediately adjacent to individual foundations is to cause scour (considered as a	Persistent changes to wave and currents may have a net influence over time on patterns of sediment transport (rates and directions), with consequential impacts to seabed and coastal morphology. The sensitivity of these patterns to change will depend upon: > The relative importance of currents and/or waves; > The magnitude and extent of any effect;
7.5	Potential changes to the wave regime.		
7.6	Potential changes to the sediment transport regime.		
7.7	Potential impacts to seabed morphology (sandbanks and sandwaves).		
7.8	Potential impacts to coastal morphology.		

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		separate impact below). At greater distances but still within the extent of the array area, the effect on tidal currents is evident as a series of discrete wake features extending downstream along the tidal axis from each foundation. The effect of a foundation on individual waves is typically not measurable in practice but the cumulative effect of many foundations is generally accepted to be a slight reduction in wave height that is not significant in EIA terms (e.g. RWE, 2021).	> The nature of the seabed substrate; and > The degree to which the system is presently in balance (e.g. could a small change reverse the direction of net transport, or, is the present rate and direction of transport essential to the maintenance of a dynamic morphological feature). The importance of small changes to instantaneous wave and current parameters will be evaluated in the context of the wide range of natural temporal variability (from hourly to decadal timescales) and longer-term trends (e.g. annual to decadal cycles). The wave assessment will also include consideration of the potential for a windfarm array to reduce wind energy in its lee that may in turn alter wave patterns, which may have an impact on long term coastal forcing conditions. Potential changes to the tidal (water levels and currents) and wave regimes caused by the presence of the wind farm foundations will be assessed by reference to the results

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			of existing numerical modelling studies undertaken for sufficiently analogous wind farm developments and metocean conditions, with consideration of the environmental setting and the foundation type, number and layout. A comparison will then be made of the blockage density presented by the additional foundations in the VE array areas. This will be completed through consideration of the cross-sectional area of each foundation, turbine spacing, number and the dimensions of the VE array areas. The blockage density will be considered both in absolute terms and in comparison, to the Galloper OWF and other operational wind farms where no associated direct or indirect adverse impacts have yet been observed. Potential changes to the sediment transport regime will be primarily assessed on the nature and magnitude of any impacts on the tidal and wave regimes (which control the rates and patterns of sediment transport). Consideration will then be given to whether the nature or rate of sediment supply across the wider area might be otherwise affected by VE.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
7.9	Scour.	Interaction between the naturally present waves and currents and the wind farm infrastructure has the potential to cause localised scouring of seabed sediment, leaving a depression that will persist in some form until the structure is removed. The extent and depth of scour may vary over time and may be limited under certain physical conditions.	A conservative approach using standard relationships from the relevant literature will be applied to calculating the maximum expected dimensions of scour independent of other factors. Scour protection measures are typically used to mitigate the engineering risk posed by scour and, where used, will largely prevent scour developing. However, the area occupied by the scour protection might also be similarly considered as a modification to habitat.
DECOMMISSIONING			
7.10	Potential changes to SSC, bed levels and sediment type.	Activities such as removal of foundations or cables (if required) can cause increases in SSC as a result of seabed disturbance. The transport of the disturbed material and the eventual deposition could in turn result in variations in the underlying bed levels and changes to the sediment type.	It is expected that decommissioning activities will result in a lesser rate of sediment disturbance than that already considered in relation to the construction phase. No further quantitative assessment of the actual (similar or lower) resulting levels of SSC or the fate of locally re-suspended sediments will be undertaken.
7.11	Potential impacts to seabed morphology (sandbanks and sandwaves).	Cable or cable protection removal operations (if required) have the potential to directly disturb the	Assessed as a semi-quantitative desktop exercise. This will be based on the local sediment transport potential and the

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		morphology of sand banks and sand waves	dimensions of any bedforms present, also referring to a range of existing evidence that ABPmer has developed in relation to this assessment over the last ~3 years for other wind farm projects.
7.12	Potential impacts to landfall morphology.	Where the offshore AoS makes landfall, it must transition through the intertidal zone. The methods identified for removing or decommissioning the cable and/or cable protection measures may physically disturb or disrupt the intertidal morphology.	If infrastructure previously affecting physical processes is removed, there will be a subsequent readjustment back towards the (future) baseline conditions. This may include changes to the regional coastal morphology by local enhancement or interruption of a long-shore sediment transport pathways. The potential for impacts relating to the decommissioning of cables and/or cable protection measures at the landfall will be assessed as part of the cable landfall desktop analysis described in relation to the construction and operation phases. This will include the consideration of observational evidence from analogous cable decommissioning activities and with reference to the metocean baseline understanding and the wider evidence base.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

7.5.11 As part of the design process for VE a number of designed-in measures are proposed to reduce the potential for impacts on physical process receptors. These are presented below. These will evolve over the development process as the EIA progresses and in response to consultation.

7.5.12 VE OWFL is committed to implement these measures, and various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments for the scoping of impacts (Table 7.3).

7.5.13 Measures adopted as part of the project will include:

- Development of, and adherence to, a Cable Specification and Installation Plan post consent (if granted), which sets out measures to minimise adverse impacts to potentially sensitive receptors. It will also set out appropriate cable burial depth in accordance with industry good practice, minimising the risk of cable exposure; and
- Use of scour and cable protection where there is the potential for scour to develop around wind farm infrastructure, including wind turbine generator (WTG) foundations, offshore substation platform (OSP) foundations and cables.

7.5.14 The requirement and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

POTENTIAL CUMULATIVE IMPACTS

7.5.15 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative impacts will be assessed through the CIA. For physical processes, cumulative interactions may occur with other planned OWF as well as other activities in the study area (such as aggregate dredging). Potential cumulative impacts with other projects and activities are summarised below.

7.5.16 The potential impacts of VE on physical processes are likely to be small in both absolute and relative terms. Previous studies have consistently shown that similar arrays of WTG foundations are relatively unlikely to have significant effects in EIA terms on waves, currents or sediment transport. Numerical modelling completed as part of the Galloper OWF ES concluded there will be no effects of that development either alone or in-combination with the adjacent Greater Gabbard OWF, with conservative design options considered for both projects. These projects are both operational and no significant effects (attributable to changes in hydrodynamics, waves and/or sediment transport) are understood to have been observed or reported. Given the similar environmental setting of VE in relation to the existing projects, and likely similarity in design options, the potential for cumulative effects is likely to be similarly limited.

7.5.17 Operational OWFs within the study area (in particular Galloper and Greater Gabbard) will not be considered within the CIA as they are considered part of the baseline environment and hence have already been taken into consideration within the project-alone assessment. However, planned (but yet unbuilt) OWF projects (such as East Anglia Hub TWO and North Falls) will be included which are within the study area (and so the potential ZoI for physical processes pathways arising from VE's activities and infrastructure).

7.5.18 There is (limited) potential for other nearby activities to result in cumulative sediment plume impacts, including aggregate dredging, shipping, subsea cabling, and oil and gas (O&G) exploration and development. However, the short duration, temporary and localised nature of sediment plumes means that cumulative effects are relatively unlikely to occur at all, and if so, only for short durations in very localised areas. As detailed in Chapter 4, a short listing process, for the Physical Processes assessment, will be undertaken to screen in any proposed plans, projects or activities which have the potential for temporal and spatial overlap.

7.5.19 Impacts proposed to be scoped into the CIA are:

- Potential changes to SSC, bed levels and sediment type;
- Potential changes to the tidal regime;
- Potential changes to the wave regime;
- Potential changes to the sediment transport regime; and
- Potential impacts to seabed morphology (sandbanks and sandwaves).

7.5.20 Impacts proposed to be scoped out of the cumulative assessment are:

- Scour - This is due to the highly localised nature of the change.

POTENTIAL TRANSBOUNDARY IMPACTS

7.5.21 A description of how potential transboundary effects will be assessed is outlined in Chapter 4: Environmental Impact Assessment approach and methodology. As presented in Chapter 4, the limits of the Dutch, Belgian and French Exclusive Economic Zones are located approximately 16 km (south east), 25 km (south) and 18 km (north east) of the VE array areas respectively. However, due to the localised nature of any potential changes to physical process, transboundary impacts are unlikely to occur and therefore transboundary impacts will be scoped out from further consideration within the EIA.

7.6 SUMMARY OF NEXT STEPS

7.6.1 Aside from the site specific geophysical and benthic survey being completed in 2021, no further surveys are anticipated to inform the physical processes assessment. No requirement for new numerical modelling is anticipated.

7.6.2 The proposed assessment approach for the PEIR and subsequent ES chapter is as outlined in the methodology section (Section 7.5).

7.7 FURTHER CONSIDERATION FOR CONSULTEES

7.7.1 We seek responses to the following questions:

- Do you agree that the data sources identified are sufficient to inform the physical process baseline for the VE PEIR and ES?
- Have all potential impacts resulting from VE been identified both for the physical processes receptors and indirect effects on other topics?
- For those impacts scoped in (Table 7.3), do you agree that the methods described are sufficient to inform a robust impact assessment?
- Do you agree that scour can be scoped out of the cumulative impacts assessment and that transboundary impacts can also be scoped out?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of VE on the physical process receptor and pathway?
- Are there any known physical processes issues associated with the operational Galloper and Greater Gabbard OWF that we should be aware of?

8. WATER AND SEDIMENT QUALITY

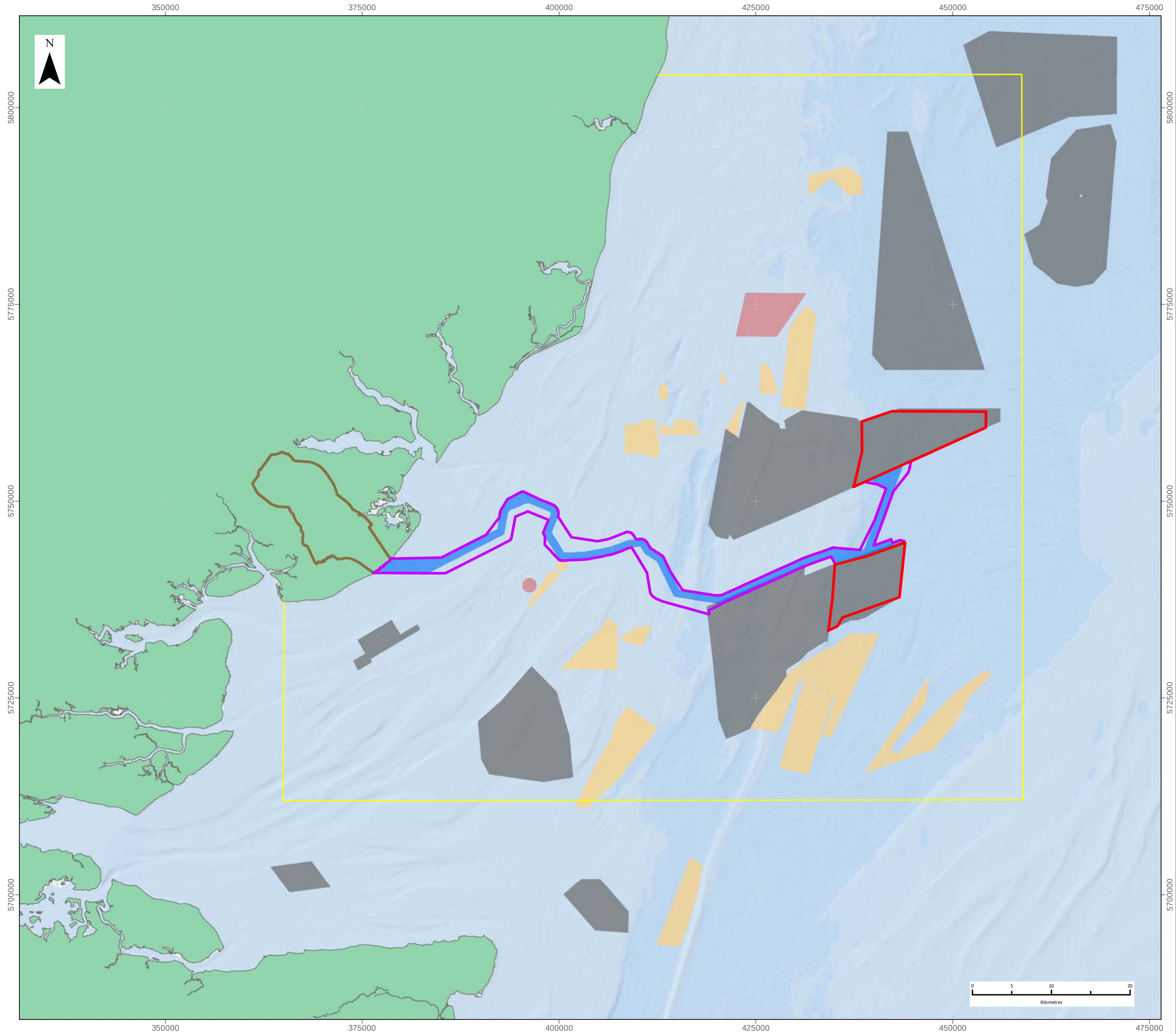
8.1 INTRODUCTION

8.1.1 This chapter of the Scoping Report identifies the marine water and sediment quality (MW&SQ) receptors of relevant to the VE array area and offshore export cable corridor Area of Search (offshore AoS) which comprises the offshore elements of the scoping boundary. This chapter describes the potential effects from the construction, operation and maintenance, and decommissioning of VE on MW&SQ and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

8.2 STUDY AREA

8.2.1 The study area for the MW&SQ assessment is located within the Outer Thames Estuary and includes the VE array areas and the offshore AoS (Figure 8.1). The MW&SQ study area was defined based on a precautionary zone of influence based on the likely maximum tidal excursion extents. The study area is consistent with the physical processes Scoping Report assessment (see Chapter 7 for a more detailed consideration) which considered the work previously undertaken for the Galloper and Greater Gabbard OWFs and analysis of anticipated tidal excursion distances and prevailing wave directions. Tidal flow is relatively rectilinear within the VE array areas, with tidal current direction to the northeast during the ebb and to the southwest during the flood.

8.2.2 The study area for the assessment in the PEIR (and ES) will be reviewed and potentially refined based on the tidal excursion (and so the potential zone of influence of VE on MW&SQ receptors) and the project envelope at that time.



LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Study Area
- Existing Offshore Wind Farms
- Dumping Grounds (Oceanwise)
- Aggregate Extraction Areas

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Marine Water and Sediment Quality Study Area

VER	DATE	REMARKS	Drawn	Checked
1	17/09/2021	For Issue	SWM	FM

DRAWING NUMBER:

8.1

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\MWSQ\VE_SA_Fig8_1_V1 (1).mxd

8.3 BASELINE DATA

8.3.1 A desk-based review of literature and data sources undertaken to support this Scoping Report, is presented in Table 8.1. Table 8.1 also identifies additional sources of information that will inform the assessment in the PEIR and ES.

8.3.2 In addition to publicly available data and literature sources, further information will be collected through site-specific benthic ecology surveys which will be undertaken across both the array areas and the offshore AoS (including the intertidal area). As part of the site-specific surveys sediment samples will be collected and analysed for particle size analysis (PSA) and a suite of contaminants. Data from other sources such as the North Falls Offshore Wind Farm benthic sampling data and sediment sampling data from 2021 will be reviewed, if available.

Table 8.1 - Key sources of information for MW&SQ

SOURCE	SUMMARY	COVERAGE OF VE
Anglian River Basin Management Plan (and associated data)	The River Basin Management Plan provides information on the current status, pressures, objectives and programme of measures of the water environment.	Full coverage of waterbodies designated under the Water Framework Directive (WFD). Therefore, there is partial spatial coverage of the MW&SQ study area.
Environment Agency WFD water body sampling data	Data collected by the Environment Agency to quantify the chemical performance of the water environment.	Full coverage of waterbodies designated under the WFD. Therefore, there is partial spatial coverage of the MW&SQ study area.
Environment Agency Bathing Water classifications	Data collected by the Environment Agency to quantify the performance of the local bathing waters.	Full coverage of waterbodies designated under the WFD. Therefore, there is partial spatial coverage of the MW&SQ study area.
Environment Agency Shellfish Water classifications	Data collected by the Environment Agency to quantify the performance of the local shellfish waters.	Full coverage of waterbodies designated under the WFD. Therefore, there is partial spatial coverage of the MW&SQ study area.
Galloper Wind Farm post-construction data/information. Sourced from VE OWFL.	Benthic environmental monitoring was carried out for Galloper OWF to establish if the wind farm is having an effect upon the local benthic	Partial spatial coverage of the MW&SQ study area.

SOURCE	SUMMARY	COVERAGE OF VE
	ecology and seabed sedimentology.	
Galloper Wind Farm Environmental Statement.	Characterisation and monitoring data for the existing operational Galloper OWF site (including particle size analysis; contaminant analysis, and drop down video surveys).	Partial spatial coverage of the MW&SQ study area.
Greater Gabbard OWF	Characterisation and monitoring data for the existing operational Greater Gabbard OWF site.	Partial spatial coverage of the MW&SQ study area.
Sediment model detailing multiple different sediment classifications, including Folk and EUNIS substrate (Cefas, 2018)	Spatial predictions of the fractions of mud, sand and gravel as continuous response variables for the north-west European continental shelf.	Full coverage of the MW&SQ study area.
Cefas Suspended Particulate Matter (SPM) data (Cefas, 2016).	Annual average of non-algal SPM data available from Cefas. These data are based on the satellite derived Ifremer OC5 algorithm (Gohin *et al*, 2011).	Full coverage of the MW&SQ study area.
OSPAR Intermediate Assessment 2017 (OSPAR, 2017)	This assessment provides OSPAR's understanding of the marine environment's current status.	Full coverage of the MW&SQ study area.

8.4 BASELINE ENVIRONMENT

WATER QUALITY

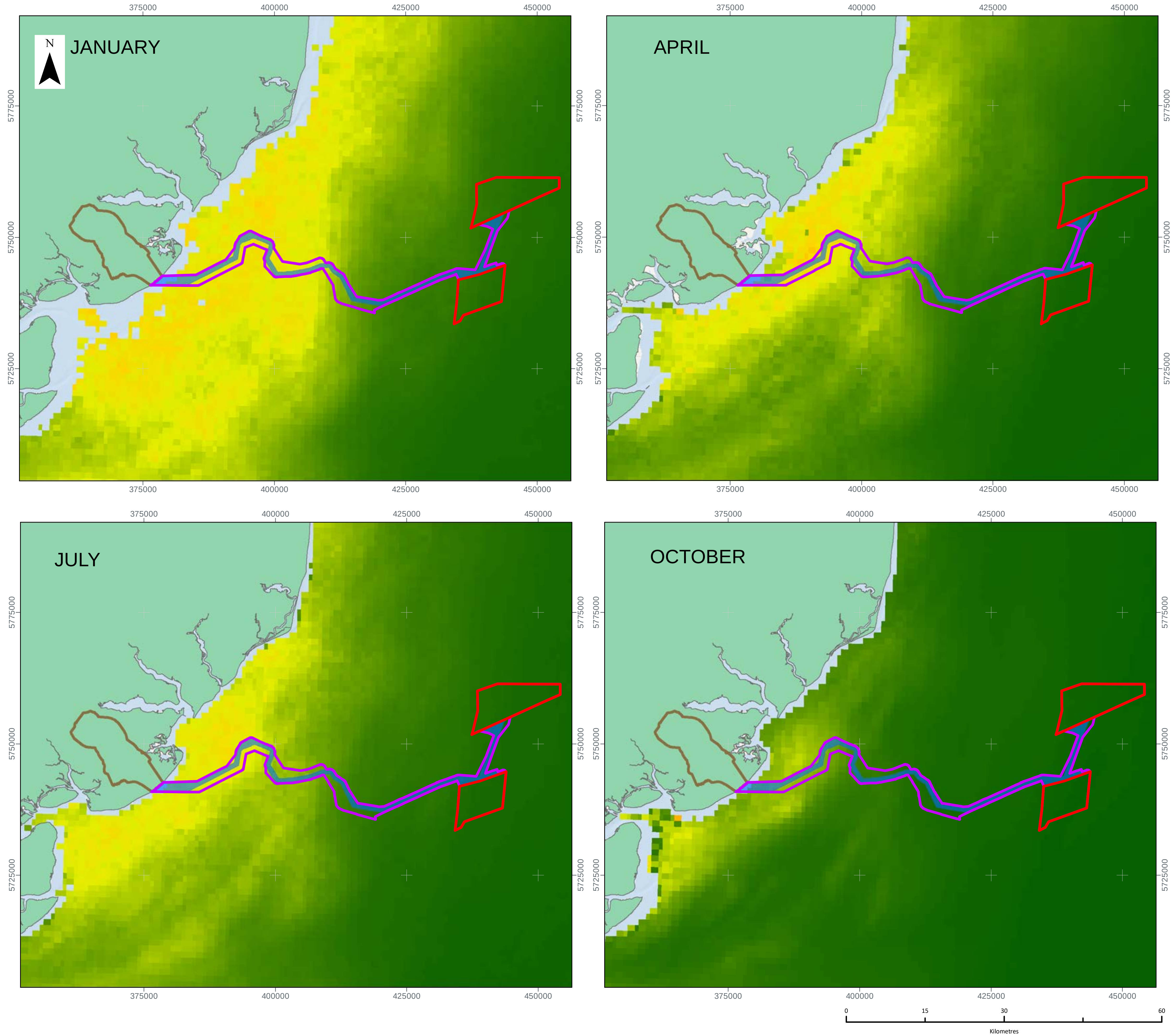
8.4.1 The southern North Sea is characterised by a high degree of spatial and temporal (both annual and inter-annual) variability in Suspended Sediment Concentration (SSC). In general, there exists an inshore to offshore gradient in SSC, with the highest concentrations observed close to, and especially at the mouths of, large estuaries such as the Thames (Cefas, 2016).

8.4.2 The VE array areas are located close to the Thames Estuary, an area characterised by naturally high levels of turbidity, primarily in response to the input of fine grained sediments from fluvial sources, erosion of soft cliff coasts and the frequent re-suspension of mobile material from shallow seabed settings. It is situated at the boundary between the turbid Thames Estuary and the clearer North Sea, in a region known as the East Anglian Plume (Cefas, 2016). The East Anglian Plume extends from the East coast of the UK across the southern North Sea towards the Danish coastline and has an important role in transporting sediment across the North Sea (Dyer and Moffat, 1998).

8.4.3 Monthly averaged satellite imagery of SPM[29] relative to VE is presented in Figure 8.2. These data indicate that within the VE array areas average SPM is approximately 7 mg/l, increasing during winter months to values of approximately 11 mg/l (Cefas, 2016), occasionally reaching up to 18 mg/l. Higher values are anticipated during spring tides and storm conditions, with the greatest concentrations encountered close to the bed.

8.4.4 As presented in Figure 8.2, the VE offshore AoS shows variation, with the highest values in the southern extents near the coast. The offshore AoS shows a greater seasonality than the array areas, increasing in the winter months to mean SPM values between 30 to 120 mg/l. Higher SPM values are anticipated during spring tides and storm conditions, with the greatest concentrations encountered close to the seabed in the offshore AoS.

[29] At the surface



LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search

SPM

180
150
120
90
60
30
0

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Analysed satellite SPM data (Cefas, 2016)

VER	DATE	REMARKS	Drawn	Checked
1	27/09/2021	For Issue	SWM	FM

DRAWING NUMBER:

8.2

SCALE: 1:750,000 | PLOT SIZE: A3 | DATUM: WGS84 | PROJECTION: UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

Z:\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\MWSQ\VE_MWSQ_Fig8_2_V1.mxd

SEDIMENT QUALITY

8.4.5 The distribution of contaminants in sediments is generally similar to that of the surface water. The sediment type is an important factor when considering the potential presence of contaminants within sediments. Sediments with a finer particle size, such as clays and muds, can act as adsorption surfaces for contaminants that may be released into the water column if the sediment is disturbed (Cefas, 2001). Sediments with larger particle sizes (e.g. sands) are not associated with anthropogenic contaminants. Hydrocarbons in particular are closely linked to the spatial distribution of sediment types, decreasing from the northern to the southern North Sea where coarser sediments are more prevalent.

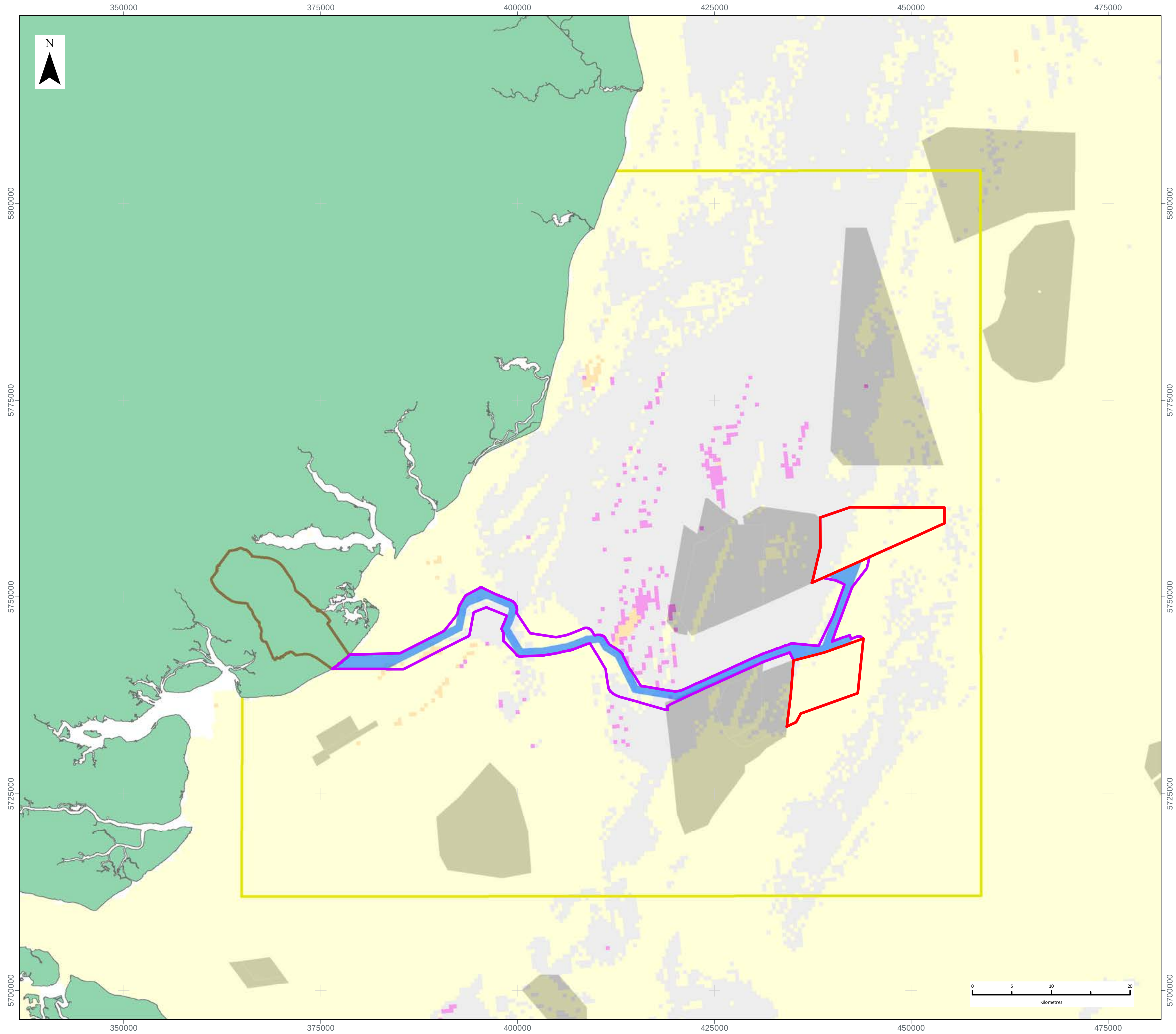
8.4.6 The concentrations of metals in sediments are generally higher in the coastal zone and around estuaries, decreasing offshore, indicating that river input and run-off from land are significant sources.

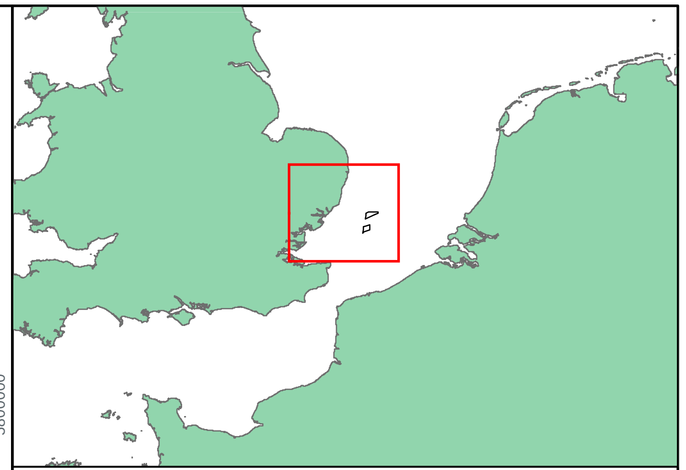
8.4.7 As presented in Figure 8.3, the sediments within the study area are typically coarse sediment with pockets of mixed sediments and sandy muds. Given the coarse nature of the sediment present, both the array areas and the offshore AoS are considered to be low risk for anthropogenic contaminants.

8.4.8 The assumption of typically being a low risk area for contaminants was supported by the contaminant analysis undertaken for the Galloper OWF. Hydrocarbons (such as PAHs, PCBs and TBT) were typically of very low levels or undetectable within the Galloper OWF survey. Ten out of eleven samples had metals (excluding arsenic and nickel) below Cefas Action Level 1 (CAL1). Elevated concentrations of nickel and arsenic were recorded within the Galloper OWF survey. Nickel exceeded CAL1 for five out of ten samples but did not exceed Cefas Action Level 2 (CAL2). It should be noted that nickel has little capacity for bioaccumulation.

8.4.9 The samples showed that arsenic levels were elevated across all samples (and exceeding CAL1 for eight of the ten samples) but none exceeded CAL2. Natural sources of arsenic in the marine environment include (but are not limited to) remobilisation and erosion of arsenic-rich rocks (Research Council of Norway, 2012), which vary naturally according to local geology. Anthropogenic sources include mining and smelting (Research Council of Norway, 2012) as well as the burning of fossil fuels. Due to the high natural occurrence of this metal, it is often difficult to precisely discern between natural and anthropogenic sources of this metal (OSPAR, 2005). However, high arsenic concentrations in the outer Thames Estuary, as well as the south-west Dogger Bank and Norfolk may be associated with a history of arsenical waste disposal in the Thames estuary (Whalley *et al*., 1999).

8.4.10 The arsenic concentrations recorded for the Galloper OWF were within the range reported for the southern North Sea: < 0.5 mg kg^{-1} to 135 mg kg^{-1} of dry weight arsenic (Whalley *et al*., 1999).





LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Study Area

Cefas Sediment Model (2015)

- Coarse Sediments
- Mixed Sediments
- Mud and Sandy Mud
- Sand and Muddy Sand
- Offshore Wind Farms

Data Source:
Basemap:

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Sediment type distribution (source: Cefas, 2018)

VER	DATE	REMARKS	Drawn	Checked
1	27/09/2021	For Issue	SWM	FM

DRAWING NUMBER:

8.3

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\MWSQ\VE_MWSQ_Fig8_3_V1.mxd

8.4.11 The EU WFD (2000/60/EC) was established in 2000 in order to provide a single framework for the protection of surface waterbodies (including rivers, lakes, coasts and estuaries) and groundwater. Each waterbody has an assigned ecological status. The ecological status is assigned by considering the biological, hydromorphological, chemical and specific chemicals. The Environment Bill sets out a new environmental governance framework as the UK leaves the EU's environmental policy and legislative structures which will replace the Water Environment (Water Framework Directive) (England and Wales) Regulations 20217 which currently transposes the WFD into English Law.

8.4.12 The offshore AoS passes through the Essex Coastal WFD water body (GB650503520001) (see Figure 8.4). The Essex water body is described as heavily modified due to extensive coastal and flood protection infrastructure being present. The waterbody is of Good chemical status and Moderate ecological status (Environment Agency, 2021). The overall status is Moderate, see Table 8.2 (Environment Agency, 2021). Further details of the WFD assessment are provided in Section 8.5.

8.4.13 Table 8.2 presents the water bodies and protected areas, as designated under the Water Framework Directive within 2 km of the offshore AoS. A 2 km buffer has been applied in accordance with the guidance (Environment Agency, 2017). The sites outlined in Table 8.2 will be considered further in the screening and scoping assessments of the WFD assessment, to be provided within the PEIR.

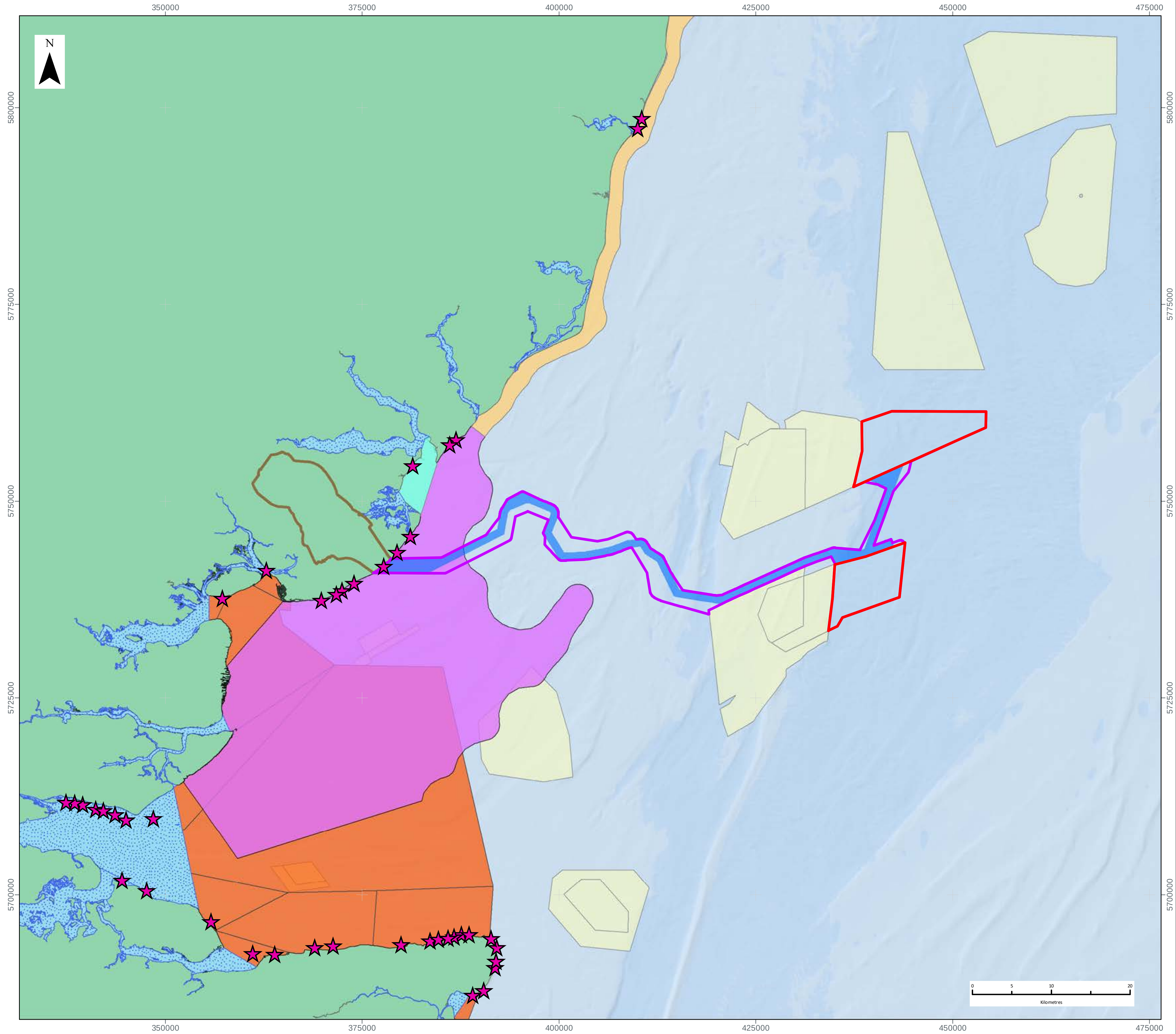
8.4.14 No transitional WFD water bodies, nutrient sensitive areas or designated shellfish waters are within 2 km of the offshore AoS.

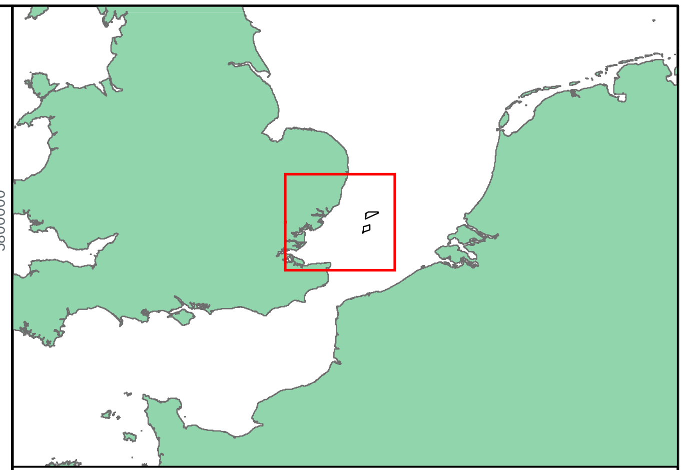
Table 8.2 – Relevant Water Framework Directive sites

SITE NAME	TYPE	CURRENT STATUS
Essex	Coastal water body	Overall = Moderate Ecological = Moderate Chemical = Good[30]
Frinton	Bathing Water	Good[31]
Holland	Bathing Water	Excellent[31]

[30] O = Overall Status; E = Ecological Status; C = Chemical Status. Based on the 2015 classifications. However, VE OWFL are aware that based on the latest monitoring data (2019) this water body's chemical status is failing. VE OWFL will discuss with the Environment Agency the methodology for assessing this within the WFD assessment under the Evidence Plan Process.

[31] Owing to the Covid-19 pandemic, the classifications for bathing waters were not awarded by the Environment Agency in 2020 (Environment Agency, 2020). Therefore, these classifications presented are from 2019.





LEGEND

- Offshore Scoping Boundary
- Array Area
- Preferred Offshore Export Cable Route
- Onshore Cable Corridor Area of Search
- Shellfish Waters
- Transitional Waterbodies
- Designated Bathing Waters
- Existing Offshore Wind Farms

Coastal WFD Waterbodies:

- Walberswick Marshes Coastal water body
- Suffolk Coastal water body
- Harwich Approaches Coastal water body
- Essex Coastal water body

Data Source:
Basemap: © OpenStreetMap (and) contributors, CC-BY-SA
Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

WFD and Protected Areas

VER	DATE	REMARKS	Drawn	Checked
1	27/09/2021	For Issue	SWM	BB

DRAWING NUMBER:

8.4

SCALE: 1:500,000	PLOT SIZE: A3	DATUM: WGS84	PROJECTION: UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\MWSQ\VE_MWSQ_Fig8_4_V1.mxd

8.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED METHODOLOGY

8.5.1 The MW&SQ assessment will follow the methodology set out in Chapter 4. In addition, the following principal guidance documents will be considered:

- Water Framework Directive assessment: estuarine and coastal waters (Environment Agency, 2017); and
- Advice Note Eighteen: The Water Framework Directive' (PINS, 2017).

WATER FRAMEWORK DIRECTIVE ASSESSMENT

8.5.2 A WFD assessment will be provided as a standalone document to accompany the PEIR and ES. This assessment will be prepared in accordance with the 'Water Framework Directive assessment: estuarine and coastal waters' guidance[32] (Environment Agency, 2017). This assessment will present the findings of the WFD Assessment for the potential impacts of VE. The purpose of the WFD assessment will be to demonstrate that the proposed activities associated with VE do not result in a deterioration in a designated water body (or protected area) and do not jeopardise the attainment of good status (or the potential to achieve good ecological and chemical status). The WFD assessment will be informed by relevant topic specific assessments in the PEIR and ES.

POTENTIAL PROJECT IMPACTS

8.5.3 A range of potential impacts on MW&SQ have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that are proposed to be scoped into the VE EIA are outlined in Table 8.3, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses to enable an assessment of the impact.

8.5.4 Based on the baseline information currently available and the Project Description (see Chapter 3), several impacts are proposed to be scoped out of the EIA for this topic. These impacts are described in Table 8.4, together with a justification for scoping them out.

[32] Formerly known as the 'Clearing the Waters for All' Guidance

Table 8.3 - Impacts proposed to be scoped in to the assessment for MW&SQ

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
8.1	Deterioration in water quality due to suspension of sediments	Sediment disturbance arising from construction activities, such as cable laying and foundation installation, may result in adverse effects on marine water quality. This can be a result of temporary increase in SSC as the associated effects (reduction in clarity and increases in nutrient concentrations).	A characterisation of the baseline will be provided, including details of the presence and extent of sediment types will be described using existing and new site-specific survey data for both the array and the offshore AoS. The sensitivity of the environment to the impact will be determined through available literature, designations and expert judgement. The magnitude of the impact will be informed by the physical processes assessment, including the quantification of the predicted sediment plume concentrations and longevity. Further details regarding the proposed approach to quantifying SSC is provided in Chapter 7. It should be noted that no project specific hydrodynamic modelling (and associated transport simulations) is proposed to inform the EIA; an evidence based approach will be used based on modelling and assessments undertaken at adjacent OWF projects. The sensitivity and magnitude will be utilised to inform the significance of the effect – see Chapter 4.
8.2	Release of sediment-bound contaminants	Sediment disturbance arising from construction activities, such as cable laying and foundation installation, may result in adverse effects on marine water quality. This can be a	The presence and extent of sediment bound contaminants will be described using existing and new site-specific survey data for both the array areas and the offshore AoS.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
	from disturbed sediments	result of temporary re-suspension of contaminants within the seabed sediments.	The sensitivity of the environment to the impact will be determined through available literature, designations and expert judgement. The magnitude of the impact will be informed by the physical processes assessment, including the quantification of the predicted sediment plume concentrations and longevity. The sensitivity and magnitude will be utilised to inform the significance of the effect – see Chapter 4.
8.3	Accidental releases or spills of materials or chemicals	During construction activities accidental spills of releases could occur without appropriate mitigation in place.	The sensitivity of the environment to the impact will be determined through available literature, designations and expert judgement. A consideration of the potential liquids which could be spilt during the activities will be considered to determine the potential magnitude. The sensitivity and magnitude will be utilised to inform the significance of the effect – see Chapter 4. Whilst it is noted that the majority of chapters have proposed to scope out the impacts from accidental releases and spills, this effect has been retained in this chapter. This is primarily to provide information to inform the HRA assessment. The likelihood of an incident will be substantially reduced by the implementation of a Project Environmental Management Plan (PEMP).
8.4	Deterioration in water clarity due to the	The principal issue, for MW&SQ receptors, relating to bentonite release to the water column comprise the potential for an increase in SSC	The assessment will present the maximum volume (and rate) in which inert drilling mud may be released into the environment. The determination of the sensitivity of

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
	release of drilling mud	(and so turbidity) within the water column and potential reduction in bacterial mortality.	receptors will utilise the same approach will be outlined for impact 8.1.
OPERATIONS AND MAINTENANCE			
8.5	Accidental releases or spills of materials or chemicals	During O&M activities accidental spills of releases could occur without appropriate mitigation in place.	The same approach will be adopted as impact 8.3.
8.6	Deterioration in water quality due to suspension of sediments from O&M activities	Sediment disturbance arising from O&M activities, such as cable reburial and cable repair, may result in adverse effects on marine water quality. This can be a result of temporary increase in SSC as the associated effects (including release of sediment bound contaminants, reduction in clarity and increases in nutrient concentrations).	The same approach will be adopted as impact 8.1 and 8.2.
DECOMMISSIONING			
8.7	Deterioration in water quality due to re-	Similar to during construction activities, decommissioning could result in temporary increases in	The same approach will be adopted as impact 8.1 and 8.2.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
	suspension of sediments	suspended SSC and the associated effects (including release of sediment bound contaminants, reduction in clarity and increases in nutrient concentrations).	
8.8	Accidental releases or spills of construction materials or chemicals	During decommissioning activities accidental spills of releases could occur without appropriate mitigation in place.	The same approach will be adopted as impact 8.3.

Table 8.4 - Impacts proposed to be scoped out of assessment for MW&SQ

IMPACT NO	IMPACT	JUSTIFICATION FOR SCOPING OUT
8.9	Deterioration in water quality due to re-suspension of sediments and contaminants as a result of scour – O&M phase only	There is the potential that sediment could be re-suspended as a result of scour around project infrastructure (including WTGs and cable protection). Given that the volume of suspended sediment released during operation via scour will be much lower than during construction, it is proposed that this impact will be scoped out from further consideration within the EIA. Furthermore, the effect will be highly localised and associated volumes of mobilised sediment (and associated contaminants) are considered to be within the range of natural variability. Therefore, subject to consultation with the SNCBs and feedback received on this Scoping Report, it is intended to scope this impact out of further consideration within the EIA.
8.10	Release of sediment-bound contaminants from disturbed sediments in water quality due to cumulative effects with other projects and plans	The potential effects of VE on MW&SQ will be highly localised and small scale, and so cumulative impacts are unlikely to occur. This is supported by the relatively low levels of potential contaminants, particularly further offshore, within the sediments. As such no cumulative impacts are anticipated with other wind farms or other activities in the region. It is therefore proposed that in line with the approach agreed for previous projects (e.g. East Anglia THREE and Norfolk Vanguard (Planning Inspectorate, 2012 and 2016)) that these cumulative impacts are scoped out from further consideration within the EIA. Therefore, subject to consultation with stakeholders and feedback received on this Scoping Report, VE intends it is intended to scope this impact out of further consideration within the EIA.
8.11	Potential deterioration in water quality which may result in transboundary effects	The potential effects of VE on marine water quality will be highly localised and small scale with limited potential for transboundary impacts. No transboundary impacts are anticipated with other wind farms or other activities in the region It is proposed that transboundary impacts are scoped out from further consideration within the EIA. Therefore, subject to consultation with the SNCBs and feedback received on this Scoping Report, it is intended to scope this impact out of further consideration within the EIA.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

8.5.5 As part of the design process for VE, a number of designed-in measures are proposed to reduce the potential for impacts on MW&SQ receptors. These are presented below. These will evolve over the development process, as the EIA progresses and in response to consultation.

8.5.6 VE OWFL are committed to implement these measures, and also various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/out presented in Table 8.3 and Table 8.4.

8.5.7 Measures adopted as part of the project will include:

- A Project Environment Management Plan (PEMP) will be produced post-consent and implemented to cover the construction and O&M phases of VE. The PEMP will include a Marine Pollution Contingency Plan to cover accidental spills, potential contaminant release and include key emergency contact details (e.g. Marine Management Organisation, Maritime Coastguard Agency and the project site co-ordinator).
- A Decommissioning Programme will be developed to cover the decommissioning phase;
- Typical measures to be included within the plans above include: storage of all chemicals in secure designated areas with impermeable bunding (generally to 110% of the volume); and double skinning of pipes and tanks containing hazardous materials. The purpose of these measures is to ensure that potential for contaminant release is strictly controlled and provides protection to marine life across all phases of the life of the wind farm; and
- The requirement and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

POTENTIAL CUMULATIVE IMPACTS

8.5.8 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For MW&SA, cumulative interactions may occur with other planned projects and developments in the study area. Potential cumulative impacts with other projects and activities will be considered for each of the impacts considered in Table 8.3.

8.5.9 As outlined in Table 8.4 in relation to the project alone, cumulative effects associated with the release of sediment bound contaminants is highly unlikely to be significant (in EIA terms) and is proposed to be scoped out from further consideration within the EIA for MW&SQ.

8.5.10 There is the potential for cumulative impacts on MW&SQ receptors specifically associated with increases in SSC on MW&SQ receptors. As outlined in Table 8.4, due to the localised nature of any potential impacts, such as suspended sediment plumes, cumulative impacts are unlikely to be significant (in EIA terms). However, if there is proposed to be simultaneous cable laying or HDD operations in a WFD waterbody or protected area for both VE and another development (such as North Falls OWF), then this will be scoped in for further consideration within the EIA. However, if no temporal overlap is proposed then cumulative impacts on MW&SQ will be scoped out from further consideration within the EIA for MW&SQ.

POTENTIAL TRANSBOUNDARY IMPACTS

8.5.11 A description of how potential transboundary effects will be assessed is outlined in Chapter 4: Environmental Impact Assessment approach and methodology. As presented in Chapter 4, the limits of the Dutch, Belgian and French Exclusive Economic Zones are located approximately 16 km (south east), 25 km (south) and 18 km (north east) of the VE array areas respectively.

8.5.12 As outlined in Table 8.4, due to the localised nature of any potential impacts, such as suspended sediment plumes, transboundary impacts are unlikely to occur and therefore it is suggested that this impact will be scoped out from further consideration within the EIA for MW&SQ.

8.6 SUMMARY OF NEXT STEPS

8.6.1 The proposed approach to the assessment for MW&SQ PEIR chapter will first include the definition of the worst-case scenarios on which the assessments will be based. The assessment will be informed by the physical processes assessment, and in particular the assessment of changes in SSC and bed disposition.

8.6.2 Additional site- specific surveys and sediment analysis are proposed for to help fill data gaps that currently exist across the VE study area. Surveys will identify the potential areas of sediment contamination and to quantify the levels of contamination within the PEIR study area.

8.7 FURTHER CONSIDERATIONS FOR CONSULTEES

> Do you agree that the data sources identified are sufficient to inform the offshore and intertidal baseline for the VE PEIR and ES?

> Are you aware of any point sources of contaminants within the study area which may be of concern? If so, are any data available for these?

> Have all potential impacts resulting from VE been identified for marine water quality receptors?

> Have all potential impacts resulting from VE been identified for marine sediment quality receptors?

> Do you agree that the most appropriate guidance is 'Water Framework Directive assessment: estuarine and coastal waters' and the Planning Inspectorate Advice Note 18?

> Do you agree that the impacts described in Table 8.4can be scoped out?

> For those impacts scoped in (see Table 8.3), do you agree that the methods described are sufficient to inform a robust impact assessment?

> Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of VE on MW&SQ receptors?

9. BENTHIC AND INTERTIDAL ECOLOGY

9.1 INTRODUCTION

9.1.1 This section of the Scoping Report identifies the benthic and intertidal ecology receptors of relevance to the VE array areas and offshore AoS. It describes the potential effects from the construction, operation and maintenance, and decommissioning of VE on benthic species and habitats (up to the mean high-water springs (MHWS) mark) and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

9.1.2 Habitats landward of the MHWS have been considered in the onshore ecology chapter (see Chapter 19: Terrestrial Ecology and Nature Conservation).

9.1.3 This chapter should be read alongside the following chapters of this Scoping Report:

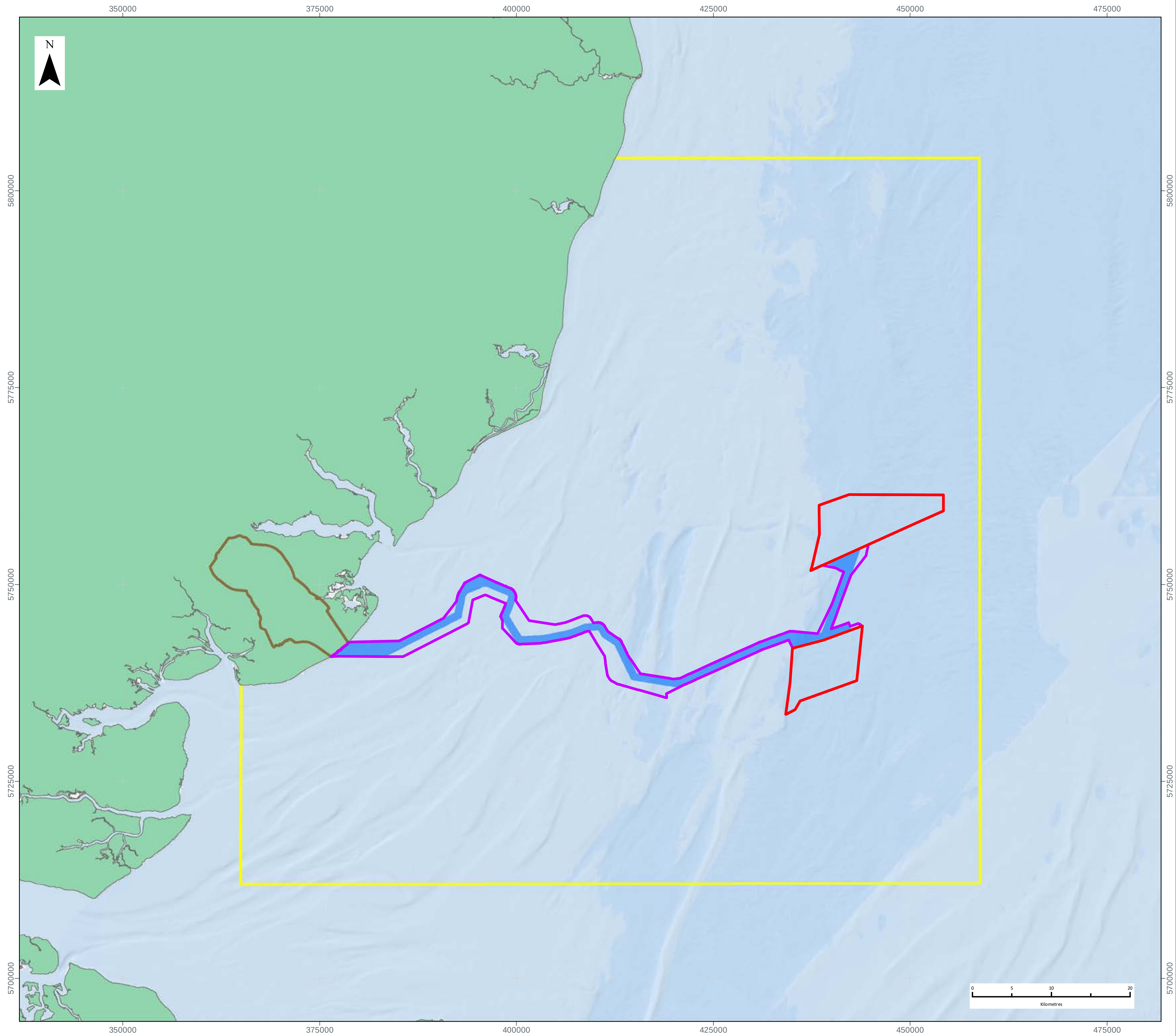
- Chapter 7: Physical Processes;
- Chapter 10: Fish and Shellfish Resources; and
- Chapter 19: Terrestrial Ecology and Nature Conservation.

9.2 STUDY AREA

9.2.1 For the purposes of this benthic and intertidal ecology scoping assessment, the VE benthic, subtidal and intertidal ecology study area has been defined at two spatial scales:

- The VE benthic, subtidal and intertidal ecology study area includes the array areas and the offshore AoS, and is synonymous with the offshore scoping boundary, as shown in Figure 9.1. The study area includes the intertidal zone at the potential landfall option ending at MHWS within the offshore AoS. Site-specific survey will be available within this study area to inform consideration of direct impacts associated with the construction and operation and maintenance of installed VE infrastructure.
- A wider study area has been delineated, which is consistent with the physical processes Scoping Report assessment (see Chapter 7: Physical Processes for a more detailed consideration). This has been identified taking into account the work previously undertaken for the Galloper and Greater Gabbard OWFs and analysis of anticipated tidal excursion distances (see Figure 9.1). This study area incorporates the area where there is potential from indirect impacts associated with increased suspended sediment during construction, operation and maintenance, and decommissioning and therefore covers a precautionary maximum zone of influence within which there may be potential impacts to benthic receptors. The study area for the assessment in the Preliminary Environmental Impact Report (PEIR) (and Environmental Statement (ES)) will be reviewed and refined based on the maximum tidal excursion identified within the physical processes assessment, to determine the zone of influence for benthic receptors outside of the offshore AoS and array areas.

9.2.2 The study area will be reviewed during subsequent stages of the EIA process and refined as necessary to reflect the development of the scheme. Additionally, information from the physical processes technical report will inform the final study area, which will take into account one tidal extent, in order to incorporate the maximum distance that suspended sediments disturbed by the development of VE might impact on benthic habitats.



LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Study Area

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

VE benthic ecology study area

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	SWM	FM

DRAWING NUMBER:

9.1

SCALE: 1:500,000	PLOT SIZE: A3	DATUM: WGS84	PROJECTION: UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Benthic\VE_BEN_SA_Fig10_1_V1.mxd

9.3 BASELINE DATA

9.3.1 A desk-based review of literature and data sources to support this Scoping Report highlighted the following data sources, presented in Table 9.1, which provide coverage across large parts of the VE benthic, subtidal and intertidal ecology study area, and wider region (Figure 9.2).

9.3.2 To supplement these publicly available data sources, additional data collected as part of site-specific benthic subtidal and intertidal ecology surveys will be used to characterise the baseline environment. The survey area will include the preferred OECR, the array areas and the landfall zone. Surveys commenced in August 2021.

9.3.3 Subtidal benthic habitats will be sampled via a combination of targeted benthic infaunal grab sampling and Drop Down Video (DDV) surveys. Sampling stations will be selected based on interpretation of geophysical survey data collected as part of the benthic survey campaign. Sediment samples will also be collected for contaminant and Particle Size Analysis (PSA), as part of the site specific survey. The specific survey methods were subject to consultation with Natural England and Cefas prior to commencement

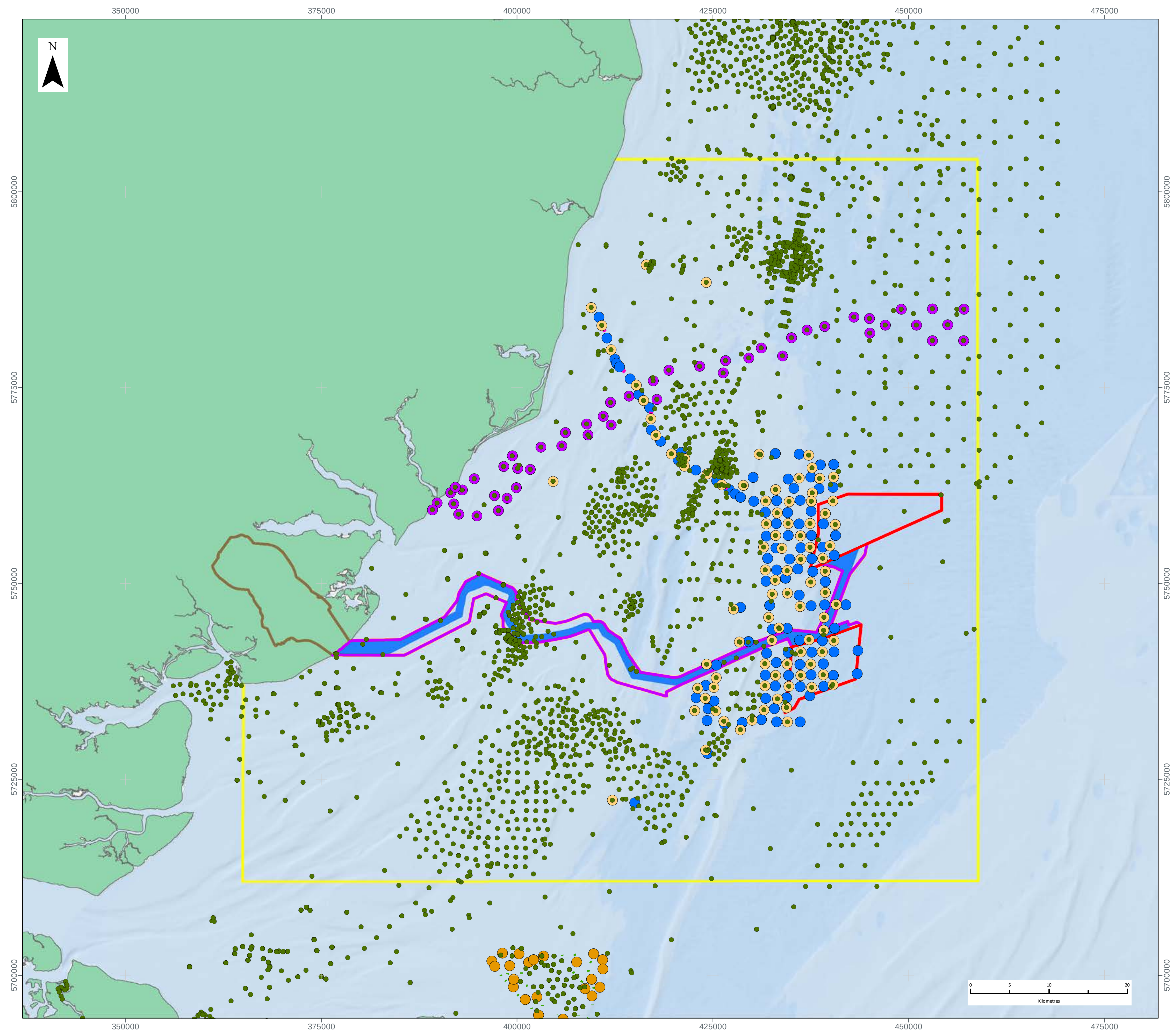
9.3.4 Intertidal benthic habitats for the proposed cable landing will be characterised via a Phase I biotope mapping and Phase II core sampling survey.

Table 9.1 - Key sources of information for benthic, subtidal and intertidal ecology[33]

SOURCE	SUMMARY	COVERAGE OF VE
Regional Seabed Monitoring Programme (RSMP) (Cooper and Barry, 2017)	The dataset comprises of 33,198 macrofaunal samples (83% with associated data on sediment particle size composition) covering large parts of the UK continental shelf. Data points for the VE benthic, subtidal and intertidal ecology study area were extracted.	Good coverage across the benthic, subtidal and intertidal ecology study area.
Galloper Offshore Wind Farm (OWF) site (Centre for Marine and Coastal Studies (CMACS), 2010), including pre- and post-construction surveys.	Beam trawl, benthic grab and DDV surveys were deployed to characterise the benthic infaunal and epifaunal communities. Samples collected for benthic faunal analysis, contaminant and PSA were also undertaken for baseline characterisation.	Coverage within VE array areas.
Environmental Statements from other OWF developments within the Outer Thames Strategic Area (Galloper, East Anglia One, Thanet Extension, Greater Gabbard and Gunfleet Sands OWF (CMACS, 2010; Marine Ecological Surveys Limited (MESL), 2012; Fugro, 2018; Greater Gabbard Offshore Wind Limited (GGOWL), 2005; RPS, 2007)).	Characterisation and monitoring data for the existing OWF developments.	Site specific benthic, subtidal and intertidal surveys for wind farm developments across the Outer Thames estuary and off the coast of East Anglia.

[33] The data detailed within the Table 9.1 was reviewed against the Cefas OneBenthic Baseline Tool. No additional datasets were identified. Prior to commencing the EIA the OneBenthic Baseline Tool will be reviewed to identify any additional datasets added prior to undertaking the assessment.

SOURCE	SUMMARY	COVERAGE OF VE
UKSeaMap (2019)	European Nature Information System (EUNIS) Level 4 model, detailing biological zone and substrate.	Complete modelled coverage up to MHWS.
The Outer Thames Estuary Regional Environmental Characterisation (Marine Aggregate Levy Sustainability Fund (MALSF), 2009)	Provides characterisation of the marine and seabed conditions for the Outer Thames region.	Regional dataset and report covering the benthic, subtidal and intertidal ecology study area.
Information on species of conservation interest (Joint Nature Conservation Committee (JNCC), 2007)	Species specific data, of native species of conservation interest.	This data source provides species specific data. of native species of conservation interest
British Geological Survey (BGS) Marine Sediment Particle Size dataset sourced from the BGS GeoIndex Offshore portal;	National PSA dataset	This is a national dataset providing full coverage of the benthic, subtidal and intertidal study area.
VE site specific benthic survey data (August 2021 – Q4 2021)	Infaunal analysis of grab sample and PSA. Sediment contaminants data to inform assessment on potential for release of contaminants from sediment disturbance. Intertidal Phase I and Phase II surveys	Offshore AoS, array areas and the landfall zone



LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Study Area
- RSMP Benthic Dataset (Cooper 2019)

Thanet Extension (2016)

- Fauna and PSA
- DDV

Galloper EIA (2009)

- Fauna and PSA
- DDV
- Trawls

East Anglia One EIA (2011)

- Fauna, PSA and DDV

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Existing subtidal benthic grab, DDV and trawl data across the VE study area

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	SWM	FM

DRAWING NUMBER:

9.2

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Benthic\VE_BEN_Fig10_2_V1.mxd

9.4 BASELINE ENVIRONMENT

9.4.1 The following section provides a high-level overview of the benthic and intertidal ecology baseline environment for the VE benthic, subtidal and intertidal ecology study area and wider study area, including a review of the relevant marine nature conservation designations.

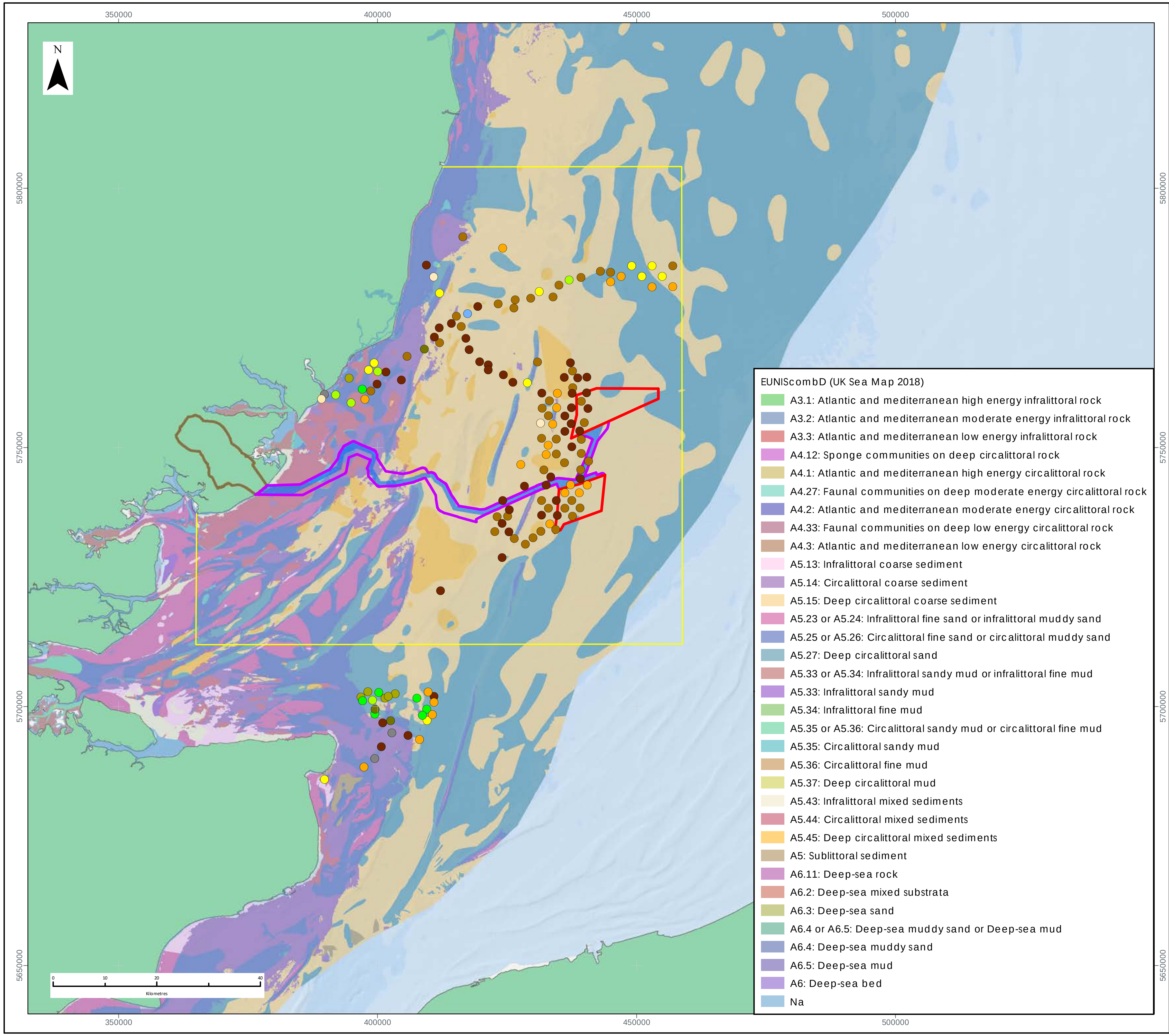
SUBTIDAL SEDIMENTS

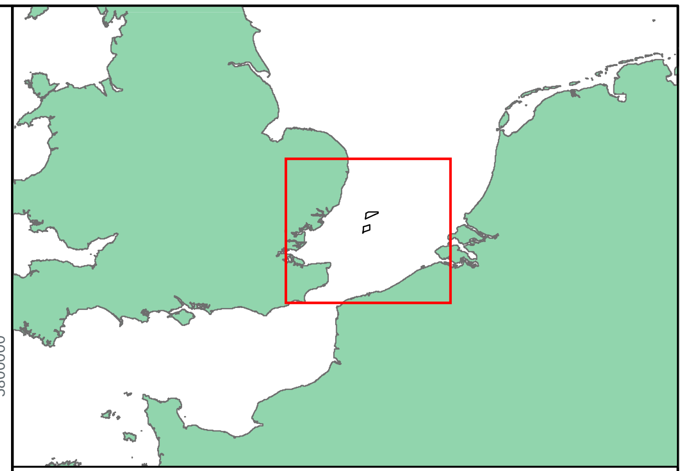
9.4.2 Broadscale regional habitat mapping to EUNIS Level 4, detailing biological zone and substrate (UKSeaMap, 2019), indicates that the dominant habitats across the VE benthic, subtidal and intertidal ecology study area are predominantly characterised by circalittoral coarse sediments, circalittoral mixed sediments, circalittoral fine sand or circalittoral muddy sand and circalittoral sands (Figure 9.2).

9.4.3 Figure 9.2 represents point sediment data (which has been accessed for the Scoping Study) that have been collected across the VE benthic, subtidal and intertidal ecology study area, as part of monitoring programmes at Galloper OWF (CMACS, 2010) and East Anglia One EIA (MESL, 2012). Wider regional data at the recently surveyed Thanet Extension OWF site (Fugro, 2018), are also presented. Data is presented for surveys where the interpreted shapefiles were readily available, it should be noted that the RSMP (2017) datasets will be included in the assessment in the PEIR, however the inclusion of the data has not been proposed to inform this Scoping Report. The data demonstrate that the sediments within the VE benthic, subtidal and intertidal ecology study area and wider region comprise a mixture of sands, gravels and muds ranging across the wide range of British Geological Survey (BGS) categories slightly gravelly sand ((g)S), slightly gravelly muddy sand ((g)mS), gravelly muddy sand (gmS), gravel (G), sand (S), gravelly mud (gM), gravelly Sand (gS), muddy sand (mS), muddy sandy Gravel (msG), sandy gravel (sG) and sandy mud (sM). Although, as depicted by Figure 9.3, gS and sG are the predominant sediment types recorded.

9.4.4 During the baseline characterisation survey at Galloper OWF (CMACS, 2010), the organic content for most of the stations ranged between 0.50 and 2.95%, levels that can reasonably be expected from areas dominated by sG and gS, with low organic content typically associated with coarser sediments.

9.4.5 The baseline characterisation at Galloper OWF also tested surface sediments for a range of contaminants. The results revealed that there were elevated levels of arsenic in all samples. For the most part, contaminants that will have an anthropogenic source (i.e. organic compounds and heavy metals) were found to be at low levels (CMACS, 2010). Similar results were recorded at the Greater Gabbard and London Array OWF, with the only contaminant found at significant levels being arsenic (GGOWL, 2005). Arsenic is known to occur at high levels in seabed sediments in several parts of the North Sea, including a wide area of the outer Thames Estuary (Whalley *et al.,* 1999), which has been attributed to historical disposal of arsenical wastes.





LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Study Area

BGS Sediment Description

- (g)S
- (g)mS
- G
- S
- gM
- gS
- gmS
- mS
- msG
- sG
- sM

Thanet Extension (2006)

- Gravel
- Gravelly Muddy Sand
- Muddy Sand
- Muddy Sandy Gravel
- Sand
- Sandy Gravel
- Slightly Gravelly Muddy Sand
- Slightly Gravelly Sand

Galloper EIA benthic grab data (2009)

- Sandy Gravel
- Gravelly Sand
- Sand
- Sandy Mud
- Slightly Gravelly Sand

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

BGS Sediment description across the VE benthic ecology study area

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	SWM	FM

DRAWING NUMBER:

9.3

SCALE: 1:750,000 | PLOT SIZE: A3 | DATUM: WGS84 | PROJECTION: UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Benthic\VE_BEN_Fig10_3_V1.mxd

9.4.6 The benthic habitats of the southern North Sea are generally defined by the substrata of the seabed. Mobile sand dominated habitats are generally considered to be species poor and are characterised by robust species such as annelid worms and fast burrowing bivalves (Barne *et al.,* 1998, Jones *et al.,* 2004). Epibenthic flora and fauna normally occur on mixed substrata with significant coarse components, where a range of microhabitats allow colonisation by a wide array of species (Jones *et al.,* 2004).

9.4.7 The MALSF Regional Environmental Classification (REC) work (MALSF, 2009) found four broad groups of benthic infauna across the region, dominated at the high level by sublittoral coarse sediment (SS.SCS) and sublittoral sands and muddy sand (SS.SSa) habitat complexes (Connor *et al.,* 2004).

9.4.8 During pre-construction benthic ecology surveys undertaken at Greater Gabbard OWF (which overlap with the VE benthic, subtidal and intertidal ecology study area), it was identified that the most abundant taxa were the Ross worm *Sabellaria spinulosa*, the barnacle *Verruca stroemia*, the porcelain crab *Pisidia longicornis*, the sea urchin *Echinocyamus pusillus* and the polycheate worm *Lumbrineris gracilis* (GGOWL, 2005).

9.4.9 The biotopes recorded at the Greater Gabbard OWF included SS.SSA.IiSa.ImoSa (Infralittoral mobile clean sand with sparse fauna), SS.SCS.ICS.Glap (*Glycera lapidum* in impoverished infralittoral mobile gravel and sand), SS.SCS.CCS.MedLumVen (*Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel) and SS.SBR.PoR.SspiMx (*S. spinulosa* on stable circalittoral mixed sediment).

9.4.10 It was noted that a common denominator of benthic communities within the Greater Gabbard OWF study area was that communities were all well adapted to the turbid waters and very high levels of suspended sediments in this part of the southern North Sea.

9.4.11 During the Galloper OWF characterisation study of benthic resources, a total of 6,052 individuals from 265 taxa were identified from 90 0.1 m^2 mini-Hamon grab samples. It was noted that the samples obtained at Galloper OWF were similar in composition of taxa to those collected at Greater Gabbard (GGOWL, 2005).

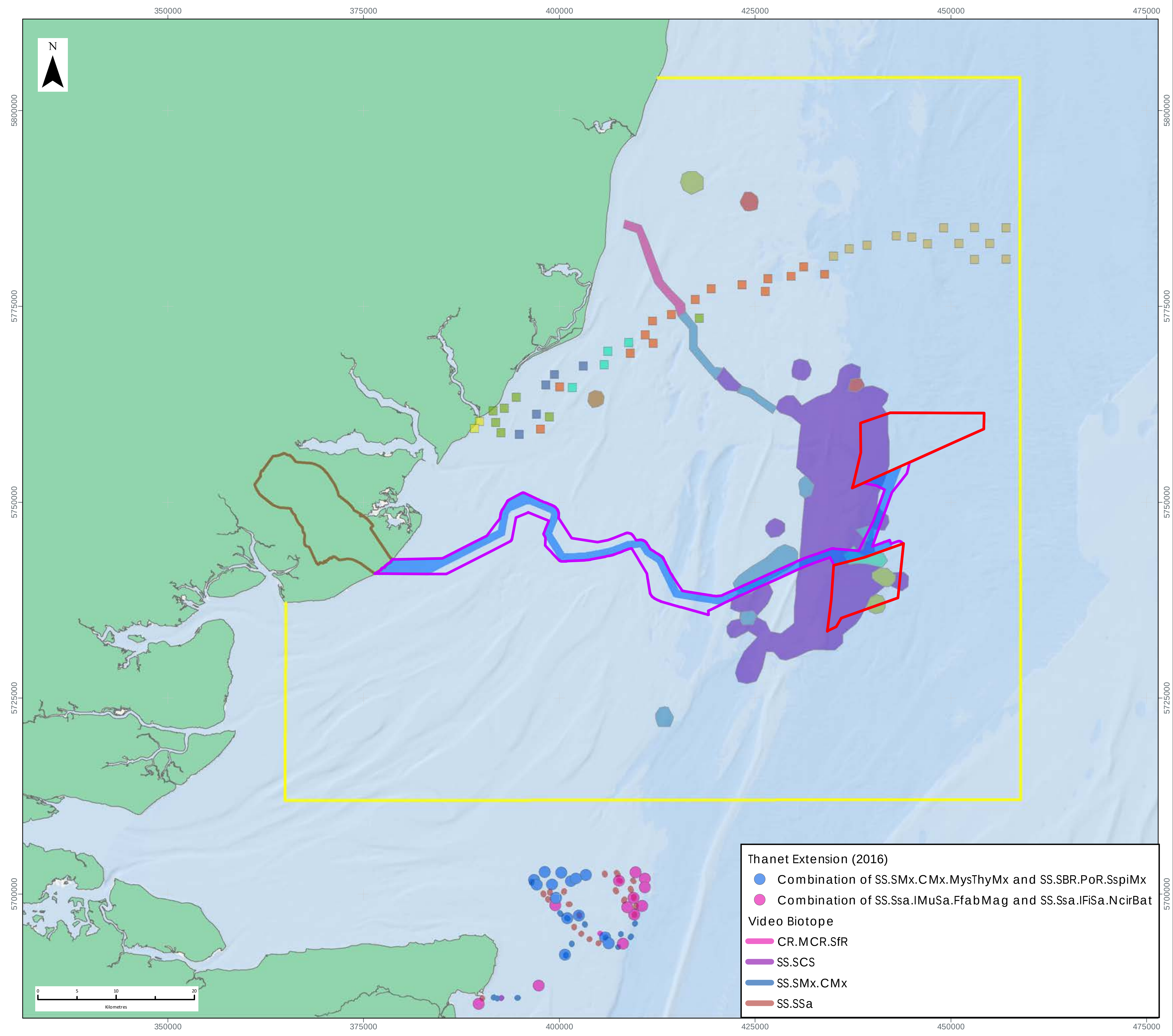
9.4.12 The most abundant species across the Galloper OWF site were annelids, with six of the 12 most abundant species belonging to the group. The most common species recorded from samples was the keelworm *Spirobranchus triqueter* (formerly *Pomatoceros triqueter)*. This species is sessile, occupying a calcified tube which encrusts the surface.

9.4.13 The biotopes found at the Galloper OWF site included SS.SCS.CCS.MedLumVen, SS.SMx.OMx.PoVen (Polychaete-rich deep Venus community in offshore mixed sediments), SS.SSa.IFiSa.NcirBat (*Nephtys cirrosa* and *Bathyporeia* spp. In infralittoral sand), SS.SCS.CCS.PomB (*S. triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles), SS.SSa.IMuSa.SsubNhom (*Spisula subtruncata* and *Nephtys hombergi* in shallow muddy sand) and SS.SBR.PoR.SspiMx.

9.4.14 As demonstrated in Figure 9.4, the majority of the offshore Galloper OWF site was characterised by SS.SCS.CCS.MedLumVen and SS.SMX.OMx.PoVen which collectively represent the 'deep Venus community'. On a regional scale, SS.SCS.CCS.MedLumVen was the principal biotope at the Greater Gabbard OWF site (GGOWL, 2005). This biotope was also widespread on the London Array site (CMACS, 2005b) to the south of the Galloper OWF and Greater Gabbard OWF.

9.4.15 The only biotope of potential conservation importance that was recorded through a review of historic surveys was the *S. spinulosa* dominated biotope. Further detail relating to *S. spinulosa* is presented in paragraphs 9.4.18 to 9.4.24.

9.4.16 As depicted in Figure 9.3, the EUNIS Level 4 habitats that characterise the VE benthic ecology, subtidal and intertidal study area are widespread across the southern North Sea region. It is therefore expected that the biotopes within the VE benthic, subtidal and intertidal ecology study area are representative of those that have been recorded previously across the site and wider study area.



LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Study Area

Biotopes EA ONE EIA (2009)

- SS.SBR.PoR.SspiMx
- SS.SCS.CCS.MedLumVen
- SS.SCS.ICS.HeloMsim
- SS.SSa.CMuSa.AalbNuc
- SS.Smx.CMx.MysThyMx
- SS.Ssa.CFiSa.EpusOborApr

Biotopes Galloper EIA (2009)

- SS.SBR.PoR.SspiMx
- SS.SCS.CCS.MedLumVen/SS.SMX.OMX.PoVen
- SS.SCS.CCS.PomB
- SS.SCS.ICS.SSh
- SS.SSA.CFiSa.EpusOborApri
- SS.SSA.IFiSa.NcirBat
- SS.SSA.IMuSa.SsubNhom

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Biotope descriptions and faunal groups across the VE benthic ecology SA

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	SWM	FM

DRAWING NUMBER:

9.4

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Benthic\VE_BEN_Fig10_4_V1.mxd

INTERTIDAL BENTHIC ECOLOGY

9.4.17 The intertidal habitats within the VE benthic, subtidal and intertidal ecology study area are predominantly characterised by shingle and sandy shores. The proposed landfall is located in an area of sandy beach, with a large sea defence wall positioned in front of a priority coastal and floodplain. The area behind the sea wall is designated as part of Holland Haven marshes SSSI[34] which is cited as providing an outstanding example of a freshwater to brackish water transition intimated by the aquatic plant communities, including a number of nationally and locally scarce species. Based on the citation and review of aerial imagery the area behind the sea defence wall is likely to comprise mainly grazing marsh.

ANNEX I HABITATS

9.4.18 Annex I habitats are defined under the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora; more commonly referred to as the EC Habitats Directive (1992) as amended. Under these regulations, species and habitats that fall into specific categories are eligible for legal protection from activities that have the potential to damage them. Annex I habitats are protected through a network for Special Areas of Conservation (SACs) that aims to establish a network of important high-quality conservation sites that will make a significant contribution to conserving the habitats listed in Annex I.

9.4.19 As depicted in Figure 9.5, non-designated Annex I 'reef' (biogenic and geogenic) and Annex I 'sandbanks slightly covered by seawater all the time' have been recorded across the VE benthic, subtidal and intertidal ecology study area, particularly in relation to the offshore AoS. The offshore AoS crosses the northern top of the Margate and Long Sands SAC which is designated for 'sandbanks slightly covered by seawater all the time' (see the section on Designated sites for more details).

SABLLARIA SPINULOSA REEF

9.4.20 *S. spinulosa* is prevalent in the southern North Sea, with reefs more commonly found in association with more stable sedimentary deposits (Pearce, 2014). *S. spinulosa* reef can be extremely ephemeral in nature and has been recorded 'disappearing' in areas where a seemingly stable habitat has previously been established, such as Saturn Reef in the southern North Sea (Pearce, 2014).

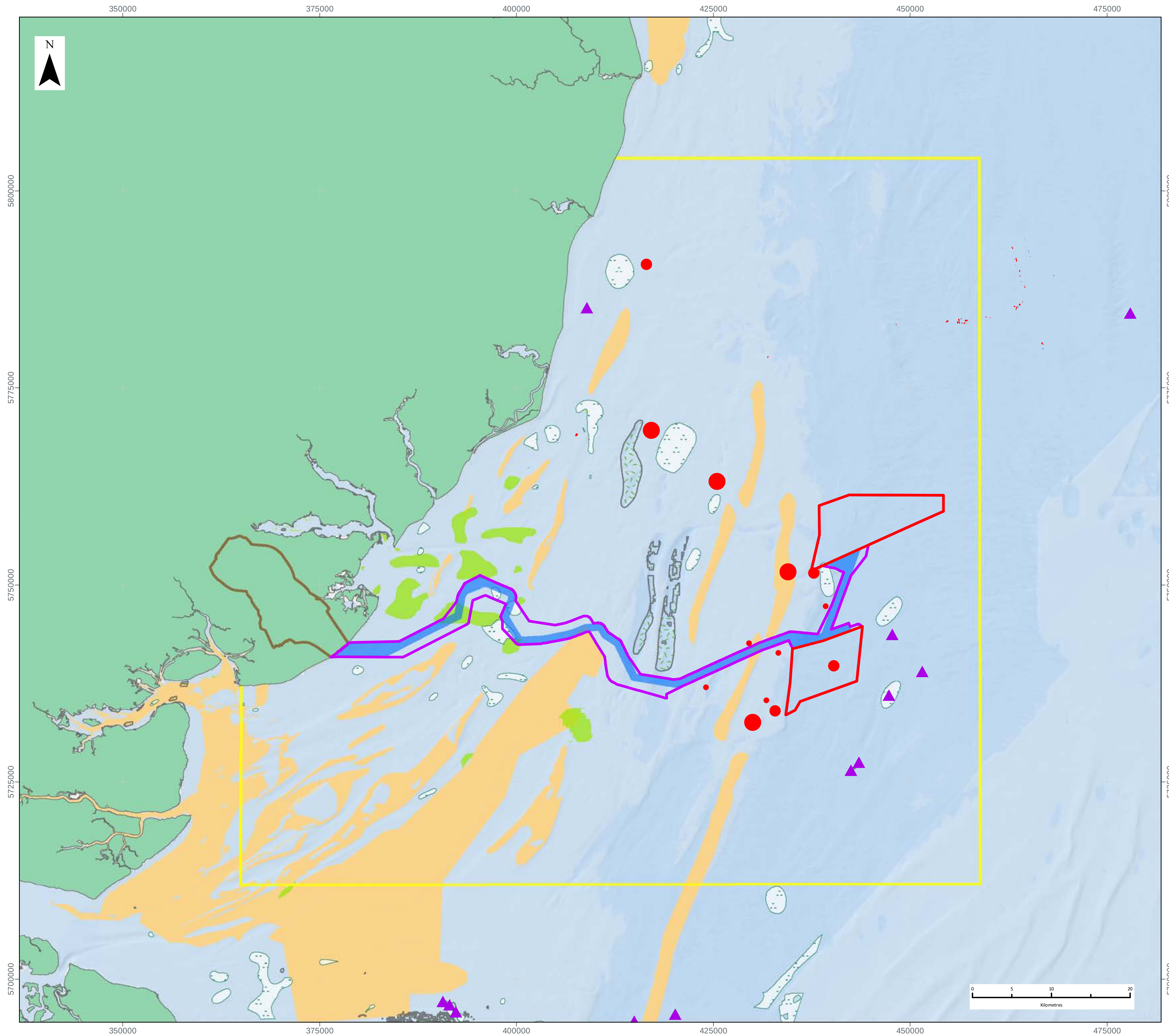
9.4.21 Dense aggregations of the *S. spinulosa* have previously been found in the deeper, polychaete dominated areas, on mixed sediments across the Outer Thames Estuary (MALSF, 2009). The only *S. spinulosa* reefs recorded during the MALSF REC surveys were to the south of Greater Gabbard and Galloper OWF, in the vicinity of Long Sand Head (MALSF, 2009).

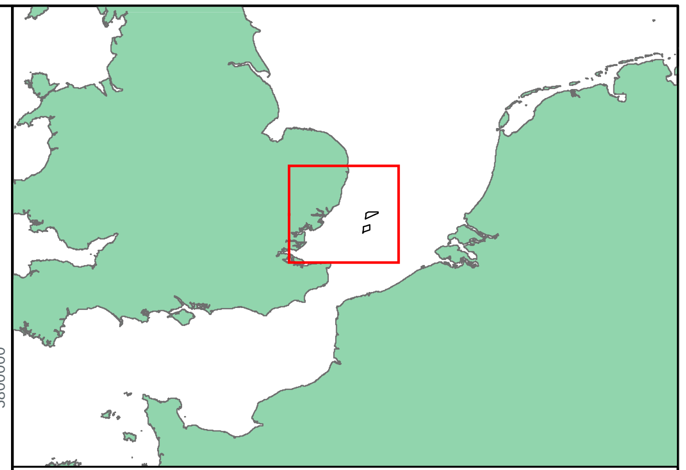
9.4.22 Interpretation of side-scan sonar survey data to summarise major seabed features for the Greater Gabbard OWF found no indications of extensive reef-like structures and suggested most of the area away from the Gabbard and Galloper sandbanks to be generally thin layers of sand and gravel over clay (GGOWL, 2005).

[34] https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1006349.pdf

9.4.23 During the benthic characterisation at Galloper OWF, *S. spinulosa* was commonly recorded, however, there was only a single station (located outside of the Galloper OWF boundary) where *S. spinulosa* dominated in possible reef form.

9.4.24 *S. spinulosa* has been found in sufficient abundance to warrant the classification of a separate biotope at several other wind farms in the region including Scroby Sands (Worsfold and Dyer, 2005), Thanet (MESL, 2005), Thanet Extension (Fugro, 2018) and East Anglia One (MESL, 2012). At Thanet OWF where development microsited around areas of *S. spinulosa* reef, post-construction surveys noted a positive growth of reef features which was attributed to the reduction in destructive bottom fishing activities as a result of the presence of the OWF and associated cable infrastructure (Pearce *et al.,* 2014).





LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Reefs (BGS)
- Annex I Sandbanks High Confidence (JNCC 2019)

Annex I Reefs by Subtype (JNCC 2021):

- Bedrock
- Bedrock / Mixed
- Biogenic
- Stony

Galloper EIA (2009)

- Extensive
- Present
- abundant patches

EA ONE EIA (2009)

- Potential low quality reef
- Potential low-medium quality reef

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Potential Annex I habitats across the VE Benthic Ecology Study Area

VER	DATE	REMARKS	Drawn	Checked
1	17/09/2021	For Issue	SWM	FM

DRAWING NUMBER:

9.5

SCALE:	1:500,000	PLOT SIZE:	A3	DATUM:	WGS84	PROJECTION:	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

Z:\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Benthic\VE_BEN_Fig10_5_V1.mxd

DESIGNATED SITES

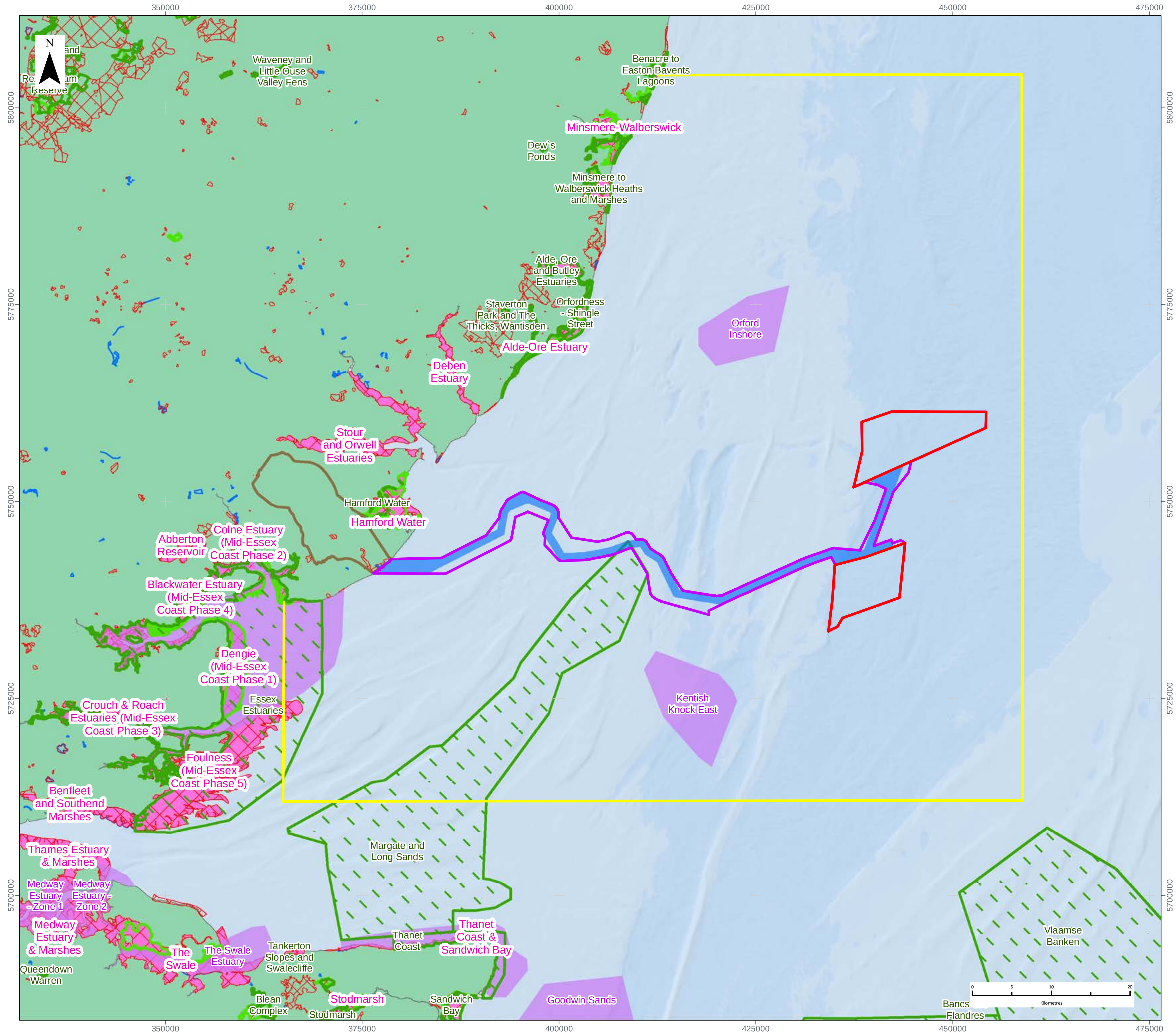
9.4.25 For this Scoping Report, a review has been undertaken to identify designated sites in the benthic, subtidal and intertidal ecology study area which are either designated for benthic and intertidal ecology interest or habitats/species which are dependent on or associated with benthic and intertidal ecology.

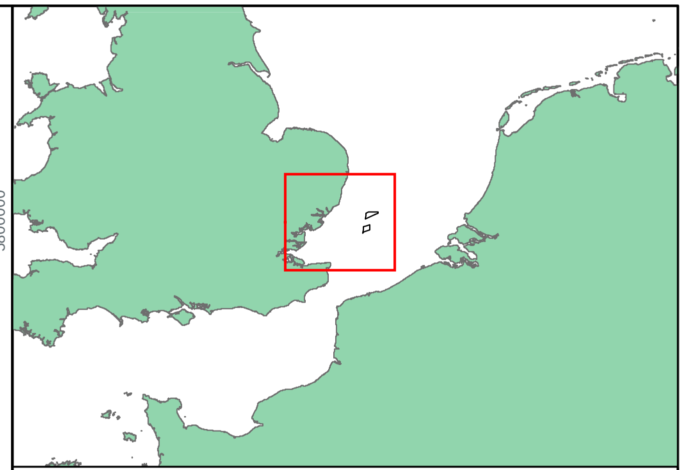
9.4.26 The nature designations which have been screened in for consideration in the benthic and intertidal ecology EIA comprise of European conservation sites (i.e. SACs, Sites of Community Importance (SCIs) and Ramsar sites) and national designations (i.e. Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs) and designated Marine Conservation Zones (MCZs)), which are listed in Table 9.2 and presented in Figure 9.6. Further details on the SACs, SCIs, SSSIs and Ramsar sites are provided in the Habitats Regulations Assessment (HRA) Screening Report (VE OWFL, 2021). It should be noted that the benthic, subtidal and intertidal ecology study area will be reviewed during subsequent stages of the EIA process and refined as necessary to reflect the development of the scheme and as such the list of designated sites provided in Table 9.2 will be reconsidered and refined during this process.

Table 9.2 - Marine nature conservation designations with relevance to benthic and intertidal ecology and VE

SITE	CLOSEST DISTANCE TO VE OWF	FEATURES OR DESCRIPTION
INTERNATIONAL		
Margate and Long Sands SAC	The northern tip of the site overlaps with the offshore AoS	Annex I habitats that are a primary reason for the selection of this site, which include: > Sandbanks which are slightly covered by seawater all the time
Essex Estuaries SAC	No overlap but the site is within 8.1 km of the VE offshore AoS	Annex I habitats that are a primary reason for the selection of this site, which include: > Estuaries; > Mudflats and sandflats not covered by seawater at low tide; > Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
Orfordness - Shingle Street SAC	No overlap but the site is within 12.2 km of the VE offshore AoS	Annex I habitats that are a primary reason for the selection of this site, which include: > Coastal lagoons; > Annual vegetation of drift lines; > Perennial vegetation of stony banks
Alde, Ore and Butley Estuaries SAC	No overlap but the site is within 15.3 km of the VE offshore AoS	Annex I habitats that are a primary reason for the selection of this site, which include: > Estuaries Annex I habitats present as a qualifying feature, include: > Mudflats and sandflats not covered by seawater at low tide; > Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
Stour and Orwell Estuaries Ramsar	No overlap but the site is within 12.93 km of the VE offshore AoS.	An estuary comprising extensive mudflats, low cliffs, saltmarsh, and areas of vegetated shingle on the lower river reaches. Contains *Z. noltii* and *Spartina maritima*.
Colne Estuary (Mid-Essex Coast Phase 2) Ramsar	No overlap but the site is within 10.11 km of the VE offshore AoS.	The site includes an intertidal zone of mudflat communities. The main habitats include mudflats, saltmarsh, grazing marsh, reedbeds, sand and shingle spits, and unused gravel pits.

SITE	CLOSEST DISTANCE TO VE OWF	FEATURES OR DESCRIPTION
Alde-Ore Estuary Ramsar	No overlap but the site is within 12.2 km of the VE offshore AoS.	The habitats including intertidal mudflats, saltmarsh, a vegetated shingle spit, saline lagoons, and semi-intensified grazing marsh.
Foulness (Mid-Essex Coast Phase 5) Ramsar	No overlap but the site is within 19.31 km of the VE offshore AoS.	An open coast estuarine system comprising grazing marsh, saltmarsh, intertidal mud and sandflats.
NATIONAL		
Blackwater, Crouch, Roach and Colne Estuaries MCZ	No overlap but the site is within 5 km the VE offshore AoS	Designated for intertidal mixed sediments.
Kentish Knock East MCZ	No overlap but the site is within 7.2 km from VE offshore AoS	Designated for subtidal sand, subtidal coarse sediment and subtidal mixed sediment.
Orford Inshore MCZ	No overlap but the site is within 14.2 km from the VE array area	Designated for subtidal mixed sediments.
Holland Haven Marshes SSSI	Overlaps with the VE intertidal offshore AoS	Designated for estuarine saltmarsh and freshwater marsh.
Holland-on-Sea Cliff SSSI	Overlaps with the VE intertidal offshore AoS	Designated for important cliff exposures.
Hamford Water SSSI	No overlap but the site is within 3.7 km from the VE offshore AoS	Designated for important intertidal areas which support invertebrates and mudflats which support seagrass (e.g. *Zostera noltii*).
The Naze SSSI	No overlap but the site is within 4 km from the VE offshore AoS	Designated for intertidal mixed sediments.
Deben Estuary SSSI	No overlap but the site is within 11.2 km from the VE intertidal offshore AoS	Designated for important estuarine saltmarsh.
Landguard Common SSSI	No overlap but the site is within 10 km from the VE intertidal offshore AoS	Designated for benthic intertidal features which include the shingle community and a large population of sea kale *C. maritima*.
Alde-Ore Estuary SSSI	No overlap but the site is within 12.2 km of the VE offshore AoS	Designated for benthic intertidal features including estuaries, saline coastal lagoons, the strandline community, sheltered muddy shores and the starlet sea anemone.





LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Study Area
- Special Area of Conservation
- Marine Conservation Zones
- Local Nature Reserves
- Ramsar Sites
- Sites of Specific Scientific Interest
- Marine Conservation Zones
- National Nature Reserves

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Designated sites near VE, relating to benthic and intertidal ecology

VER	DATE	REMARKS	Drawn	Checked
1	17/09/2021	For Issue	SWM	FM

DRAWING NUMBER:

9.6

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

Z:\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Benthic\VE_BEN_Fig10_6_V2KAT.mxd

9.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

9.5.1 The benthic and intertidal ecology EIA will follow the methodology set out in Chapter 4: Environmental Impact Assessment approach and methodology. Specific to the benthic and intertidal ecology EIA, the following guidance documents will be considered:

> Guidelines for EIA in Britain and Ireland. Marine and Coastal, Final Document (Institute of Ecology and Environmental Management (IEEM), 2010);

> Guidance note for EIA in respect of FEPA and CPA requirements (Centre for Environment, Fisheries and Aquaculture (Cefas), 2004);

> Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects (Judd, 2012); and

> Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008).

9.5.2 Sensitivity of features based upon the Marine Evidence-based Sensitivity Assessment (MarESA) framework where possible (MarLIN, 2021).

POTENTIAL PROJECT IMPACTS

9.5.3 A range of potential impacts on benthic and intertidal ecology have been identified, which may arise during construction, operation (and maintenance) and decommissioning phases of the VE. The potential impacts that are proposed to be scoped into the VE EIA are detailed in Table 9.3, along with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) required to facilitate an impact assessment.

Based on the benthic and intertidal ecology information currently available and the project description, outlined in Chapter 3: Project description, a number of impacts are proposed to be scoped out of the EIA for benthic and intertidal ecology. These impacts are outlined in

9.5.4 Table 9.4, together with a justification for scoping them out.

Table 9.3 - Impacts proposed to be scoped in to the assessment for benthic and intertidal ecology

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION PHASE			
9.1	Temporary habitat disturbance	There is the potential for direct habitat disturbance during construction activities in the array area and along the offshore AoS, due to cable laying and during foundation and WTG installation where jack up or vessel anchoring is required.	The presence and extent of benthic and intertidal habitats and features will be informed through the use of existing and new site-specific survey data. The area of habitat disturbance will be defined using a worst-case scenario-based approach. The sensitivity of habitat types to the temporary impact will be determined through available literature and expert knowledge, based on the habitats resilience and resistance to impacts.
9.2	Temporary increase in suspended sediment and sediment deposition	Sediment disturbance arising from construction activities, such as cable laying and foundation installation, may result in adverse effects on benthic communities. This can be a result of a temporary increase in suspended sediment concentrations (SSC) and associated sediment deposition.	The effects on benthic and intertidal ecology from increased suspended sediment and sediment deposition will be informed by the findings and assessment of Chapter 7: Physical Processes. The sensitivity of habitat types to the impact will be determined through available literature and expert knowledge, based on the habitats resilience and resistance to impacts.
9.3	Direct and indirect seabed disturbances leading to the release of sediment contaminants	Seabed disturbances during construction could lead to the mobilisation of sediment contaminants that could be harmful to the benthos.	The effects on benthic and intertidal ecology from changes to water quality will be informed by the findings and assessment of the Water Quality Assessment. The sensitivity of habitat types to the impact will be determined through available literature and expert

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			knowledge, based on the habitats resilience and resistance to impacts.
9.4	Increased risk of introduction or spread of Marine Invasive Non-Native Species (INNS)	Increased risk of introduction or spread of Marine INNS due to increased vessel movements during construction (e.g. ballast water) may facilitate the spread of non-native species and may subsequently impact biodiversity and benthic ecology of the area.	The potential introduction or spread of Marine INNS and subsequent impact to local benthic ecology receptors will be assessed based on current industry understanding, available literature and expert knowledge. The assessment will take into consideration the mitigation and control of invasive species measures that will be incorporated into a Project Environmental Monitoring Programme (PEMP).
OPERATION AND MAINTENANCE PHASE			
9.5	Long-term habitat loss/alteration	There is the potential for long-term / permanent habitat loss or alterations directly associated with the presence of foundations, scour protection and cable laying, where secondary cable protection is required.	The presence and extent of benthic and intertidal habitats and features will be informed through the use of existing and new site-specific survey data. The area of habitat loss will be defined using a worst-case scenario to determine the maximum loss of seabed due to the presence of infrastructure. The presence and extent of benthic habitats and features will be informed through the use of existing and new site-specific survey data.
9.6	Temporary habitat disturbance	There is the potential for direct habitat disturbance of the seabed during planned and unplanned maintenance or, in the case of a cable failure, excavation of cables.	The presence and extent of benthic and intertidal habitats and features will be informed through the use of existing and new site-specific survey data. The area of habitat disturbance will be defined using a worst-case scenario-based approach. The sensitivity of habitat types to the temporary impact will be determined through available literature and expert knowledge,

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			based on the habitats resilience and resistance to impacts.
9.7	Colonisation of hard substrates	Man-made substructures (Wind Turbine Generator (WTG) foundations and associated scour/cable protection) on the seabed are expected to be colonised by a variety of marine organisms. This can result in an increase in local biodiversity and alterations to the benthic ecology.	The potential impacts on benthic ecology receptors will be considered in terms of effects on biodiversity and productivity. The area of introduction of hard substrate will be defined using a worst-case scenario to determine the maximum area of impact. The sensitivity of habitat types to the impact will be determined through available literature and expert knowledge, based on the habitats resilience and resistance to impacts.
9.8	Increased risk of introduction or spread of Marine Invasive Non-Native Species (INNS)	Increased risk of introduction or spread of Marine INNS due to the presence of the subsea infrastructures and increased vessel movements may facilitate the spread of non-native species and may subsequently impact biodiversity and benthic ecology of the area.	The potential introduction or spread of Marine INNS and subsequent impact to local benthic ecology receptors will be assessed based on current industry understanding, available literature and expert knowledge. The assessment will take into consideration the mitigation and control of invasive species measures that will be incorporated into a PEMP.
9.9	Changes in physical processes	The presence of the OWF subsea infrastructure can result in potential effects on benthic communities arising from scour	The effects on benthic and intertidal ecology from changes in physical processes will be informed by the findings and assessment of Chapter 7: Physical Processes. The sensitivity of habitat types to the impact will be determined through available literature and

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		effects, changes in sediment transport and wave regimes.	expert knowledge, based on the habitats resilience and resistance to impacts.
9.10	Electromagnetic fields (EMF) effects generated by inter-array and export cables during operational phase.	There is potential for indirect disturbance of benthic species from EMF generated by operational inter-array and export cables.	The potential for impacts on benthic and subtidal ecology receptors will be considered in terms of effect as a result of EMF. The assessment will be informed by using available literature to undertake a precautionary assessment. It is noted that cable burial will be the preferred option for cable protection, however there is the potential that it may not be possible to bury cables at all locations (e.g. at crossings or in hard substrate), therefore there may be sections of surface laid cables with cable protection. The assessment will consider a worst-case scenario to determine the maximum potential for impact on benthic receptors.
DECOMMISSIONING PHASE			
The potential impacts arising during the decommissioning phase are envisaged to be similar to those described for the construction phase and will therefore be assessed in the same way as set out above, however, there will also be an assessment of the loss of additional habitat arising from the removal of any infrastructure that have been colonised during the operational phase of the project.			

Table 9.4 - Impacts proposed to be scoped out of assessment for benthic and intertidal ecology

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
9.11	Noise pollution on benthic ecology during foundation installation (construction phase)	It is generally accepted that the particle motion component of noise is most relevant to benthic species. While there are few studies looking at reactions of benthic invertebrates and in particular polychaetes and infaunal bivalves, it is likely that particle motion will dissipate in close proximity to the noise source (in the order of metres). In addition, the noise will be temporary in nature and conditions will return to baseline following cessation of piling. It is proposed that this impact is therefore scoped out of the assessment.
9.12	Accidental pollution (construction, operation and maintenance, and decommissioning phases)	The magnitude of an accidental spill will be limited by the size of chemical or oil inventory on construction vessels. In addition, released hydrocarbons will be subject to rapid dilution, weathering and dispersion and will be unlikely to persist in the marine environment. The likelihood of an incident will be reduced by the implementation of a PEMP and Marine Pollution Contingency Plan (MPCP). It is proposed that this impact is therefore scoped out of the assessment.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

9.5.5 As part of the design process for the VE, a number of designed-in measures are proposed to reduce the potential for impacts on benthic and intertidal ecology receptors. These will evolve over the development process as the EIA progresses and in response to consultation.

VE OWFL are committed to implementing these measures, in addition to various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/out presented in Table 9.3 and Table 9.4 as far as feasible

9.5.6 Measures adopted as part of the project will include:

- Wind farm infrastructure will be micro-sited around Annex I habitat as far as practicable, to avoid where possible direct significant impacts on these conservation features within designated sites;
- A cable burial risk assessment will be undertaken to inform front end engineering works. Cable burial will be the preferred option for cable protection and this will minimise any impacts associated with habitat loss;
- Development of, and adherence to, an appropriate Project Environmental Management and Monitoring Plan (PEMP), which will include a Marine Pollution Contingency Plan (MPCP); and
- Development of, and adherence to, a Decommissioning Programme (DP).

9.5.7 The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects on benthic and intertidal ecology and will be consulted upon with statutory consultees throughout the EIA process.

POTENTIAL CUMULATIVE IMPACTS

9.5.8 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the cumulative impact assessment (CIA). For Benthic and Intertidal Ecology, cumulative interactions may occur with other planned OWF as well as other activities in the study area. Potential cumulative impacts with other projects and activities will be considered for each of the impacts considered in Table 9.3.

9.5.9 There is the potential for cumulative impacts from other OWF developments and other activities occurring in the region, these include aggregate dredging, shipping and oil and gas exploration and development and subsea cabling. It is anticipated that impacts will be localised and restricted to the zone of influence which will be restricted to the maximum tidal excursion (subject to the outputs of the physical processes assessment. Whilst it is not considered likely that there will be significant cumulative impacts, all potential impacts (i.e. those listed for VE in isolation) will be assessed as part of the EIA. The cumulative list of projects will be developed based on the maximum likely zone of influence for VE and any other plans or projects as appropriate.

POTENTIAL TRANSBOUNDARY IMPACTS

9.5.10 A description of how potential transboundary effects will be assessed is outlined in Chapter 4: Environmental Impact Assessment approach and methodology. As presented in Chapter 4, the limits of the Dutch, Belgian and French Exclusive Economic Zones are located approximately 16 km (south east), 25 km (south) and 18 km (north east) of the VE array areas respectively. As with Chapter 7: Physical Processes, due to the localised nature of any potential impacts, transboundary impacts are unlikely to occur and therefore it is suggested that this impact will be scoped out from further consideration within the EIA.

9.6 SUMMARY OF NEXT STEPS

9.6.1 The proposed approach to the assessment for benthic and intertidal ecology PEIR chapter will first include the definition of the worst-case scenarios on which the assessments will be based. The geographic footprint of the project and the impacts resulting from any changes to physical processes, including scour effects and changes in the sediment transport will be key considerations in defining the worst-case scenarios for benthic and intertidal ecology receptors.

9.6.2 Additional site-specific surveys will be available to characterise the benthic and intertidal ecology to help fill data gaps that currently exist across the VE benthic, subtidal and intertidal ecology study area. Surveys will identify the extent and distribution of key habitat types and features, with a focus on any species or habitats of conservation importance including *S. spinulosa* reef, that might exist across the area of interest.

9.7 FURTHER CONSIDERATION FOR CONSULTEES

9.7.1 Scoping questions in relation to benthic and intertidal ecology include:

> Are you satisfied that the baseline data referenced above is valid for the purposes of the scoping assessment?

> Have all potential impacts resulting from VE been identified for benthic and intertidal receptors?

> For those impacts scoped in (Table 9.3), do you agree that the methods described are sufficient to inform a robust impact assessment?

> Do you agree that considering the embedded mitigation in place, the assessment of benthic and intertidal ecology impacts as detailed above (

> Table 9.4) can be scoped out of the VE EIA?

> Do you agree with the proposed approach to assessing the impact of VE on the benthic and intertidal ecology receptors identified?

> Do you agree with the approach and the impacts scoped in to the proposed cumulative effects assessment?

10. FISH AND SHELLFISH RESOURCE

10.1 INTRODUCTION

10.1.1 This chapter of the Scoping Report identifies the fish and shellfish receptors of relevance to the VE array areas and offshore AoS. It describes the potential effects from the construction, operation and maintenance, and decommissioning of VE on fish and shellfish and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

10.1.2 This chapter should be read alongside the following chapters of this Scoping Report:

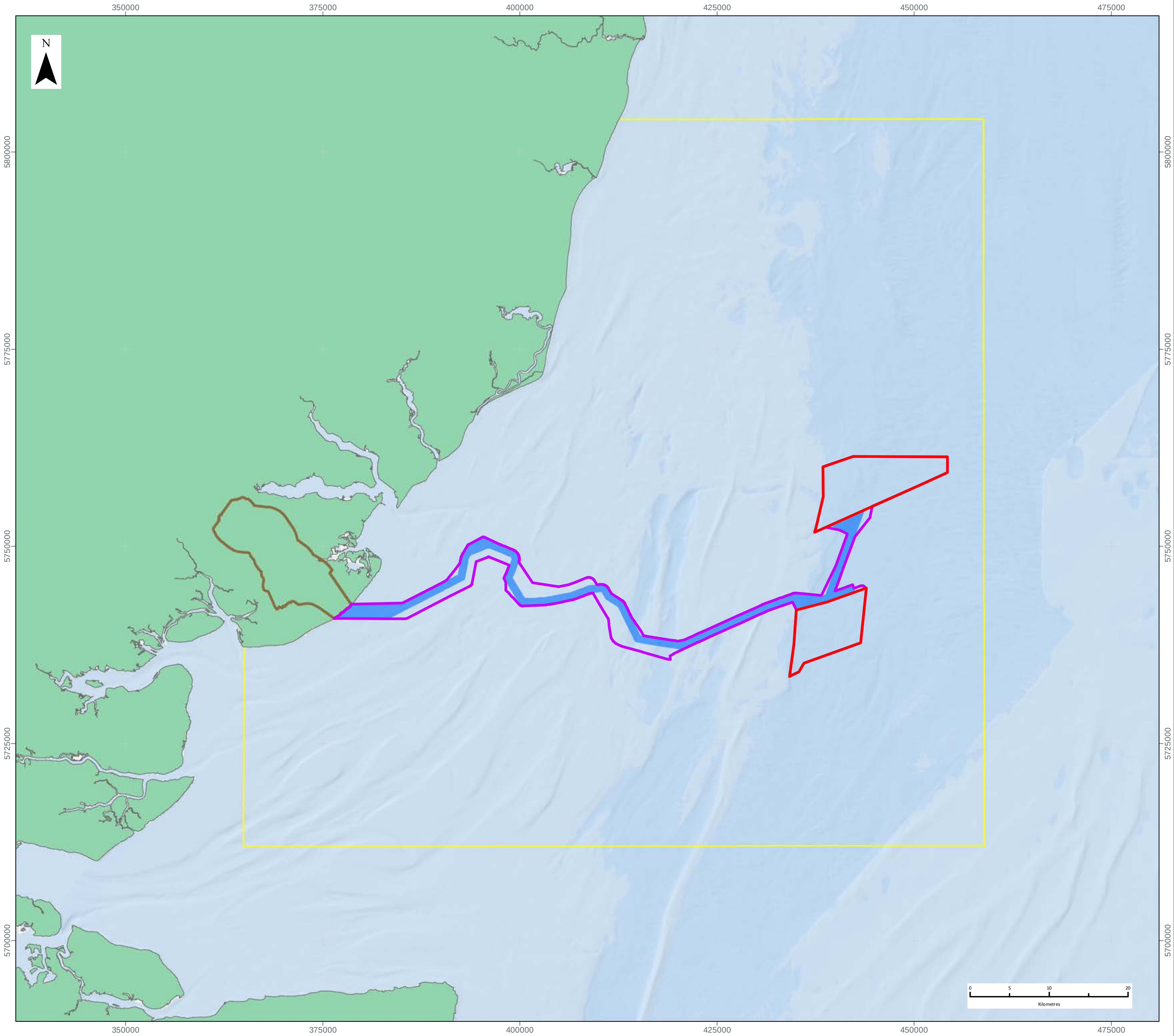
- Chapter 7: Physical Processes;
- Chapter 9: Benthic and Intertidal Ecology; and
- Chapter 13: Commercial Fisheries.

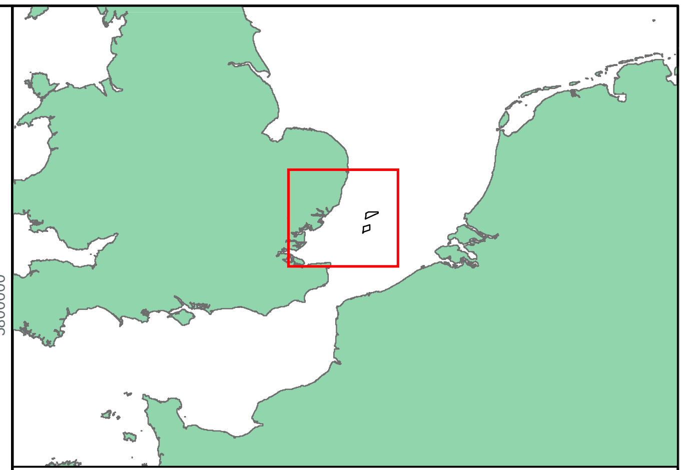
10.2 STUDY AREA

10.2.1 For the purposes of this fish and shellfish ecology scoping assessment, the fish and shellfish Study Area includes the offshore components of the VE scoping boundary comprising the preferred OECR and the surrounding areas to allow for route refinement (offshore AoS) and array areas (Figure 10.1). The study area is consistent with the physical processes Scoping Report assessment (see Chapter 7 for a more detailed consideration) which considered the work previously undertaken for the Galloper and Greater Gabbard OWFs and analysis of anticipated tidal excursion distances. Impacts from underwater noise will be considered in relation to the species and habitats found throughout the wider Southern North Sea biogeographic region and data available on the spawning and nursery grounds within this area. Site-specific predictive noise modelling will be undertaken as part of the EIA and reviewed to further define the study area. The study area will therefore take account of the impact with the greatest zone of influence on species likely to be present within the relevant area.

10.2.2 The current Study Area overlaps with the International Council for the Exploration of the Sea (ICES) rectangles 32F2, 32F1, 33F2 and 33F1, and provides a regional context on fish and shellfish ecology and is sufficient to cover potential effects outside of the array areas and offshore AoS.

10.2.3 The Study Area will be reviewed and amended for future stages PEI) and subsequently ES in response to such matters as refinement of the offshore AoS, feedback from consultees and/ or the identification of additional constraints (environmental and/ or engineering).





LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Study Area

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

VE Study Area for fish and shellfish

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	SWM	FM

DRAWING NUMBER:

10.1

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Fish and Shellfish\VE_FS_Fig11_1_V1.mxd

10.3 BASELINE DATA

10.3.1 A desk-based review of literature and data sources undertaken to support this Scoping Report, as presented in Table 10.1. Table 10.1also identifies additional sources of information that will inform assessment in the PEIR and ES.

10.3.2 In addition to publicly available data sources, further information will be collected through site-specific benthic ecology surveys which will be undertaken across both the array areas and the offshore AoS. Sediment samples will be collected and analysed for particle size analysis (PSA) as part of this site-specific survey and will be used to determine spawning habitat suitability for sandeel and herring. Data from benthic ecology surveys and PSA analysis for the North Falls Offshore Wind Farm will also be reviewed, if available.

10.3.3 The data available from existing literature and relevant surveys provide an appropriate evidence base for fish and shellfish populations within the VE Study Area, sufficient for the purposes of EIA and it is intended that these are utilised to characterise the fish and shellfish receptors in the vicinity of the VE array area and offshore AoS. On the basis that sufficient information exists to enable a robust characterisation of the receiving environment, including identification of relevant valued fish and shellfish receptors, additional site-specific surveys are not proposed to be undertaken.

Table 10.1 - Key sources of information for fish and shellfish ecology

SOURCE	SUMMARY	COVERAGE OF VE
Galloper Offshore Wind Farm Environmental Statement, site specific surveys - Brown and May fish resource survey reports (Brown and May Ltd, 2009a, 2009b)[35].	Site specific fish and shellfish surveys undertaken at the adjacent Galloper offshore wind farm.	Partial coverage of the fish and shellfish ecology study area.
Environmental Statements from other OWF developments within the Outer Thames Strategic Area: > Gunfleet Sands OWF (GE Wind Energy, 2002[36]); > Greater Gabbard OWF (Greater Gabbard	Characterisation and monitoring data for the existing OWF developments.	Site specific fish and shellfish surveys for wind farm developments across the Outer Thames estuary and off the coast of East Anglia.

[35] http://www.galloperwindfarm.com/assets/images/documents/GWF%20Environmental%20Statement/ES_Appendices_Technical_Appendix_3_Part_1.pdf
[36] https://tethys.pnnl.gov/sites/default/files/publications/GunfleetSands2-ES-2007_0.pdf

SOURCE	SUMMARY	COVERAGE OF VE
Offshore Winds Limited (GGOWL), 2005[37]; > Kentish Flats OWF Extension (Royal Haskoning, 2010[38]); > London Array OWF (London Array Ltd (LAL) 2005)[39]; and > East Anglia Three OWF (East Anglia Three, 2015[40]).		
MMO UK Sea Fisheries Monthly Reports[41] and Annual Statistics Reports[42]	MMO fisheries landings data from the UK fishing fleet and details on the status of commercially important fish stocks.	This is a national dataset providing full coverage of the fish and shellfish ecology study area.
Department of Environment Food and Rural Affairs (Defra) spawning and nursery maps for mobile species considered to be of conservation importance (Ellis et al, 2010)[43];	Fisheries sensitivity maps indicating spawning and nursery habitats for a range of commercially important fish species.	These are a national datasets providing full coverage of the fish and shellfish ecology study area.
The International Herring Larval Survey (IHLS) data (ICES, 2007-2021)[44];	Herring larvae surveys conducted across the North Sea and adjacent areas to provide quantitative estimates of herring larval abundance used as a relative index of changes of herring spawning stock biomass.	This is an international dataset providing full coverage of the fish and shellfish ecology study area.

37 https://tethys.pnnl.gov/sites/default/files/publications/greatergabbard2005.pdf
38 https://tethys.pnnl.gov/sites/default/files/publications/Haskoning2010.pdf
39 https://londonarray.com/wp-content/uploads/2020/07/Non-technical-summary.pdf
40 https://infrastructure.planninginspectorate.gov.uk/projects/eastern/east-anglia-three-offshore-wind-farm/?ipcsection=docs
41 https://www.gov.uk/government/collections/monthly-uk-sea-fisheries-statistics
42 https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2019
43 https://www.cefas.co.uk/publications/techrep/techrep147.pdf
44 https://obis.org/dataset/94829f49-bab5-48a5-9a64-38425f8ec640

SOURCE	SUMMARY	COVERAGE OF VE
IFISH (Integrated Fisheries System Holding) Database[45]	Fisheries data, including landings and fishing effort data	This is a national database providing full coverage of the fish and shellfish ecology study area.
British Geological Survey (BGS) Marine Sediment Particle Size dataset sourced from the BGS GeoIndex Offshore portal[46];	National PSA dataset	This is a national dataset providing full coverage of the fish and shellfish ecology study area.
The International Bottom Trawl Surveys (IBTS) (ICES 2010-2021)	Long time series of species distribution data from beam trawl surveys conducted across the North Sea and wider ICES regions.	This is an international dataset providing full coverage of the fish and shellfish ecology study area.
Kent and Essex Inshore Fisheries and Conservation Authorities (KEIFCA) data and reports[47]	Anticipated to include fisheries monitoring report and research reports providing a regional context	Data coverage to be confirmed through consultation with KEIFCA.
KEIFCA Thames Estuary Cockle Survey Report (Dyer and Bailey, 2019)[48]	Provides review of cockle stock status, and long-term trends in populations.	This is a regional report utilised to inform the assessment.
EIFCA Whelk Technical Summary Report (2020)[49]	Provides review of whelk fisheries permit conditions, and current status of the fishery.	This is a regional report utilised to inform the assessment.
EIFCA Briefing Note: The Wash Cockle Fishery (2020)[50]	Provides an update on the current status of The Wash Cockle Fishery	This is a regional report utilised to inform the assessment.
The Outer Thames Estuary Regional Environmental Characterisation (The Marine	Fisheries activity survey data and sediment	This is a regional dataset with coverage across the Outer Thames Estuary

[45] https://data.cefas.co.uk/search/1/ifish
[46] http://mapapps2.bgs.ac.uk/geoindex_offshore/home.html?_ga=2.180987503.950258115.1631718927-1084102068.1631718927
[47] https://www.kentandessex-ifca.gov.uk/about-us/corporate-publications
[48] https://www.kentandessex-ifca.gov.uk/wp-content/uploads/2019/08/Cockle-report-2018-v1.pdf
[49] https://www.eastern-ifca.gov.uk/wp-content/uploads/2020/08/Whelk-Technical-Summary-Report-.pdf
[50] https://www.eastern-ifca.gov.uk/wp-content/uploads/2020/09/2020_09_23_Wash_Cockle_Fishery_2020_Briefing_Note.pdf

SOURCE	SUMMARY	COVERAGE OF VE
Aggregate Levy Sustainability Fund (MALSF), 2009)[51]	transport data across the Outer Thames Estuary	
Information on species of conservation interest (Joint Nature Conservation Committee (JNCC) (2007)[52]	Species specific data, of native species of conservation interest.	This data source provides species specific data. of native species of conservation interest.
Centre for Environment, Fisheries and Aquaculture (Cefas) research publications and broad scale survey data[53]	Broadscale trawl survey data.	This is a national dataset providing full coverage of the fish and shellfish ecology study area.
ICES Fish Map (ICES, 2006)[54]	Fish species distribution maps.	This is a national dataset with coverage of UK waters
VE site specific benthic survey data (August 2021 – Q4 2021).	PSA data to determine spawning habitat suitability within the array areas, interconnector area and offshore export cable corridor. Sediment contaminants data to inform assessment on potential for release of contaminants from sediment disturbance.	Site specific data collected across the OECR and array areas.
Kent and Essex Sea Fisheries Committee (KESFC)[55] District Research Reports	Regional research reports	These are regional reports and publications to inform the assessment.
Eastern Sea Fisheries Joint Committee (ESFJC) Research Reports[56]	Regional research reports	These are regional reports and publications to inform the assessment, subject to confirmation through consultation.

51 https://eprints.soton.ac.uk/153173/1/outer%2520thames%2520estuary%2520rec%2520final%2520report.pdf
52 https://hub.jncc.gov.uk/assets/98fb6dab-13ae-470d-884b-7816afce42d4#UKBAP-priority-fish.pdf
53 https://data.cefas.co.uk/
54 https://www.ices.dk/about-ICES/projects/EU-RFP/Pages/ICES-FIshMap.aspx
55 http://www.kentandessex-sfc.co.uk/
56 https://www.eastern-ifca.gov.uk/wp-content/uploads/2016/05/WFO_Shellfish_management_policies_2008.pdf

SOURCE	SUMMARY	COVERAGE OF VE
International Council for the Exploration of the Sea (ICES) Reports and Research Publications[57]	International research reports and publications	Reports and publications to inform the assessment. No spatial coverage.
Blackwater Herring Survey (FSS: INA K HER) (Cefas)[58]	Regional herring stock assessment.	This is a regional dataset with coverage across the Outer Thames Estuary
Environment Agency Ecology and Fish Data Explorer[59]	Freshwater fish survey data, utilised to inform presence or absence of migratory fish in catchments and estuaries.	This is a regional dataset with coverage across the Outer Thames Estuary

10.4 BASELINE ENVIRONMENT

10.4.1 The following sections describe the fish and shellfish ecology in and around the VE Study Area and on a broader scale across the Outer Thames Estuary. Key species identified within the study area will be addressed accordingly within the fish and shellfish ecology assessment of the EIA.

10.4.2 A detailed literature review was undertaken to describe the use of the area by fish and shellfish species in relation to key life stages, spawning and juvenile behaviour and migratory pathways. The literature review was informed by data derived from the site-specific sampling surveys conducted for Galloper OWF, and broader surveys across the Outer Thames Estuary and its coastal waters.

10.4.3 Otter trawl surveys of the Galloper OWF (Brown and May Ltd, 2009a and 2009b) recorded a total of 32 finfish species and four species of shellfish as occurring within the area. The surveys were dominated by whiting *Merlangius merlangus*, dab *Limanda limanda*, lesser spotted dogfish *Scyliorhinus canicula* and cod *Gadus morhua*. The only migratory species sampled during the Galloper OWF surveys were twaite shad *Alosa fallax*, of which three were caught. These data show a high degree of similarity to the results of other surveys undertaken at GGOWF (Greater Gabbard Offshore Winds Ltd, 2005), London Array (London Array Ltd, 2005), Thanet (Thanet Offshore Wind Ltd, 2005) and Gunfleet Sands (GE Wind Energy, 2002).

10.4.4 Bottom trawl surveys across the Outer Thames Estuary conducted to inform the IBTS (2017) were dominated by whiting, herring *Clupea harengus*, plaice *Pleuronectes platessa*, dab, grey gurnard *Eutrigla gurnardus* and sprat *Sprattus sprattus*, all of which were also recorded in high abundances across the Study Area. Cod were also recorded within the Study Area, although more sporadically.

[57] https://www.ices.dk/Science/publications/Pages/Scientific-reports.aspx
[58] https://data.cefas.co.uk/view/5
[59] https://environment.data.gov.uk/ecology/explorer/

10.4.5 Data collected as part of the North Sea Young Fish Survey (Cefas, 1981-2010) were obtained for the inshore and coastal areas of the Study Area. Species recorded in high abundance across the Outer Thames Estuary and the proposed OECR include sole *Solea solea*, dab, plaice, lesser pipefish *Syngnathus rostellatus*, pogge *Agonus cataphractus*, lesser weever fish *Echiichthys vipera* and whiting.

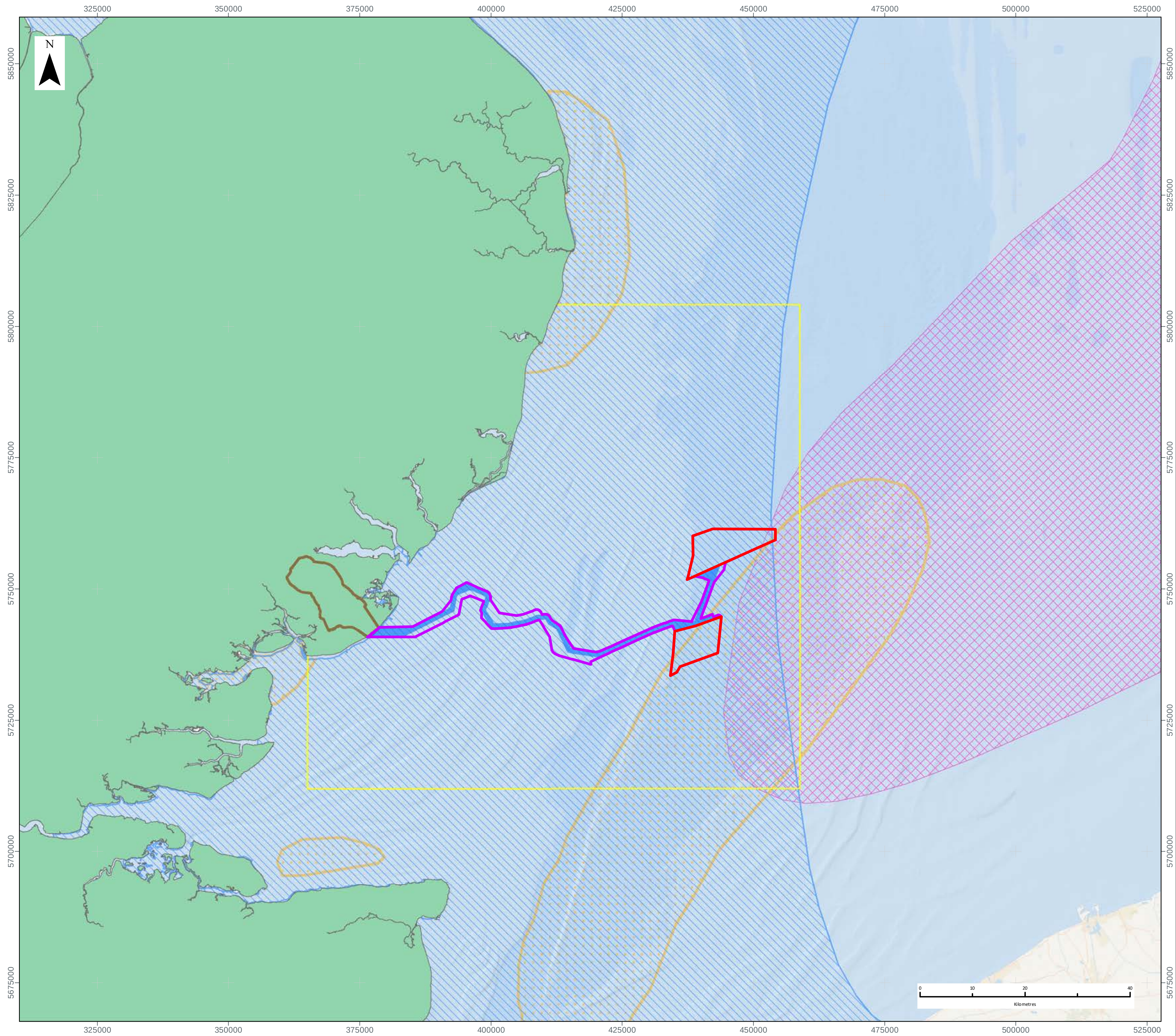
SPAWNING AND NURSERY GROUNDS

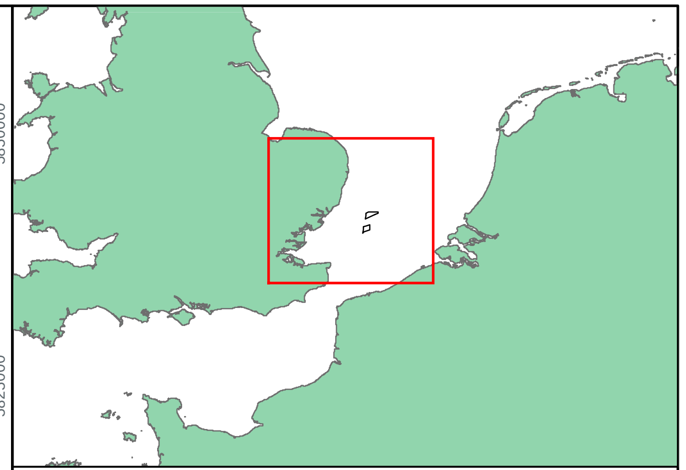
10.4.6 This section presents information on spawning and nursery areas for fish species. This is based on the data from Coull *et al*. (1998) and supported by data sources from Ellis *et al*. (2010).

10.4.7 Within the fish and shellfish Study Area 'high intensity' spawning grounds are present for both plaice and sole (Ellis *et al*, 2010). Plaice spawning grounds stretch across much of the North Sea, with high intensity spawning within the eastern Channel and the Southern Bight (ICES Fishmap, 2019). Sole spawning occurs all along the southern coasts with five main spawning grounds distinguished: the inner German Bight, off the Belgian coast, in the eastern Channel, in the Thames Estuary and on the Norfolk Banks (ICES Fishmap, 2019). Therefore, in a wider context the proposed site has a minor interaction with a small portion of the overall spawning sites for both plaice and sole (Figure 10.4). Herring spawning grounds also overlap with the proposed array areas, on the far western side of the Study Area (Coull *et al*, 1998), and the far northern edge of the Study Area. Of these species, herring are considered sensitive to increased suspended sediment concentrations (SSC) and subsequent sediment deposition due to the demersal nature of their spawning, and herring, plaice and sole are considered potentially sensitive to potential noise impacts during spawning seasons (Popper *et al*, 2014).

10.4.8 Species with low intensity spawning grounds that cross the Study Area (as well as widely around the UK) include cod, whiting and sandeel. Cod are considered sensitive to noise impacts (Popper *et al*, 2014), although spawning grounds appear widespread and are not restricted to specific areas, occurring throughout the North Sea. Sandeel are demersal spawners and are therefore considered sensitive to increased SSC and subsequent sediment deposition.

10.4.9 For fish nursery grounds, the only species with 'high intensity' grounds in the Study Area are herring and sole. High intensity sole nursery grounds extend along most of the southern UK coastlines, and high intensity herring nursery grounds extend around the entire northern UK, including its North Sea coast. Therefore, in a broader context, the Study Area only interacts with a very small portion of the high intensity nursery grounds for these species. Species with low intensity nursery areas that cross the Study Area (as well as widely around the UK) comprise of tope, thornback ray, whiting, sandeel, mackerel and plaice.





LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Study Area

Species

- Cod
- Herring
- Lemon Sole

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Cod, Herring, L.Sole Spawning Grounds (Coull et al-1998)

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	SWM	FM

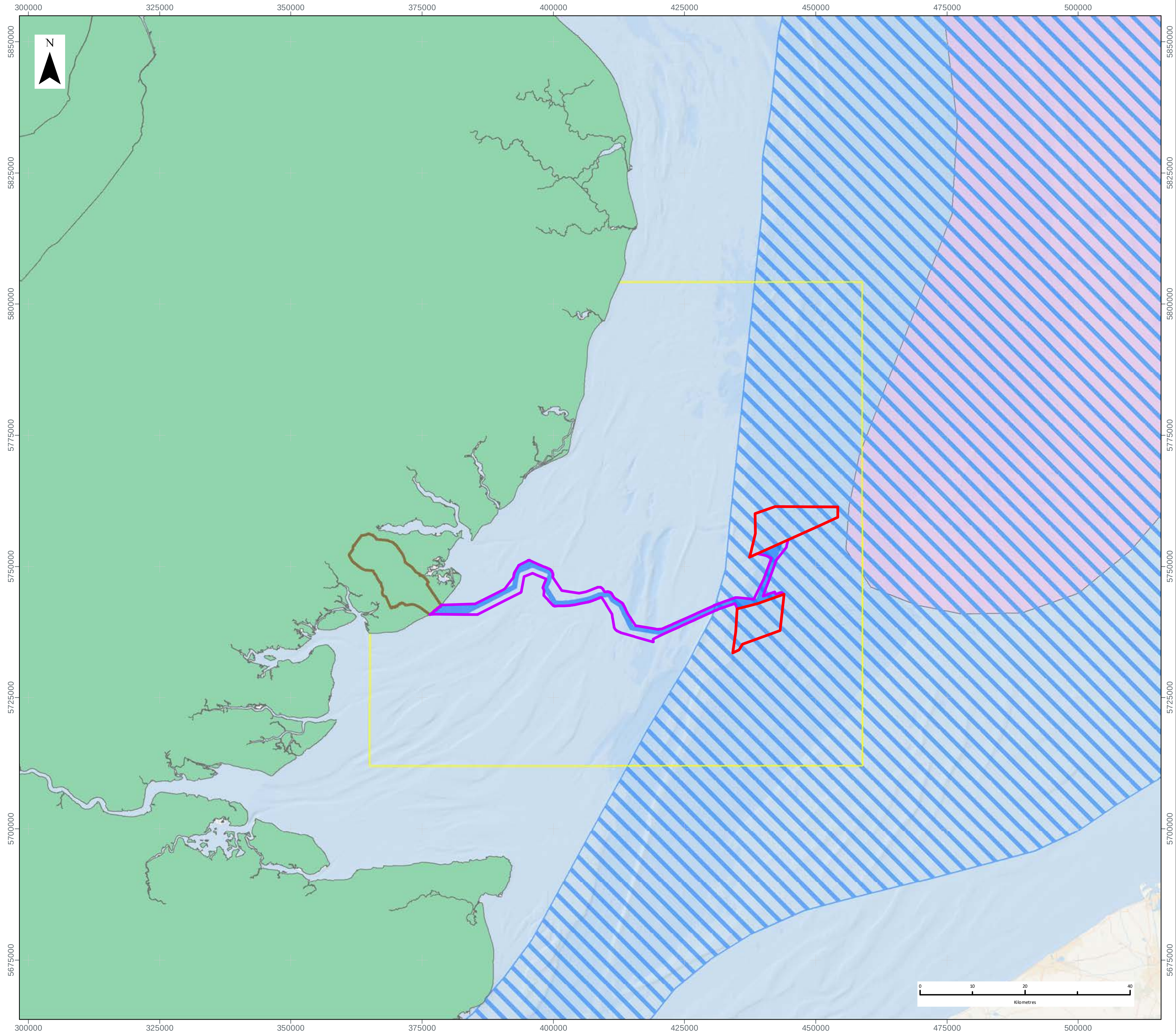
DRAWING NUMBER:

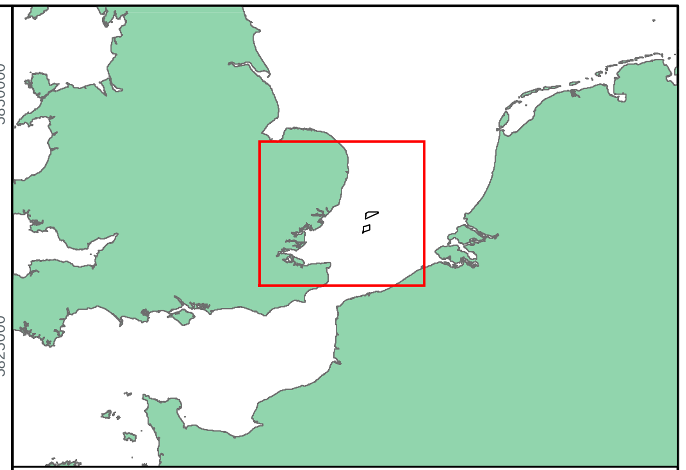
10.2

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:750,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Fish and Shellfish\VE_FS_Fig11_2_V1.mxd





LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Study Area

Species

- Mackerel
- Plaice

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Mackerel and Plaice Spawning Grounds (Coull et al-1998)

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	SWM	FM

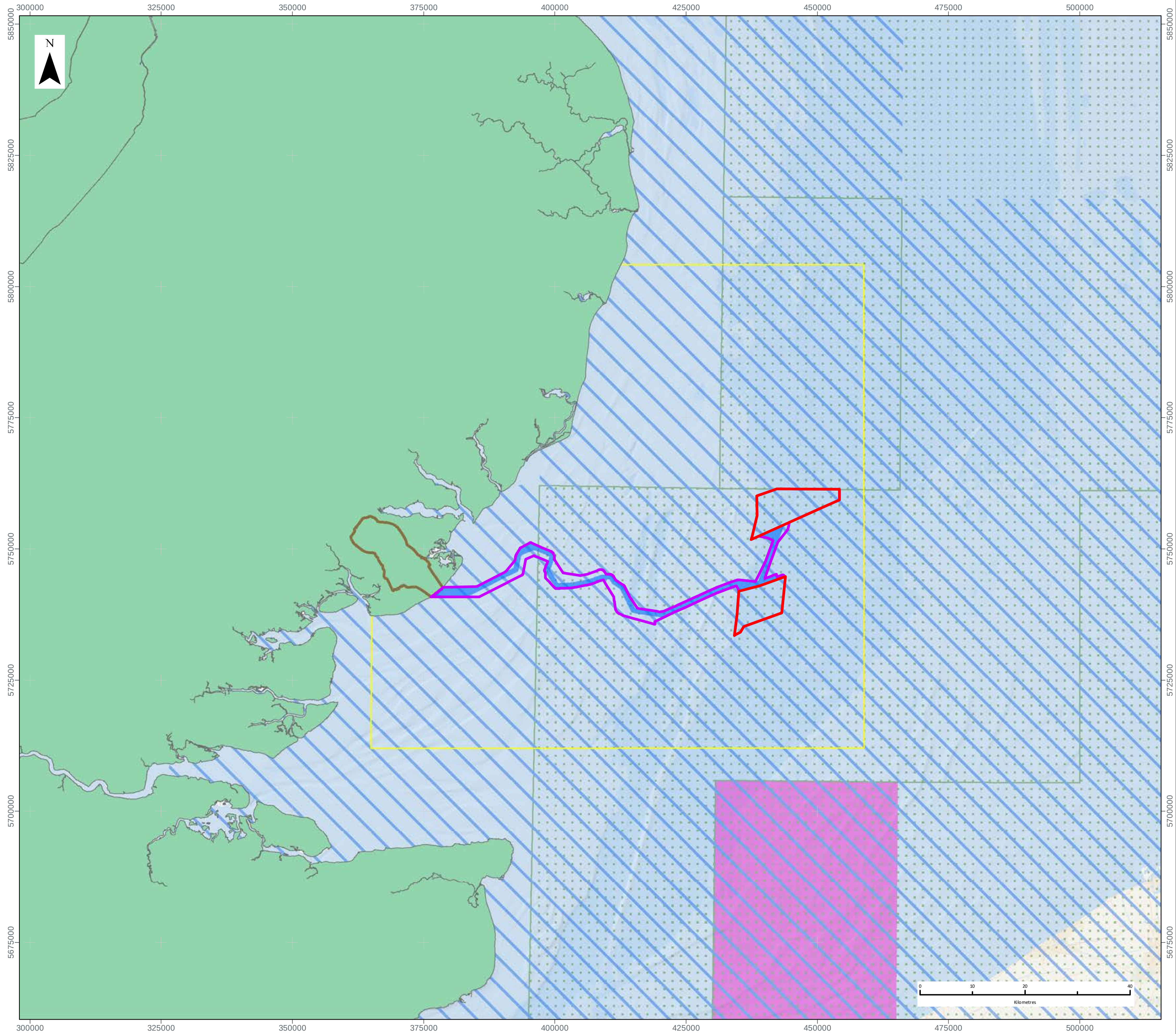
DRAWING NUMBER:

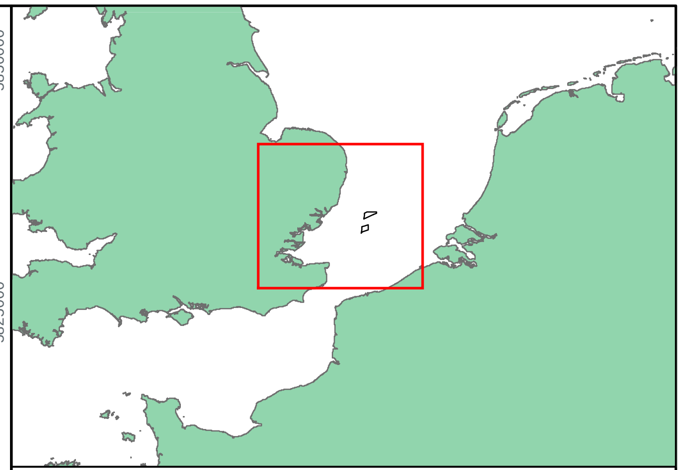
10.3

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:750,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Fish and Shellfish\VE_FS_Fig11_3_V1.mxd





LEGEND
- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Study Area

Species
- HorseMackerel
- Plaice
- Sole

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

H.Mackerel, Plaice and Sole
Spawning Grounds (Ellis et al-2010)

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	SWM	FM

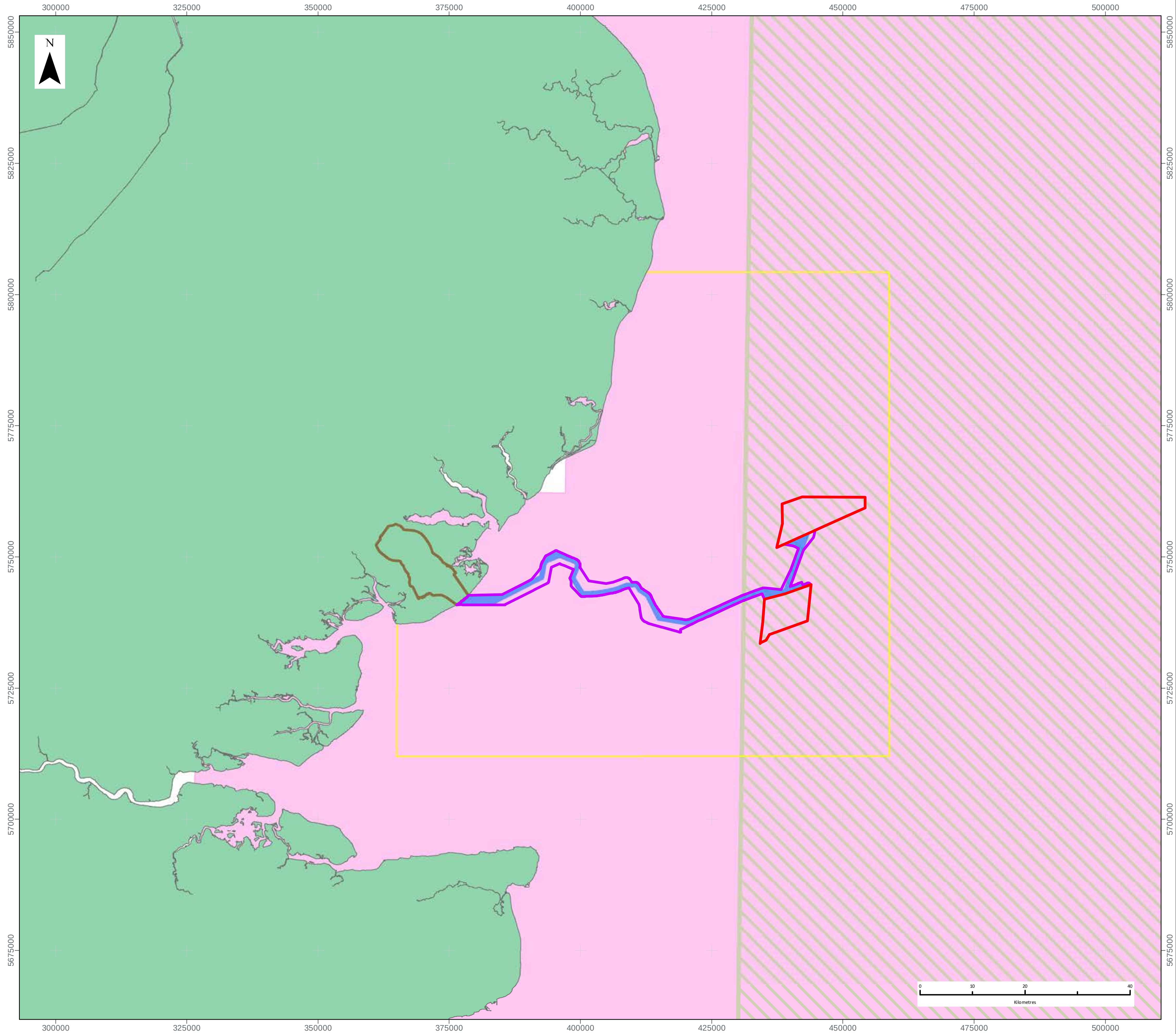
DRAWING NUMBER:

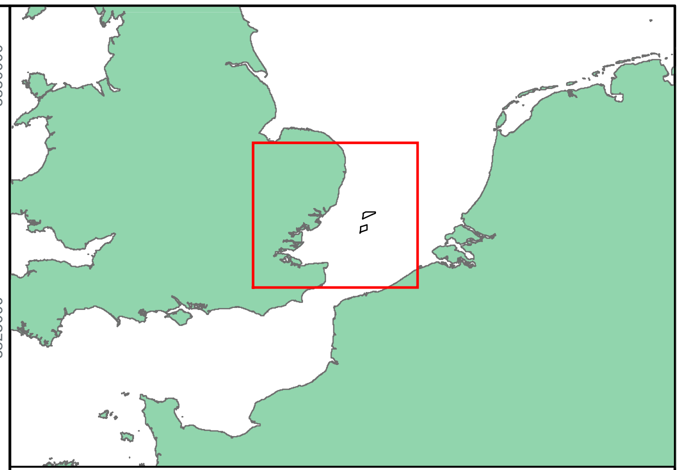
10.4

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:750,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Fish and Shellfish\VE_FS_Fig11_4_V1.mxd





LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Study Area

Species

- Sandeel
- Whiting

Data Source:
Basemap:

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Sandeel and Whiting Spawning Grounds (Ellis et al-2010)

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	SWM	FM

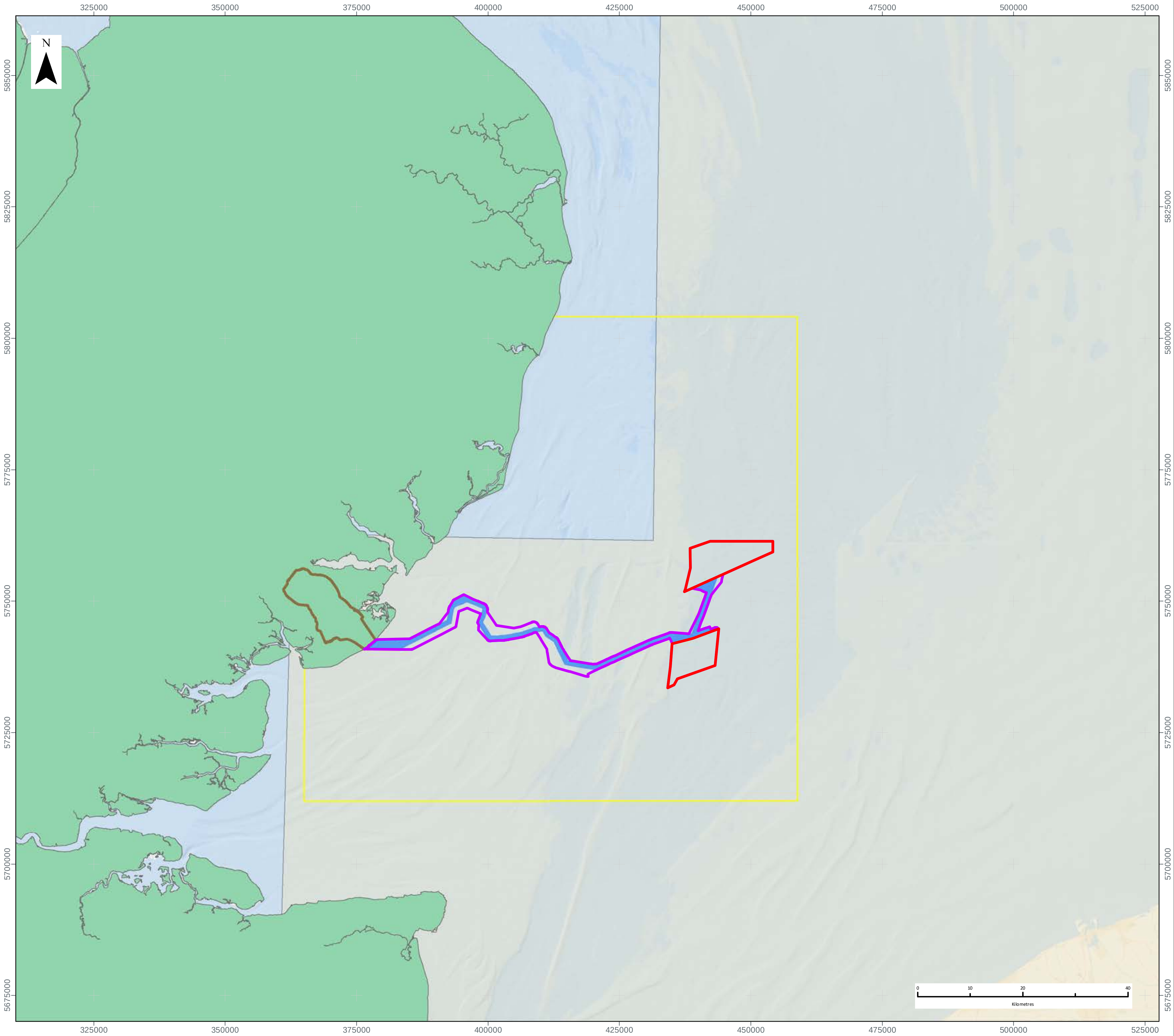
DRAWING NUMBER:

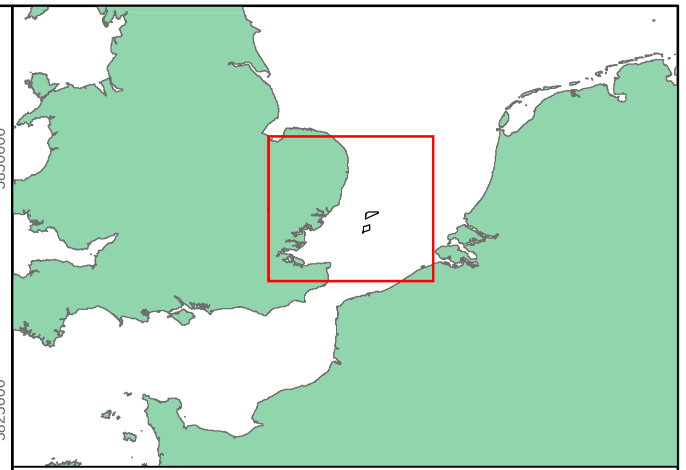
10.5

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:750,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Fish and Shellfish\VE_FS_Fig11_5_V1.mxd





LEGEND
- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Study Area

Species
- Cod

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Cod Spawning Grounds
(Ellis et al-2010)

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	SWM	FM

DRAWING NUMBER:

10.6

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:750,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Fish and Shellfish\VE_FS_Fig11_6_V1.mxd

SPECIES OF COMMERCIAL IMPORTANCE

10.4.10 Detailed information on species of commercial importance are provided in Chapter 13: Commercial Fisheries of the Scoping Report which identifies cockles *Cerastoderma edule*, whelk *Buccinum undatum*, plaice and sole as important commercial species in the region. Whelk fisheries are located along the east coast of the UK, with the highest fishing effort recorded in The Wash and North Norfolk. However, returns for areas in the vicinity of VE (north of the OECR) were consistently low from 2015-2020 (Eastern IFCA (EIFCA), 2020a). Recent reports from the EIFCA (EIFCA, 2020a) and the Blue Marine Foundation (2018) highlighted an increased demand for whelk from Asian markets, which in turn has increased the level of fishing effort on a local and national scale and increased the value of the fisheries. An increase in annual landings of whelk in the past ten years in districts along the east coast of England has been observed, with the most significant increase recorded from 2008 to 2016, with recorded landings increasing from 8 tonnes to 2,274 tonnes (EIFCA, 2020a). Landings per unit effort (LPUE) (used as an indication of the health of stocks) show an increase in whelk stock levels between 2015 and 2019 (2.2 - 2.8 LPUE (total landings/pots hauled) respectively) (EIFCA, 2020a). A slight decline has been observed in 2020 (2.6 LPUE), although this is based on a partial dataset covering the first quarter of 2020 (Blue Marine Foundation, 2018).

10.4.11 Two main cockle fisheries are located along the east coast; The Wash Fishery located to the north of VE, and the Thames Estuary fishery to the south of VE. Annual surveys of cockle and mussel stocks within The Wash indicated a significant decline in mussel stocks in 2019, this resulted in the closure of the 2019 cockle fishery prior to the exhaustion of the Total Allowable Catch (TAC) (note, a decline in mussel stocks will mean a greater reliance on cockle stocks to ensure bird food resource, and therefore to ensure the resource requirements are met, cockle restrictions were required to be implemented) (EIFCA, 2020b). The closure of the 2019 cockle fishery therefore reduced potential impacts to the TAC for the 2020 cockle fishery and the fishery was re-opened in June 2020, with a TAC of 3,636 tonnes. Once the TAC was met, the fishery was closed again in August 2020 (EIFCA, 2020b). Annual surveys of cockle stocks within the Thames Estuary indicate periodic fluctuations in populations. With observations made in the 2018 survey showing peaks in the cockle stocks, indicating the implementation of a cockle management plan by KEIFCA is resulting in sustainable commercially viable cockle stocks (Dyer and Bailey, 2019).

10.4.12 Of these species, whelk and cockles are considered to be potentially sensitive to impacts on fishing pressure, the introduction of hard substrates, and impacts from smothering and deposition, based on their limited mobility (and therefore are considered unable to avoid potential disturbance).

SPECIES OF CONSERVATION IMPORTANCE

10.4.13 Within the Study Area there are confirmed records of seven marine and estuarine species protected under national, European and international legislation. These include salmon *Salmo salar*, river lamprey *Lampetra fluviatilis*, sea lamprey *Petromyzon marinus*, European eel *Anguilla anguilla*, smelt *Atherina presbyter*, allis shad *Alosa alosa* and twaite shad. Common skate *Raja batis*, angel shark *Squatina squatina*, basking shark *Cetorhinus maximus* and sturgeon *Acipenser sturio*, are considered as those species that either were historically present in the area and/or are considered to be occasional visitors. Of these species only twaite shad (three individuals) were recorded during the autumn 2008 Galloper OWF fish surveys.

MIGRATORY SPECIES

10.4.14 Migratory fish are fish that spend part of their life cycle in freshwater and part in seawater; such species are termed diadromous. The UK Salmon and Freshwater Fishery Act (1975) (amended) recognises three migratory species: Atlantic salmon, sea trout Salmo trutta and European eel. Atlantic Salmon and Sea Trout are known to migrate through the Thames Estuary during migrations to their natal rivers to spawn. European eel have long been associated with the River Thames, however, monitoring of eels within the Thames has indicated that very few one year old eels are present and it has been suggested that most eels may spend their first year in the lower estuary (Defra, 2010). Both sea trout and European eel were found to present within the Colne and Stour catchments from 2018-2019, in addition European eel were also recorded within the Orwell catchment (Environment Agency, 2020a). Atlantic Salmon were recorded in the Stour, Duddon and Thames catchments from 2017-2019 (Environment Agency, 2020b).

10.4.15 No Atlantic Salmon, Sea Trout or European eels were recorded in site specific sampling of the Galloper OWF, although it is possible that these species will pass through the site on their migrations.

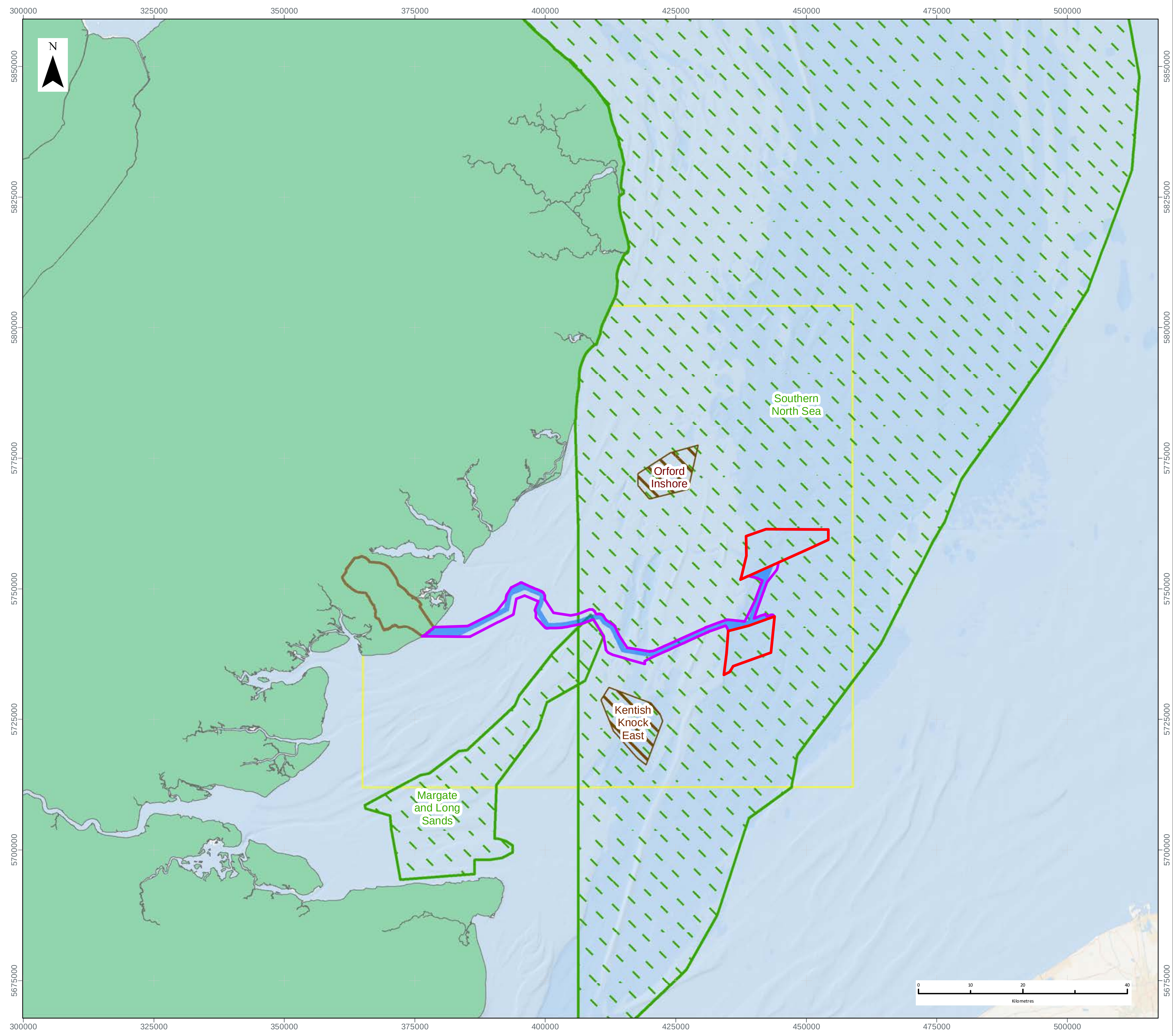
10.4.16 There are a number of additional species known to migrate through the Study Area of conservation interest and of relevance to VE. These include the river and sea Lamprey and two species protected under the Habitats Regulations, the Allis and Twaite shads. Of these species, only twaite shad were recorded in site specific surveys at the Galloper OWF.

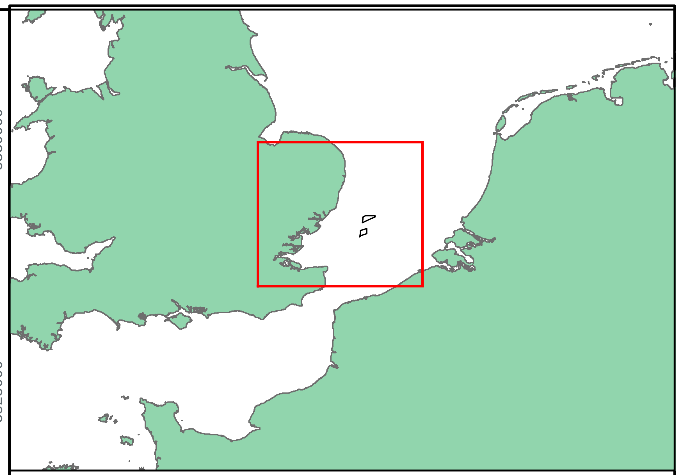
DESIGNATED SITES

10.4.17 For this Scoping Report, a review has been undertaken to identify designated sites in the area which are either designated for fish and shellfish interest or habitats/species which are dependent on or associated with fish or shellfish. The sites are presented in Table 10.2 and shown in Figure 10.7 below. It should be noted that a separate HRA Screening report is being produced which will cover in more detail matters associated with European designations.

Table 10.2 - Designated sites with relevance to fish and shellfish resource and VE

SITE	CLOSEST DISTANCE TO VE	FEATURE OR DESCRIPTION
INTERNATIONAL		
Southern North Sea Special Area of Conservation (SAC)	Interacts with the eastern half of the Study Area.	Primary reason for site selection is harbour porpoise *Phocoena phocoena*, of which herring and sandeel are key prey species.
Margate and Longsands SAC	SAC intersects with the southern border of the offshore AoS	Designated for sandbanks, which may represent spawning habitats for sandeel.
NATIONAL		
Orford Inshore Marine Conservation Zone (MCZ)	23.9 km north of the offshore AoS	Designated for Subtidal mixed sediments
Kentish Knock East MCZ	7.7 km south of the offshore AoS	Designated for Subtidal sand, Subtidal coarse sediment and Subtidal mixed sediments.





LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Marine Conservation Zones / Marine Protected Areas

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Designated sites surrounding the VE Study Area

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	SWM	FM

DRAWING NUMBER:

10.7

SCALE: 1:750,000 | PLOT SIZE: A3 | DATUM: WGS84 | PROJECTION: UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Fish and Shellfish\VE_FS_Fig11_7_V1.mxd

10.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED METHODOLOGY

10.5.1 Existing site-specific data from the Galloper OWF Windfarm Environmental Statement (Brown and May fish resource survey reports (Brown and May Ltd, 2009a, 2009b)) and from wider studies within the Outer Thames Estuary are considered sufficient in describing the fish and shellfish ecology within the study area for VE, and therefore no new site-specific surveys are proposed. These data will be reviewed, along with information derived from other data sources, including Cefas North Sea Young Fish Surveys, and the IBTS, and relevant species-specific research. This information will be further supplemented by findings of industry wide studies and relevant information obtained through consultation with local sea fisheries committees and commercial fishermen.

10.5.2 The assessment of fish and shellfish receptors will comply with the following guidance documents where they are specific to this topic:

> Guidelines for EIA in Britain and Ireland. Marine and Coastal, Final Document (IEEM, 2010);

> Guidance note for EIA in respect of Food and Environment Protection Act (FEPA) and Coast Protection Act (CPA) requirements (Cefas *et al*., 2004);

> Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects (Judd, 2012); and

> Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008).

10.5.3 In accordance with the Cefas *et al*., (2004) guidance the assessment phase of the EIA the following aspects will be considered for fish and shellfish ecology in the area:

> Spawning grounds;

> Nursery grounds;

> Feeding grounds;

> Overwintering areas for crustaceans; and

> Migration routes.

POTENTIAL PROJECT IMPACTS

10.5.4 A range of potential impacts on fish and shellfish ecology have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 10.3, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) to enable an assessment of the impact.

10.5.5 Based on the baseline environment information currently available and the project description (outlined in Chapter 3: Project Description) a number of impacts are proposed to be scoped out of the EIA for fish and shellfish ecology. These impacts are outlined in Table 10.4, together with a justification for scoping them out.

Table 10.3 - Impacts proposed to be scoped in to the assessment for fish and shellfish ecology

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION PHASE			
10.1	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Potential effects from construction activities may arise from noise and vibrations from pile-driving (monopiles and pin piles) for the installation of foundations for offshore structures (i.e. WTGs and offshore substations) and unexploded ordnance (UXO) clearance. Noise from piling has the potential to cause significant impacts to fish and shellfish species ranging from lethal trauma to behavioural changes in susceptible fish species.	The effects on spawning and nursery behaviours and eggs and larvae of fish and shellfish receptors from noise and vibration impacts during the construction phase will be considered. Site-specific predictive noise modelling will be undertaken to assess the potential for mortality, permanent and temporary injury and behavioural disturbance of noise sensitive fish and shellfish receptors based on impact thresholds reported in Popper *et al* (2014). It is considered that there is sufficient existing information on the fish and shellfish interests of the Study Area to inform this assessment and no new surveys are required.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
10.2	Increase in SSC and sediment deposition	Sediment disturbance may arise from a range of construction activities within the array area, such as foundation installation and cable installation. Sediment disturbance from foundation installation may comprise the disposal of drill arisings following WTG installation or seabed preparation. Sediment disturbance may also result from cable installation. Elevations in SSC and subsequent deposition of disturbed sediments have the potential to result in adverse and indirect impacts on fish and shellfish receptors.	The effects on demersal spawning fish (e.g. herring and sandeel) (inclusive of eggs and larvae) from increased SSC and deposition will be considered and will be informed by the findings and assessment reported within the Physical Processes EIA Chapter.
10.3	Direct and indirect seabed disturbances leading to the release of sediment contaminants	Potential effects from construction may arise from sediment resuspension; whilst in suspension, there is the potential for sediment bound contaminants, such as metals, hydrocarbons and organic pollutants, to be released into the water column and lead to an effect on fish and shellfish receptors.	The effects on fish and shellfish receptors (inclusive of eggs and larval stages) will be considered separately for the array and for the OECR, and potential interactions considered. Existing data (sourced from the BGS) and site-specific sediment sampling and contaminants analysis undertaken for the Galloper OWF EIA will be used to inform this assessment along with new site specific sediment data that will be collected as part of a benthic survey planned for VE.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
10.4	Impacts on fishing pressure due to displacement	Fishing activity may be temporarily reduced within the array areas and along the OECR as a result of the instalment of infrastructure. The proposed site is characterised by landings in cockles, whelk, plaice and sole.	Major commercial fish and shellfish species in the area will be identified, describing the fisheries, species and their seasonality. This will be done through obtaining MMO UK landings and fishing effort data as well as foreign fishing information where possible. Specific studies and information associated with other offshore wind farm sites will also be used to support the desk-based assessment, along with information collected through consultation with relevant authorities, including sea fisheries committees, Fishery Producers Organisations (FPOs) and relevant fisheries management organisations. Information collated as part of the Commercial Fisheries assessment of the EIA will be used to inform this assessment. The assessment will focus on potential impacts to species as a result of displaced fishing pressure from the array areas.
OPERATION AND MAINTENANCE PHASE			
10.5	Long-term loss of habitat due	Potential effects during operation will mostly result from the physical presence of infrastructure (i.e.	Impacts on sensitive fish and shellfish species will be considered in terms of long-term loss of spawning

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
	to the presence of turbine foundations, scour protection and cable protection.	foundations, scour protection and any cable protection above the seabed) which will result in long-term habitat loss. This has the potential for impacts on substrate dependent fish and shellfish, in particular those that have substrate specific spawning behaviours (e.g. herring and sandeel), or those with designated conservation status.	habitats and impacts on species of conservation importance. The area of habitat loss will be defined using a worst-case scenario to determine the maximum loss of seabed, and the potential loss herring and sandeel spawning grounds. It is considered that there are sufficient existing data to inform this assessment, and therefore no further surveys are proposed.
10.6	Increased hard substrate and structural complexity as a result of the introduction of turbine foundations, scour protection and cable protection	Potential effects during operation may result from the introduction of infrastructure such as foundations, scour and cable protection will result in the introduction of hard substrate. The increased structural complexity from the introduced infrastructure may also provide habitat or foraging opportunities for mobile species and provide a refuge for fish and shellfish species (Hoffman *et al.*, 2000).	The potential for impacts on fish and shellfish receptors will be considered in terms of effects on biodiversity and productivity. The potential for effects from the introduction of non-indigenous and invasive species will also be addressed with cross reference to the benthic subtidal and intertidal ecology assessment. The area of introduction of hard substrate will be defined using a worst-case scenario to determine the maximum area of impact. It is considered that there is sufficient existing data to inform this assessment, and therefore no further surveys are proposed.
10.7	Impacts on fish and shellfish due to fishing pressure displacement	Fishing activity may be reduced within the VE Array Areas as a result of the presence of infrastructure. The proposed site is characterised by landings in cockles, whelk, plaice and sole.	Major commercial fish and shellfish species in the area will be identified, describing the fisheries, species and their seasonality. This will be done through obtaining MMO UK landings and fishing effort data as well as foreign fishing information where possible. Specific studies

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			and information associated with other offshore wind farm sites will also be used to support the desk-based assessment, along with information collected through consultation with relevant authorities, including sea fisheries committees, FPOs and relevant fisheries management organisations. Information collated as part of the Commercial Fisheries assessment of the EIA will be used to inform this assessment. The assessment will focus on potential impacts to species as a result of displaced fishing pressure from the array areas.
10.8	Electromagnetic fields (EMF) effects arising from cables during operational phase	Potential EMF effects on fish and shellfish have the potential to arise from operational cables. It is noted that cable burial will be the preferred option for cable protection, however there is the potential that it may not be possible to bury cables at all locations (e.g. at crossings or in hard substrate), therefore there may be sections of surface laid cables with cable protection.	The potential for behavioural changes on fish and shellfish receptors will be considered resulting from the presence of EMFs around cabling. The assessment will consider a worst-case scenario to determine the maximum potential for impact on fish and shellfish receptors. It is considered that there is sufficient existing data to inform this assessment, and therefore no further surveys are proposed.
DECOMMISSIONING PHASE			
10.9	Mortality, injury, behavioural changes and auditory	Potential effects from decommissioning activities may arise from noise and vibrations from increased vessel movements and removal of the turbine foundations. Noise from decommissioning	The effects on spawning of noise sensitive fish and shellfish receptors and eggs and larvae from noise and vibration impacts during the decommissioning phase will be considered. It is considered that there

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
	masking arising from noise and vibration	activities has the potential to cause significant impacts to fish and shellfish species ranging from lethal trauma to behavioural changes in susceptible fish species.	is sufficient existing information on the fish and shellfish interests of the Study Area to inform this assessment and no new surveys are required.
10.10	Increase in SSC and sediment deposition	Sediment disturbance may arise from removal of any turbine foundations, scour and cable protection and cables. Elevations in SSC and subsequent deposition of disturbed sediments have the potential to result in adverse and indirect impacts on fish and shellfish receptors.	The effects on demersal spawning fish (e.g. herring and sandeel) (inclusive of eggs and larvae) from increased SSC and deposition will be considered and will be informed by the findings and assessment of the Physical Processes Chapter.
10.11	Direct and indirect seabed disturbances leading to the release of sediment contaminants	Potential effects from the decommissioning phase may arise from sediment resuspension; whilst in suspension, there is the potential for sediment bound contaminants, such as metals, hydrocarbons and organic pollutants, to be released into the water column and lead to an effect on fish and shellfish receptors.	The effects on fish and shellfish receptors (inclusive of eggs and larvae) will be considered separately for the array and for the OECR, and potential interactions considered. Existing data (sourced from the BGS) and site-specific sediment sampling and contaminants analysis undertaken for the Galloper OWF EIA will be used to inform this assessment along with some new sampling sediment data that will be collected as part of a benthic survey planned for VE .
10.12	Impacts on fish and shellfish due to fishing	Fishing activity may be reduced within VE as a result of the physical presence of the infrastructure within the array area . The proposed	Major commercial fish and shellfish species in the area will be identified, describing the fisheries, species and their seasonality.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
	pressure displacement	site is characterised by landings in plaice, sole, cockles and whelk.	This will be done through obtaining MMO UK landings and fishing effort data as well as foreign fishing information where possible. Specific studies and information associated with other offshore wind farm sites will also be used to support the desk-based assessment, along with information collected through consultation with relevant authorities, including sea fisheries committees, FPOs and relevant fisheries management organisations. Information collated as part of the Commercial Fisheries assessment of the EIA will be used to inform this assessment. The assessment will focus on potential impacts to species as a result of displaced fishing pressure from the array areas.

Table 10.4 - Impacts proposed to be scoped out of assessment for fish and shellfish resource

IMPACT NO	IMPACT	JUSTIFICATION FOR SCOPING OUT
CONSTRUCTION PHASE		
10.13	Direct damage (e.g. crushing) and disturbance to mobile demersal and pelagic fish and shellfish species arising from construction activities	Affected species are likely to be mobile and can move away from the disturbance. The habitats that will be disturbed represent a small area of the total distribution of that habitat type in the central southern North Sea. Most fish and shellfish receptors in the southern North Sea are deemed to be of low vulnerability, high recoverability and of local; to international importance within the southern North Sea. It is proposed that this impact is therefore scoped out of the EIA.
10.14	Accidental pollution events during the construction phase resulting in potential effects on fish and shellfish receptors	The magnitude of an accidental spill will be limited by the size of chemical or oil inventory on construction vessels. In addition, released hydrocarbons will be subject to rapid dilution, weathering and dispersion and will be unlikely to persist in the marine environment. The likelihood of an incident will be substantially reduced by the implementation of a Project Environmental Management Plan (PEMP) which will include a Marine Pollution Contingency Plan (MPCP). It is proposed that this impact is therefore scoped out of the EIA.
OPERATION AND MAINTENANCE		
10.15	Direct disturbance resulting from maintenance during operational phase	Affected species are likely to be mobile and can move away from disturbance. The habitats that will be disturbed represent a small area of the total distribution of that habitat type in the central southern North Sea. Most fish and shellfish receptors in the southern North Sea are deemed to be of low vulnerability, high recoverability and of local to international importance within the southern North Sea. For all species it is considered that there is no

IMPACT NO	IMPACT	JUSTIFICATION FOR SCOPING OUT
		risk of likely significant effects from this impact, and therefore this impact is scoped out of the assessment.
10.16	Accidental pollution events during the operation and maintenance phase resulting in potential effects on fish and shellfish receptors	The magnitude of an accidental spill will be limited by the size of chemical or oil inventory on construction vessels. In addition, released hydrocarbons will be subject to rapid dilution, weathering and dispersion and will be unlikely to persist in the marine environment. The likelihood of an incident will be substantially reduced by the implementation of a PEMP which will include a MPCP. It is proposed that this impact is therefore scoped out of the EIA.
DECOMMISSIONING PHASE		
10.17	Direct damage (e.g. crushing) and disturbance to mobile demersal and pelagic fish and shellfish species arising from decommissioning activities	Affected species are likely to be mobile and can move away from the disturbance. The habitats that will be disturbed represent a small area of the total distribution of that habitat type in the central southern North Sea. Most fish and shellfish receptors in the southern North Sea are deemed to be of low vulnerability, high recoverability and of local; to international importance within the southern North Sea. It is proposed that this impact is therefore scoped out of the EIA.
10.18	Accidental pollution events during the decommissioning phase resulting in potential effects on fish and shellfish receptors	The magnitude of an accidental spill will be limited by the size of chemical or oil inventory on construction vessels. In addition, released hydrocarbons will be subject to rapid dilution, weathering and dispersion and will be unlikely to persist in the marine environment. The likelihood of an incident will be substantially reduced by the implementation of a PEMP which will include a MPCP. It is proposed that this impact is therefore scoped out of the EIA.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

10.5.6 As part of the design process for VE a number of designed-in measures are proposed to reduce the potential for impacts on fish and shellfish receptors. These are presented below. These will evolve over the development process as the EIA progresses and in response to consultation.

10.5.7 VE OWFL are committed to implement these measures, and also various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/out presented in Table 10.3 and Table 10.4.

10.5.8 Measures adopted as part of the project will include:

- A PEMP will be produced post-consent and implemented to cover the construction and O&M phases of VE. The PEMP will include a MPCP to cover accidental spills, potential contaminant release and include key emergency contact details (e.g. Marine Management Organisation, Maritime Coastguard Agency and the project site co-ordinator).
- A Decommissioning Programme will be developed to cover the decommissioning phase;
- Typical measures to be included within the Plans above include: storage of all chemicals in secure designated areas with impermeable bunding (generally to 110% of the volume); and double skinning of pipes and tanks containing hazardous materials. The purpose of these measures is to ensure that potential for contaminant release is strictly controlled and provides protection to marine life across all phases of the life of the wind farm; and
- The requirement and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

POTENTIAL CUMULATIVE IMPACTS

10.5.9 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For fish and shellfish, cumulative interactions may occur with other planned projects and developments in the study area. Potential cumulative impacts with other projects and activities will be considered for each of the impacts considered Table 10.3.

10.5.10 As previously discussed, there is the potential for underwater noise to have a large spatial footprint (with regard to disturbance effects and displacement of prey species). This could have cumulative impacts spatially (i.e. if two or more piling operations are undertaken simultaneously) or temporally (i.e. if piling operations are happening consecutively). It is necessary to consider that even if a piling programme is scheduled for many months, the actual duration of pile driving will be limited to a few hours per pile given the experience of other projects in the southern North Sea.

10.5.11 The impacts resulting from increased SSC and deposition, are likely to be minor due to their localised nature, however there is potential for spatial cumulative impacts with regard to other offshore wind developments, particularly when considering cumulative impacts on spawning grounds for demersal spawning species, such as herring and sandeel. Given the proximity of the North Falls offshore wind farm offshore export cable route there may also be opportunities for cumulative impacts associated with direct temporary disturbance and or habitat loss.

10.5.12 There is the potential for other activities occurring in the region surrounding VE offshore AoS and array areas to create cumulative impacts, these include aggregate dredging, subsea cabling and oil and gas exploration and development. The spatial footprint of potential cumulative impacts associated with identified projects will be used to inform the cumulative effects assessment.

10.5.13 A range of realistic scenarios for relevant projects will be developed for the cumulative assessment, based on publicly available information, liaison with other developers where possible, as well as consultation with the Regulators and stakeholders. Potential cumulative effects with other projects and activities will be considered for each of the impacts considered in Table 10.3. Those impacts listed in Table 10.4 will be scoped out of the cumulative effects assessment.

POTENTIAL TRANSBOUNDARY IMPACTS

10.5.14 A description of how potential transboundary effects will be assessed is outlined in Chapter 4: Environmental Impact Assessment approach and methodology. As presented in Chapter 4, the limits of the Dutch, Belgian and French Exclusive Economic Zones are located approximately 16 km (south east), 25 km (south) and 18 km (north east) of the VE array areas respectively.

10.5.15 Fish and shellfish species are mobile by nature and are not restricted to national geographical boundaries. The EIA will take account of the distribution of fish and shellfish species across the wider biogeographic region irrespective of national jurisdictions. It is on this basis that a specific assessment of transboundary effects of fish and shellfish ecology is considered unnecessary. Any potential likely significant effects upon designated European Sites with fish as a qualifying feature will be assessed within the HRA.

10.6 SUMMARY OF NEXT STEPS

10.6.1 The proposed approach to the assessment for the fish and shellfish ecology PEIR chapter will first include the definition of the worst-case scenarios on which the assessments will be based. The geographic footprint of the project, the foundations proposed, and the piling hammer energies will be key considerations in defining the worst-case scenarios for fish and shellfish receptors.

10.6.2 The impacts of noise on sensitive fish and shellfish receptors are scoped into the EIA and noise modelling of the worst-case piling scenario are proposed to be undertaken for piling in the array. The worst-case scenario will be based on WTG foundation type and size, and water depths in which they will be deployed.

10.6.3 No surveys are proposed for fish and shellfish, as the area has been extensively studied previously and is therefore characterised adequately for the purpose of EIA. Furthermore, the EIA will be limited to those receptors that are considered as having a realistic potential to be significantly impacted by the proposed development.

10.6.4 As per Chapter 8: Water Quality and Chapter 10: Benthic and Intertidal Ecology, site-specific benthic ecology surveys which will be undertaken across both the array areas and the offshore AoS (including the intertidal area). Data from these site-specific surveys will be used to inform the fish and shellfish ecology assessment.

10.7 FURTHER CONSIDERATIONS FOR CONSULTEES

10.7.1 Scoping questions for consultees in relation to fish and shellfish ecology include:

- Are you satisfied that the baseline data referenced above is valid for the purposes of the scoping assessment?
- Have all potential impacts resulting from VE been identified for fish and shellfish receptors?
- For those impacts scoped in (Table 10.3), do you agree that the methods described are sufficient to inform a robust impact assessment?
- Do you agree that the impacts described in Table 10.4 can be scoped out?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of VE on fish and shellfish receptors?
- Do you agree that the cumulative effects on Fish and Shellfish receptors (other than those related to subsea noise effects during construction) should be scoped out of the EIA for VE based on the assumptions detailed in this Scoping Report?

11. MARINE MAMMALS

11.1 INTRODUCTION

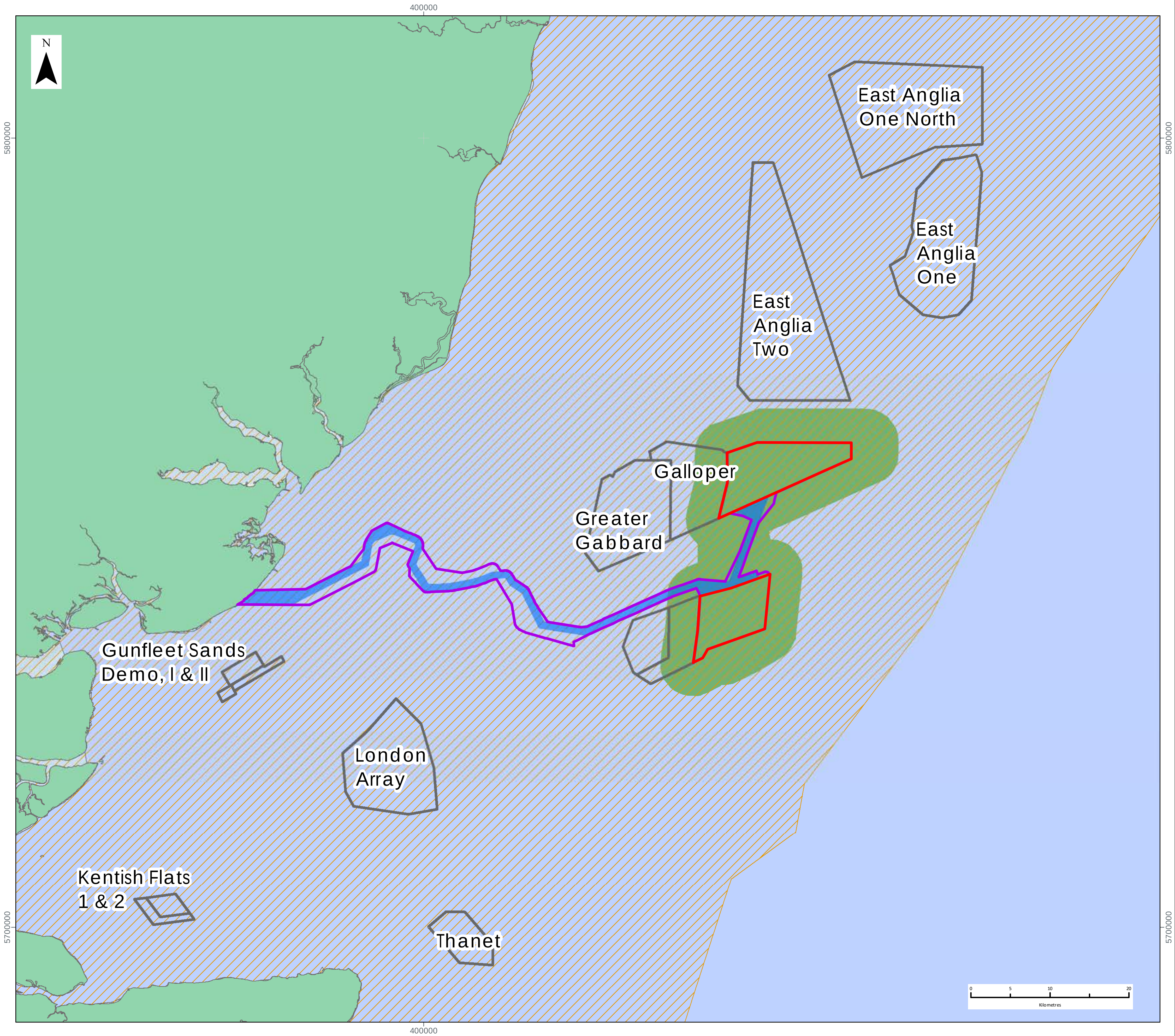
11.1.1 This chapter of the Scoping Report identifies the marine mammal receptors of relevance to VE array areas and offshore AoS. It describes the potential effects from the construction, O&M, and decommissioning of the VE and offshore components on marine mammals and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented. The key marine mammal species considered (based on the results of the two years of site-specific surveys at VE) are harbour porpoise (*Phocoena phocoena*), harbour seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*).

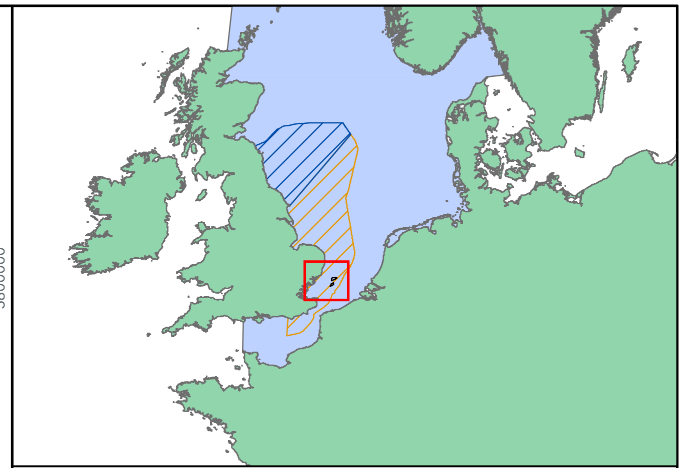
11.2 STUDY AREA

11.2.1 The VE marine mammal study area varies depending on the species, considering individual species ecology and behaviour. The marine mammal study area has been defined at two spatial scales:

- Regional Scale study area: provides a wider geographic context in terms of the species present and their estimated densities and abundance. This scale defines the appropriate reference populations for the assessment. The regional study area for each species is as follows:
  - Harbour porpoise: North Sea Management Unit (MU);
  - Harbour seals: Southeast England MU; and
  - Grey seals: combined Southeast and Northeast England MUs.
- The VE study area: includes the survey area for the VE site-specific aerial surveys (carried out between March 2019 and February 2021 as part of the ornithological aerial surveys – survey area comprised the VE array areas and a 4 km buffer as described in Chapter 13, Figure 13.1) to provide an indication of the local densities of each species across the wind farm and offshore AoS and associated impact footprints.

11.2.2 The marine mammal study area (regional MUs and survey area) is shown in Figure 11.1.





LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- Survey Area
- Northeast England MU
- Southeast England MU
- North Sea MU
- Other Offshore Wind Farms

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Marine Mammal Study Area

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	RRS	FM

DRAWING NUMBER:

11.1

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

C:\Users\rp28.ST-ANDREWS\Documents\GIS\5Est\Scoping\VE_Marine_Mammals_Scoping_Fig1_StudyArea.mxd

11.3 BASELINE DATA

11.3.1 Table 11.1 outlines the baseline datasets that exist for the study area.

Table 11.1 - Marine mammal baseline datasets

SOURCE	DESCRIPTION
Site-specific aerial surveys for VE (HiDef Aerial Surveying Ltd 2020, 2021)	Site-specific baseline characterisation digital video aerial surveys (March 2019 – February 2021). The survey area consists of the VE array areas with a 4 km buffer.
Additional OWF surveys (if available)	> Galloper OWF baseline and post-construction surveys (vessel based); > Greater Gabbard OWF baseline, construction and post-construction surveys (vessel based); and > North Falls OWF baseline surveys (aerial March 2019-February 2021).
SCANS III (Hammond *et al*. 2021)	Combination of vessel and aerial surveys of the North Sea and European Atlantic continental shelf waters conducted in July 2016.
JCP Phase III (Paxton *et al*. 2016)	38 data sources between 1994-2010. The JCP Phase III Data Analysis Product will be used to extract abundance estimates averaged for summer 2007-2010 and scaled to the SCANS III estimates for user specified areas.
SCOS reports (SCOS 2021)	Scientific Advice on Matters Related to the Management of Seal Populations. This outlines the current status of both harbour and grey seals in the UK.
Seal haul-out data (provided by SMRU)	August haul-out surveys of harbour and grey seals.
Seal haul-out data in the Greater Thames Estuary (Cox et al. 2020)	Seal population data for the Greater Thames Estuary between 2003 to 2019.
Grey seal pup counts (provided by SMRU)	Surveys of the main UK grey seal breeding colonies annually between mid-September and late-November to estimate the numbers of pups born at the main breeding colonies.
Telemetry data (provided by SMRU)	A total of 86 harbour seals have been tagged in the Southeast England MU since 2003. A total of 33 grey seals have been tagged in the Southeast England MU since 1988 and a further 31 have been tagged in the Northeast England MU.
Seal habitat preference maps (Carter et al. 2020)	Habitat modelling was used, matching seal telemetry data to habitat variables, to understand the species-environment relationships that drive seal distribution. Haul-out count data were then used to generate predictions of seal

SOURCE	DESCRIPTION
	distribution at sea from all known haul-out sites. This resulted in predicted distribution maps on a 5x5 km grid. The estimated density surface gives the percentage of the British Isles at sea population (excluding hauled-out animals) estimated to be present in each grid cell at any one time during the main foraging season.
EU telemetry data	Telemetry data from various studies on grey (Brasseur et al. 2015a, Brasseur et al. 2015b, Vincent et al. 2017, Aarts et al. 2018) and harbour seals (Brasseur et al. 2012, Brasseur and Kirkwood 2015, Vincent et al. 2017) tagged in the Netherlands, France and the Wadden Sea to assess connectivity with European sites.
Seawatch Foundation Sightings	Sightings recorded from the Eastern England region.

11.4 BASELINE ENVIRONMENT

11.4.1 The marine mammal species likely to be present in the VE marine mammal study area based on site specific survey data and historical records, include harbour porpoise, grey seal and harbour seal. Further information on the occurrence of each of these species is indicated below.

11.4.2 Other marine mammals that have been sighted in the southeast of England but are considered to be only occasionally or rarely present include: bottlenose dolphins (*Tursiops truncatus*), white-beaked dolphins (*Lagenorhynchus albirostris*), common dolphins (*Delphinus delphis*), minke whales (*Balaenoptera acutorostrata*), fin whales (*Balaenoptera physalus*) and humpback whales (*Megaptera novaeangliae*) (Reid et al. 2003). None of these other marine mammal species were identified during the two years of site-specific aerial surveys at VE (HiDef Aerial Surveying Ltd 2021), therefore it is proposed that these species are scoped out of assessment for VE.

HARBOUR PORPOISE

11.4.3 The population estimate for the North Sea MU based on SCANS III data is 346,601 harbour porpoise (95% CI: 289,498 – 419,967, CV: 0.09) (IAMMWG 2021). The conservation status of harbour porpoise in UK waters has been updated in JNCC (2019a) which concludes a favourable assessment of future prospects and range, but an unknown conclusion for population size and habitat. This resulted in an overall assessment of conservation status of “Unknown” and an overall trend in Conservation status of “Unknown”. A trend analysis indicates that the harbour porpoise abundance in the North Sea is stable and has not changed since 1994, although the associated confidence intervals are quite wide.

11.4.4 Harbour porpoise were the most abundant marine mammal sighted in the site-specific surveys (HiDef Aerial Surveying Ltd 2020, 2021). They were sighted in every survey month throughout the two survey years, totalling 575 sightings across the 24 months. Monthly density estimates varied across the surveys between 0.14 and 8.48 harbour porpoise/km^2, however for most months the density estimate was <2 harbour porpoise/km^2 (Figure 11.2). Spatial distribution of harbour porpoise within the survey area differed between surveys, with no clear pattern other than that porpoise use the entire survey area.

11.4.5 The VE is located within the SCANS III survey block L where there was an estimated density of 0.607 harbour porpoise/km^2 in July 2016 (Hammond et al. 2021). The SCANS surveys of the whole of the North Sea show a southwards shift in distribution of the North Sea harbour porpoise population between the survey years of 1994 and 2005; this pattern of higher densities in the southern North Sea persisted in the most recent 2016 surveys.

11.4.6 The JCP Phase III Data Analysis Product provided an estimate of 1.9 harbour porpoise/km^2 in the vicinity of the array areas, averaged for the summer 2007-2010. This estimate is for the summer months only and is not representative of densities at other times of the year.

11.4.7 VE is located within the Southern North Sea SAC for harbour porpoise which was identified as being a discrete and persistent area of high porpoise density (Heinänen and Skov 2015). The year-round high density in this area has also been demonstrated by the analyses presented in Waggitt et al. (2020).

11.4.8 Harbour porpoise were the main species incidentally sighted during the site-specific baseline ornithology surveys conducted at Greater Gabbard and Galloper (Royal Haskoning 2011). These data highlight that harbour porpoise are present year-round, with the highest incidental sightings rate recorded between February-May.

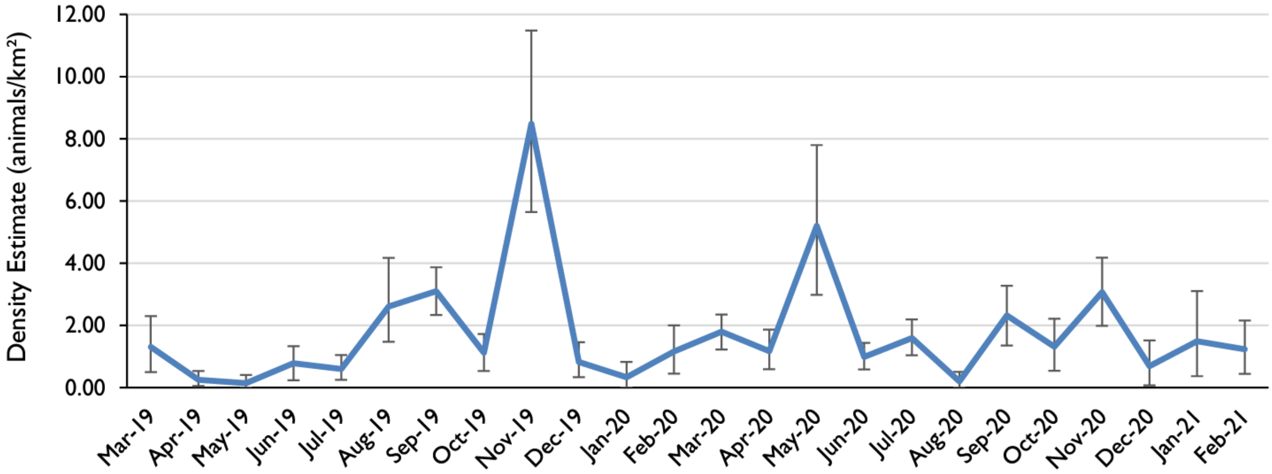


Figure 11.2 - Harbour porpoise absolute density estimates with lower and upper 95% confidence intervals between March 2019 and February 2021.

HARBOUR SEALS

11.4.9 The overall Conservation Status of harbour seals in UK waters has been assessed as Unfavourable – Inadequate with an unknown overall trend in Conservation Status (JNCC 2019c).

11.4.10 The latest August haul-out count data for harbour seals in the Southeast England MU is the 2016-2019 dataset where 3,752 harbour seals were counted (SCOS 2021). The 2019 count for the Southeast England MU was 27.6% lower than the mean count between 2012-2018, which may represent the first indication of a population decline and SCOS recommend that research is required to determine the time course and potential causes of this reduction (SCOS 2021). The 2019 count data can be scaled by the estimated proportion hauled-out (0.72, 95% CI: 0.54-0.88) (Lonergan et al. 2013) to provide an estimate of 5,211 harbour seals in the Southeast England MU in 2019 (95% CI: 4,263 – 6,948).

11.4.11 No harbour seals were sighted during the two years of site-specific surveys, however there were several sightings of unidentified seal species (n=9) and unidentified seal/small cetacean species (n=28), some of which could have been harbour seals (HiDef Aerial Surveying Ltd 2020, 2021).

11.4.12 There are no harbour seal haul-outs located within the VE offshore AoS and array areas (Figure 11.3). The nearest cluster of haul-out sites is at Hamford Water which is located about 12 km swimming distance from the closest point of the offshore AoS. There are also several haul-out sites located within the Greater Thames Estuary Area to the southwest of VE (within around 100 km from the closest point of the offshore AoS and array areas) (Figure 11.3).

11.4.13 Harbour seal at-sea density estimates within the VE array areas are low at <0.0001 harbour seals/km^2. However, densities are much higher along the offshore AoS and towards the coast, where densities within the offshore AoS and array areas reach up to 0.36 harbour seals/km^2 (Figure 11.4).

11.4.14 Telemetry data from 86 harbour seals tagged in the Thames Estuary and the Wash indicate little use of the VE array areas, with most of the tagged harbour seal activity being concentrated along the coastal part of the offshore AoS. There are also data from harbour seals tagged in the Netherlands suggestive of connectivity between the Southeast England MU and other EU sites in the Netherlands, France and the Wadden Sea.

GREY SEALS

11.4.15 The overall assessment of conservation status of grey seals in UK waters has been assessed as Favourable with an overall improving trend in conservation status (JNCC 2019b) and population modelling for regularly monitored grey seal breeding colonies across the UK show an increasing trend of 2% p.a. (SCOS 2021).

11.4.16 The nearest key breeding region for grey seals to VE is the Donna Nook and East Anglia area of the North Sea region which encompasses the breeding colonies at Donna Nook, Blakeney Point and Horsey. The latest pup production estimate for the Donna Nook and East Anglia area is 7,147 pups, and for the Farne Island is 2,737 pups (SCOS 2021). The grey seal pup production in the North Sea shows an annual increase of 7.5% p.a. between 2014 and 2018, which is a slightly lower rate of increase than the 11.5% p.a. between 2010 and 2016.

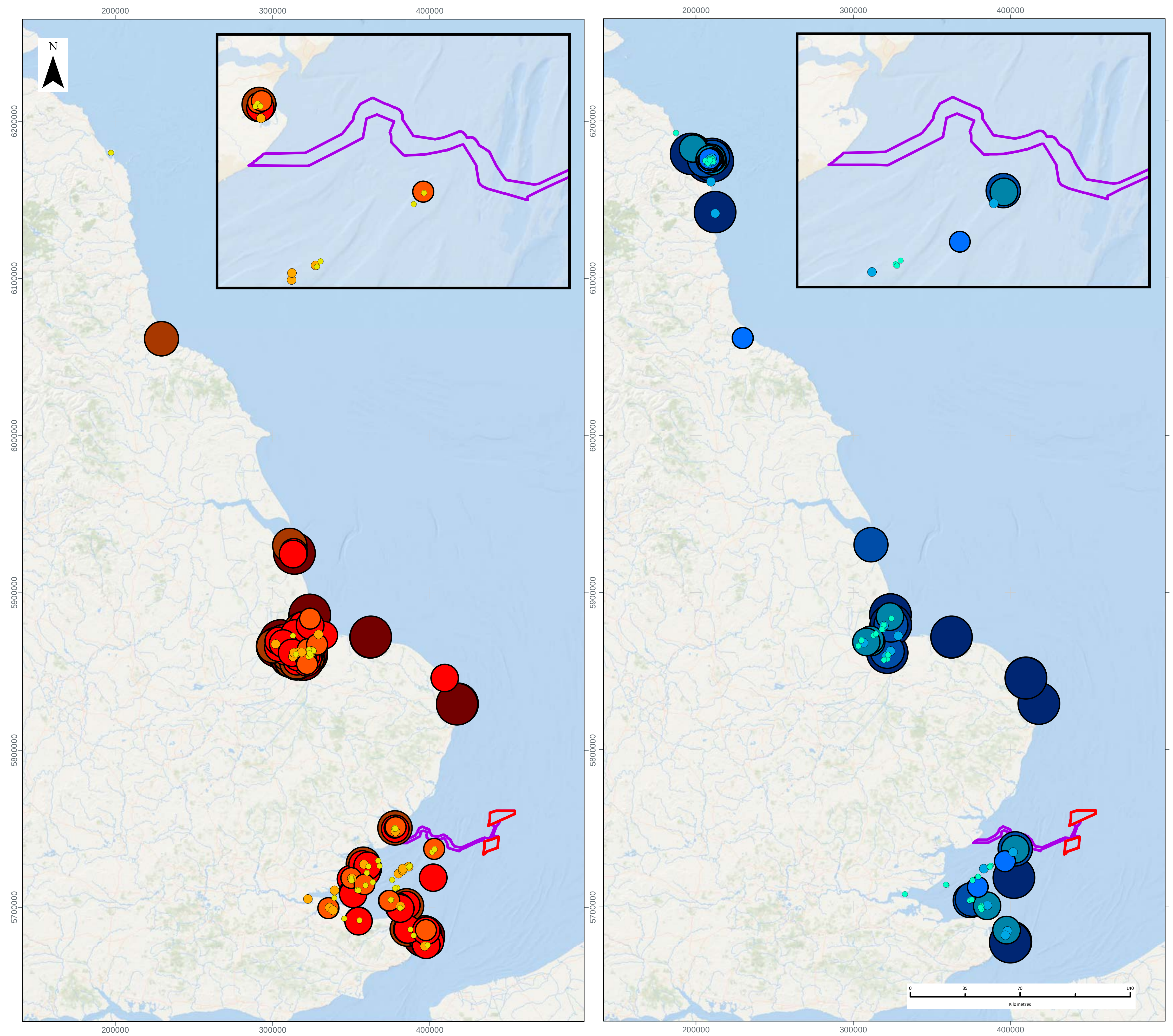
11.4.17 The latest August haul-out count for grey seals in Southeast England MU is from the 2019 survey where 8,667 grey seals were counted. Given the wide-ranging nature of grey seals and the large degree of movement between the north east and south east of England, it is not appropriate to consider the Southeast England MU as a discrete population unit in isolation, therefore the relevant population against which to assess impacts should be the combined Southeast and Northeast England MUs. The latest August haul-out count data for grey seals in Northeast England is from the 2019 survey where 6,501 grey seals were counted. The 2019 August haul-out count for the Southeast England MU combined with the 2019 count for the Northeast England MU (15,168 combined total) can be scaled by the estimated proportion hauled-out (0.239, 95% CI: 0.192 – 0.286) (Russell et al. 2016a) to produce an estimate of 63,464 grey seals in the Southeast and Northeast England MUs combined (95% CI: 53,035 -79,000).

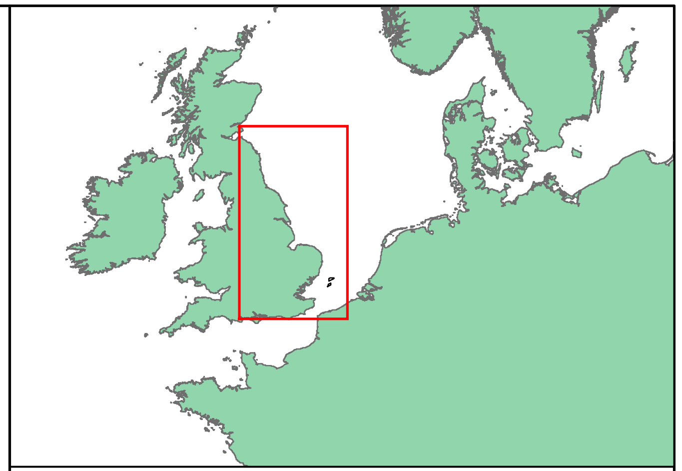
11.4.18 Grey seals were sighted only occasionally during the two years of site-specific surveys with a total of 8 sightings over the 24 surveys. However there were several sightings of unidentified seal species (n=28) and unidentified seal/small cetacean species (n=9), some of which could have been grey seals (HiDef Aerial Surveying Ltd 2020, 2021).

11.4.19 There are no grey seal haul-outs located within the VE offshore AoS and array areas (Figure 11.3). There are however several haul-out sites located within the Greater Thames Estuary Area to the southwest of VE (within about 100 km from the closest point of the offshore AoS and array areas) (Figure 11.3).

11.4.20 Grey seal at-sea density estimates within the VE offshore AoS and array areas are low – with a maximum of 0.27 grey seals/km^2 (Figure 11.4) Grey seal densities are expected to be much higher further north of the Project, with high densities extending out of the Humber Estuary SAC.

11.4.21 Data from 64 grey seals tagged in the southeast and northeast England SMAs at Donna Nook, the Farnes and Blakeney, indicate low use of the VE array areas, with most of the tagged grey seal activity being concentrated along the coastal part of the offshore AoS. Note, no grey seals have been tagged in the Thames Estuary. There are also data from grey seals tagged in France and the Netherlands which indicates connectivity between the Southeast England MU and other EU sites in the Netherlands, France and the Wadden Sea.





LEGEND

Array Areas

Offshore Area of Search

Harbour Seal	Grey Seal
1-5	1-5
6-10	6-10
11-15	11-15
16-50	16-50
51-100	51-100
>100	>100

Data Source:
Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors
Seal haul-out data: Provided by SMRU

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Seal Haul-Out Counts 2018-19

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	RRS	FM

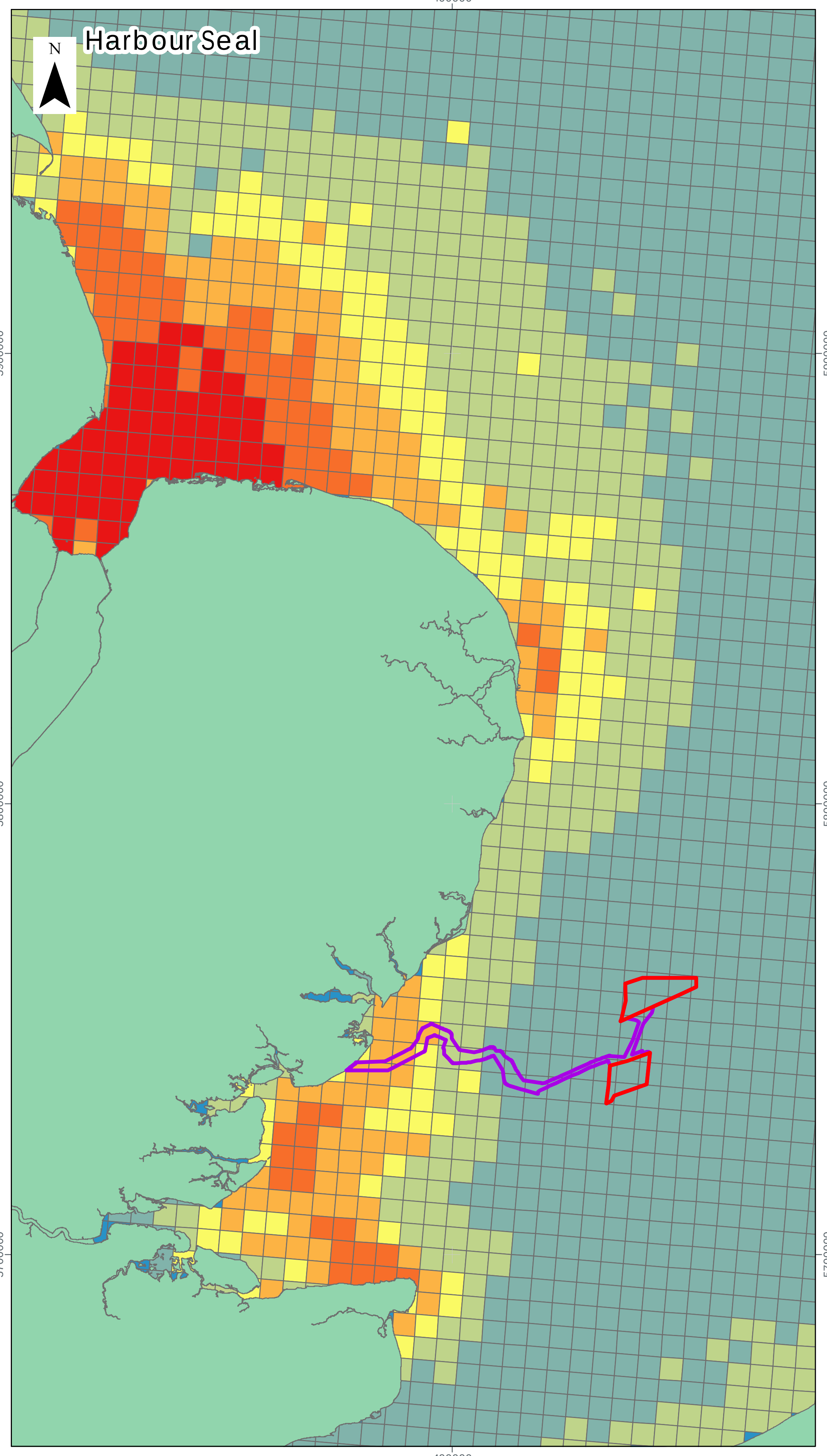
DRAWING NUMBER:

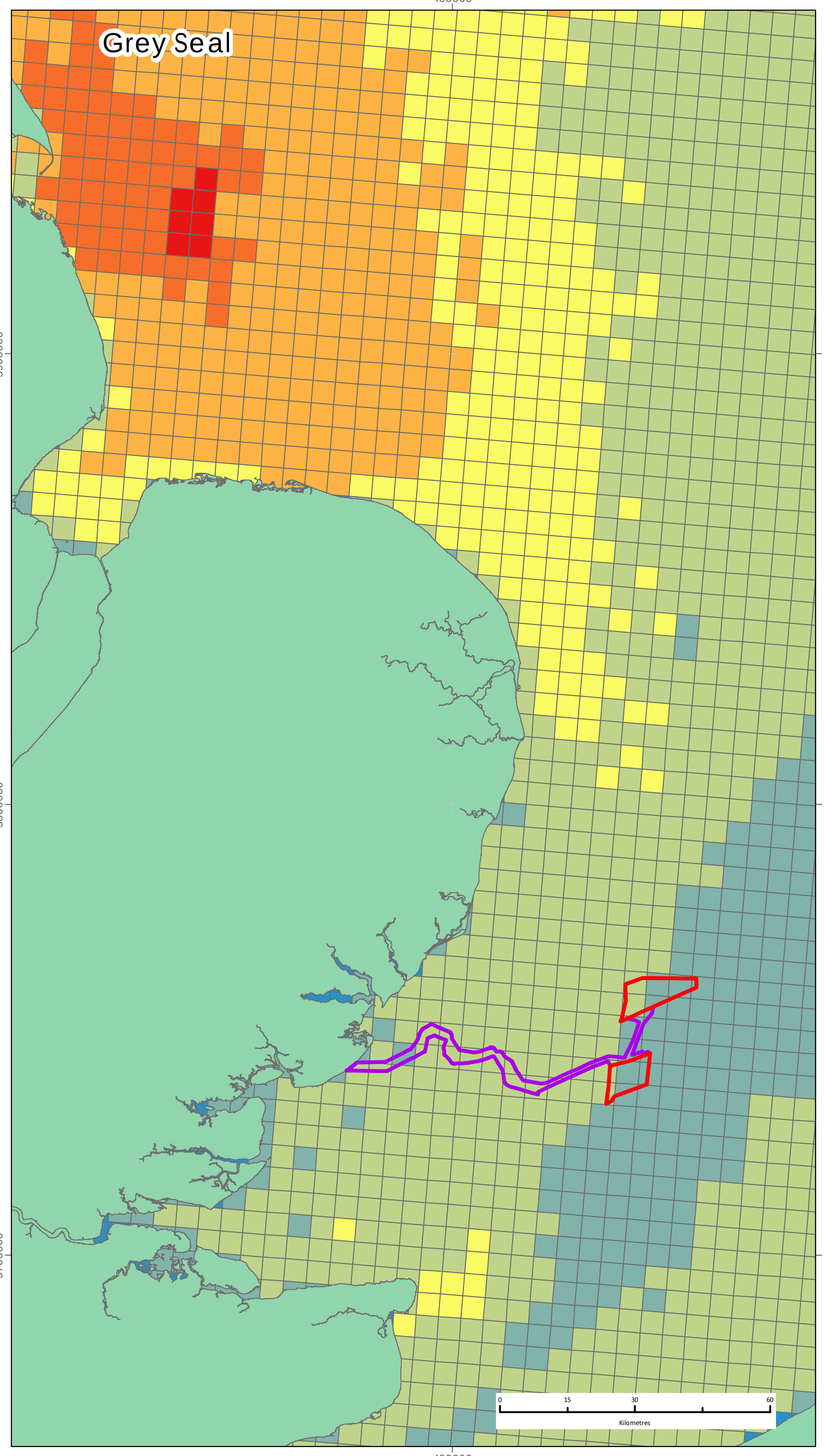
11.3

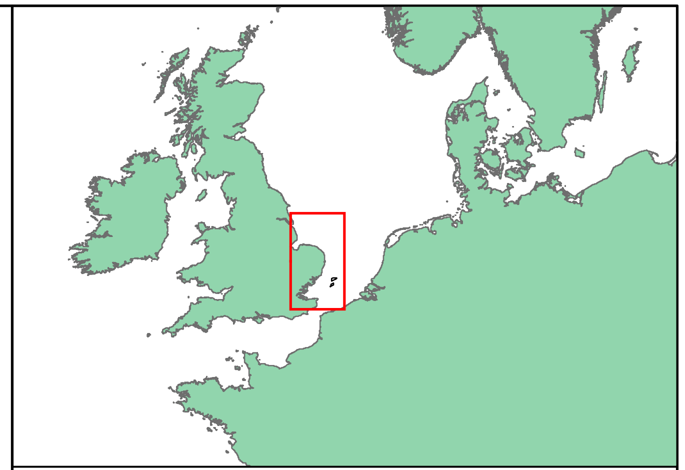
SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:2,500,000	A3	WGS84	UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

C:\Users\rp28.ST-ANDREWS\Documents\GIS\5Est\Scoping\VE_Marine_Mammals_Scoping_Fig2_SealHaulOuts.mxd







LEGEND

- Array Areas
- Offshore Area of Search

% British Isles At-Sea Population per cell (25 km²)

- 0.00
- 0.00 - 0.001
- 0.001 - 0.005
- 0.005 - 0.01
- 0.01 - 0.025
- 0.025 - 0.05
- >0.05

Data Source:
Basemap:
Seal habitat preference maps from Carter et al. (2020)

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Seal At-Sea Distribution

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	RRS	FM

DRAWING NUMBER:

11.4

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:1,250,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

C:\Users\vp28 ST-ANDREWS\Documents\GIS\5Est\Scoping\VE_Marine_Mammals_Scoping_Fig3_SealDensity.mxd

DESIGNATED SITES

11.4.22 A separate HRA screening report has been completed for VE (VE OWLF 2021), which includes details of the designated sites screened into the proposed HRA for each marine mammal species. This section outlines the SACs[60] within the assessment management units for each marine mammal species (Table 11.2 and Figure 11.5).

11.4.23 There is one UK designated site for harbour porpoise in the North Sea MU: the Southern North Sea SAC. The VE array areas and most of the offshore AoS are located within the winter area of the Southern North Sea SAC.

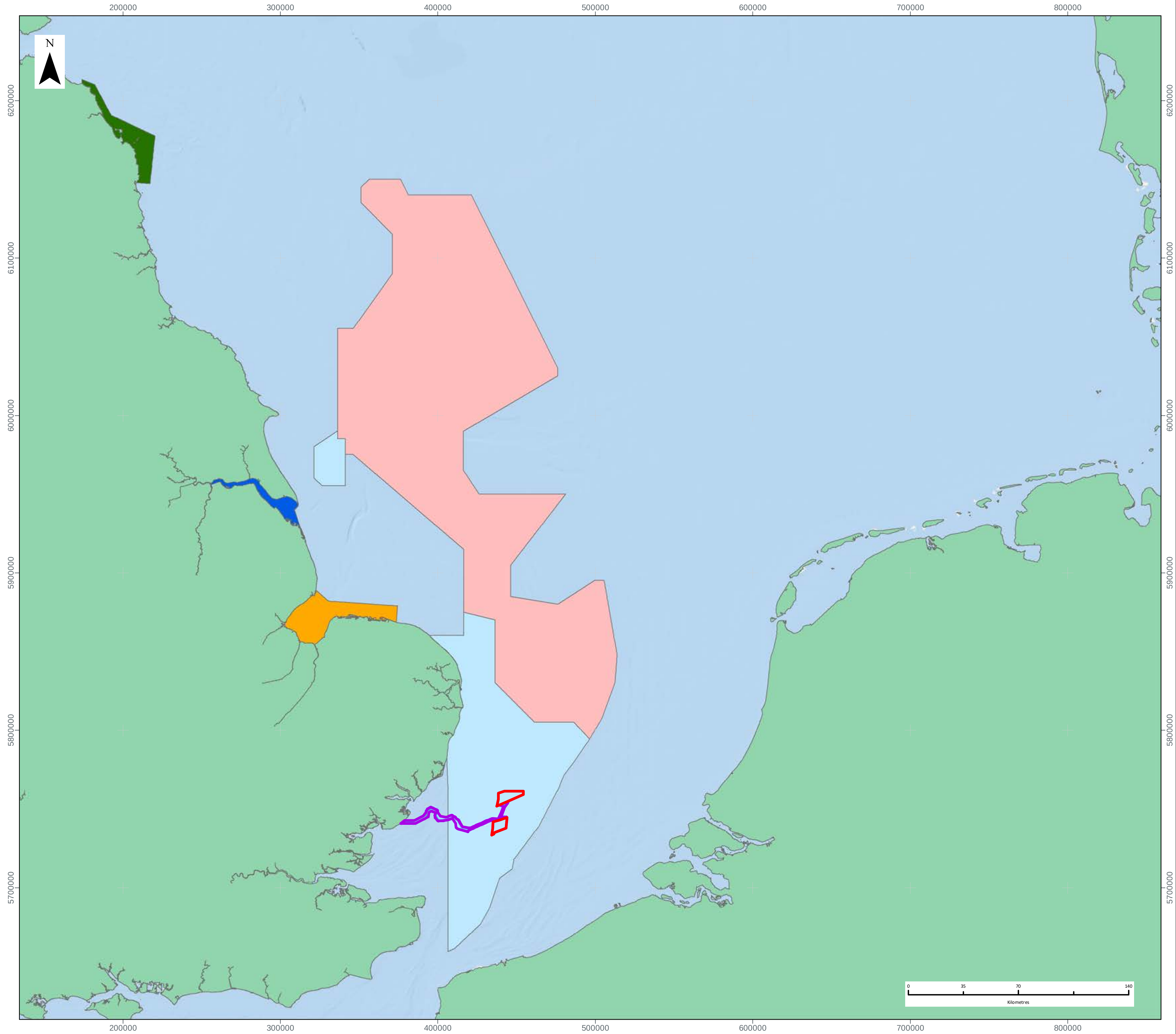
11.4.24 There is one harbour seal designated site in Southeast England MU: The Wash and North Norfolk Coast SAC.

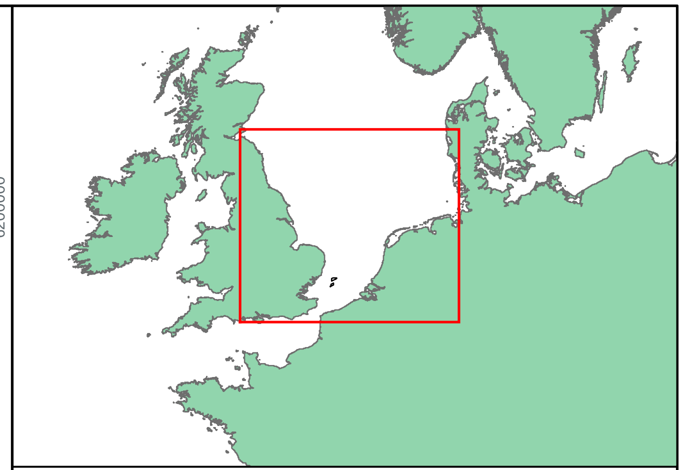
11.4.25 There are two designated sites for grey seals within the Southeast and Northeast England MUs: the Humber Estuary SAC and the Berwickshire and North Northumberland Coast SAC.

Table 11.2 - Marine nature conservation designations with relevance to marine mammals and VE

SITE	CLOSEST DISTANCE TO VE	FEATURES OR DESCRIPTION
Southern North Sea Special Area of Conservation: Winter Area	Coincident with the VE array areas and part of the offshore AoS	Primary reason for site selection - harbour porpoise
The Wash and North Norfolk Coast Special Area of Conservation	~140 km swimming distance from the VE array areas	Primary reason for site selection - harbour seal
Humber Estuary Special Area of Conservation	~215 km swimming distance from the VE array areas	Qualifying feature – grey seal
Berwickshire and North Northumberland Coast Special Area of Conservation	~450 km swimming distance from the VE array areas	Primary reason for site selection – grey seal

[60] No potential pSACs were identified.





LEGEND

- Array Areas
- Offshore Area of Search
- Berwickshire and North Northumberland SAC
- Humber Estuary SAC
- The Wash SAC
- Southern North Sea SAC SummerArea
- Southern North Sea SAC Winter Area

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Marine Mammal SACs

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	RRS	FM

DRAWING NUMBER:

11.5

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:2,500,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

C:\Users\rp28.ST-ANDREWS\Documents\GIS\5Est\Scoping\VE_Marine_Mammals_Scoping_Fig4_SACs.mxd

11.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

11.5.1 Key guidance/best practice that will be referred to in undertaking the assessment of impacts for marine mammals are as follows:

- Institute of Ecology and Environmental Management (IEEM) guidelines for marine and coastal ecological impact assessment in Britain and Ireland (IEEM 2010, CIEEM 2019);
- European Union Guidance on wind energy developments and Natura 2000 legislation (European Commission 2010);
- Oslo Paris Convention (OSPAR) Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR 2008);
- The marine mammal PTS-onset noise exposure criteria recommended in Southall et al. (2019);
- Position statement from the Joint Statutory Nature Conservation Bodies in relation to the use of ADDs for marine mammal mitigation during offshore wind farm construction (JNCC et al. 2016);
- Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs (England, Wales & Northern Ireland) JNCC Report No. 654 (May 2020); and
- Guidance on mitigation protocols to minimise the risk of injury to marine mammals from piling noise (JNCC 2010).

POTENTIAL PROJECT IMPACTS

11.5.2 A range of potential impacts on marine mammals have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 11.3, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) to enable an assessment of the impact.

11.5.3 Based on the marine mammal information currently available and the project description, a number of impacts are proposed to be scoped out of the EIA for this topic. These impacts are described in Table 11.4, together with a justification for scoping them out.

Table 11.3- Impacts proposed to be scoped into the assessment for marine mammals

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
11.1	PTS (piling)	The impact of impact piling during construction may result in hearing damage/auditory injury (PTS) in marine mammals.	Noise modelling will be undertaken to quantitatively assess the risk of PTS. Unless any new guidance is published prior to the impact assessment, the Southall et al. (2019) thresholds will be used to assess the risk of PTS. The risk of injury will be based on both of the dual criteria: cumulative sound exposure level (SEL_{cum}) and peak sound pressure level (SPL_{peak}). To assess the SEL_{cum} criterion, the predictions of received sound level over 24 hours are frequency weighted, to reflect the hearing sensitivity of each functional hearing group. The SPL_{peak} criterion is for unweighted received sound level. If required, population level modelling will be conducted using the iPCoD model. VE OWFL has commissioned monthly digital video aerial surveys across VE array areas and a 4 km buffer. These surveys were undertaken between April 2019 and February 2021. The density estimates obtained from these surveys (and/or other sources as required) will be used in the impact assessment to estimate the number of animals predicted to experience PTS-onset.
11.2	Disturbance (piling)	The impact of impact piling during construction may result in behavioural	Underwater noise modelling will be undertaken to quantitatively assess the risk of disturbance.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		disturbance/ displacement of marine mammals.	The assessment of disturbance will be based on the best practice methodology at the time of assessment, making use of the best available scientific evidence. It is likely, based on current practice, that the methodology will incorporate the application of a species-specific dose-response approach rather than a fixed behavioural threshold approach. Noise contours at appropriate intervals will be generated by noise modelling and overlain on species density surfaces to predict the number of animals potentially disturbed. This will allow the quantification of the number of animals that potentially will respond. If required (for example, if the assessment concludes a significant impact), population level modelling will be conducted using the iPCoD model to determine if the impact is sufficient to result in changes at the population level. Density estimates from digital video aerial surveys (and/or other sources as required) will be used in the impact assessment to estimate the number of animals predicted to experience behavioural disturbance/ displacement.
11.3	PTS and disturbance (other construction activities)	The impact of other construction related activities (e.g. dredging, trenching, rock dumping) may result in behavioural disturbance/ displacement of marine mammals.	Noise modelling will be undertaken to quantitatively assess the risk of PTS. Unless any new guidance is published prior to the impact assessment, the Southall et al. (2019) thresholds will be used to assess the risk of PTS. Density estimates from digital video aerial surveys (and/or other

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			sources as required) will be used in the impact assessment to estimate the number of animals predicted to experience PTS. Evidence on disturbance ranges from noise modelling and from the literature will be used to assess the likely magnitude of impact.
11.4	PTS (UXO)*	The clearance of UXOs by detonation may result in hearing damage/auditory injury (PTS) in marine mammals.	Noise modelling will be required to quantitatively assess the risk of PTS. Unless any new guidance is published prior to the impact assessment, the Southall et al. (2019) thresholds will be used to assess the risk of PTS. Density estimates from digital video aerial surveys (and/or other sources as required) will be used in the impact assessment to estimate the number of animals predicted to experience PTS-onset.
11.5	Disturbance (UXO)*	The clearance of UXOs by detonation may result in behavioural disturbance/ displacement of marine mammals.	Noise modelling may be required to quantitatively assess the risk of disturbance. The assessment of disturbance will be based on the best practice methodology at the time of assessment, making use of the best available scientific evidence. It is likely based on current practice that the methodology will incorporate an effective deterrence range approach. Density estimates from digital video aerial surveys (and/or other sources as required) will be used in the impact assessment to estimate the number of animals predicted to experience behavioural disturbance/ displacement.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
11.6	Collision risk (vessel)	Increased vessel traffic during construction, operation and maintenance and decommissioning activities may result in collisions with marine mammals.	Expected vessel numbers during construction, O&M and decommissioning phases will be compared to baseline levels of vessel activity to quantify the potential increase. Assessment of impact will be based on the most up to date scientific evidence on the effect of vessels on marine mammals (for example: Benhemma-Le Gall et al. 2020).
11.7	Disturbance (vessel)	Increased vessel traffic during construction, operation and maintenance and decommissioning activities may result in behavioural disturbance/ displacement of marine mammals.	Expected vessel numbers during construction, O&M and decommissioning phases will be compared to baseline levels of vessel activity to quantify the potential increase. Assessment of impact will be based on the most up to date scientific evidence on the effect of vessels on marine mammals (for example: Benhemma-Le Gall et al. 2020) .
11.8	Change in water quality	Increases in Suspended Sediment Concentration (SSC) resulting from construction activities may impact on the ability of marine mammals to forage.	This assessment will be dependent on the results of the Physical Processes impact assessment. Based on conclusions on the nature and extent of SSC, an assessment of the impact on marine mammals will be made based on the potential for disruption to foraging.
11.9	Change in fish abundance/ distribution	Changes in prey abundance and distribution resulting from construction, operation and decommissioning activities may impact on the ability of marine mammals to forage in the area.	The key prey species for marine mammals will be identified. This assessment will be dependent on the results of the benthic and fish ecology impact assessment. Based on conclusions on the nature, extent and significant of effects on any fish species that form an important part of marine mammal diet, an assessment of the impact on marine mammals will be made based on the potential for reductions in prey availability.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
11.10	Operational noise	Disturbance and/or displacement of marine mammals due to the noise generated by operations WTGs.	This assessment will be based on any available data on the operational noise produced by similar sized WTGs.

* Note: UXO clearance activities will not be licenced in the DCO, a separate Marine Licence will be submitted once there is more information on the number and size of UXOs in the area. However, an indicative assessment will be included in the EIA.

Table 11.4 - Impacts proposed to be scoped out of assessment for marine mammals

IMPACT NO	IMPACT	JUSTIFICATION FOR SCOPING OUT
11.11	Accidental pollution (Construction, O&M and decommissioning)	The impact of pollution including accidental spills and contaminant releases associated with the construction of infrastructure and use of supply/service vessels may lead to direct mortality of marine mammals or a reduction in prey availability either of which may affect species' survival rates. With implementation of an appropriate Project Environmental Management Plan (PEMP) it has been agreed with SNCBs on consent applications for other OWFs, that complete mortality within the equivalent extent of a windfarm's array plus buffer area is considered very unlikely to occur, and a major incident that may impact any species at a population level is considered very unlikely. It was predicted that any impact will be of local spatial extent, short term duration, intermittent and medium reversibility within the context of the regional populations and be not significant in EIA terms. This is considered to be equally applicable to VE for which construction will be comparable in scale and operation within the same environment, whilst implementing an appropriate PEMP.
11.12	Temporary threshold shift (Construction, O&M and decommissioning)	Exposure to loud sounds can result in a reduction in hearing sensitivity. This reduction in sensitivity (threshold shift) can be permanent (PTS) or temporary (TTS). Reductions in hearing sensitivity may affect an animal's ability to forage, avoid predation and communicate but the TTS onset ranges alone do not allow assessment of the magnitude or significance of the likely consequences for individuals and ultimately populations of the predicted extent over which any TTS might occur. The magnitude of the consequence is likely to be related to the duration and magnitude of the TTS. However, the current TTS onset thresholds are inappropriate to determine a biologically significant level of TTS. It is asserted that any effects of TTS, as currently defined, are captured in the period that marine mammals exposed to pile driving noise are predicted to be 'disturbed'. Therefore, a reduction in individual foraging capability as a result of exposure to pile driving noise will be included in the assessment and potential reductions in fitness as a result of noise exposure will be sufficiently captured by the assessment of disturbance.

IMPACT NO	IMPACT	JUSTIFICATION FOR SCOPING OUT
		TTS is by definition, temporary, and the duration of effect at the threshold for TTS onset is likely to be very short and therefore highly unlikely to cause any significant consequences for an animal. An impact range which encompasses such a large variation in the predicted effect on individuals is extremely difficult to interpret in terms of the potential consequences for individuals. It is important to bear in mind that the quantification of the spatial extent over which any impact is predicted to occur in the environmental assessment process, is done so in order to inform an assessment of the potential magnitude and significance of an impact. Because the TTS thresholds are not intended to indicate a level of impact of concern *per se* but are used to enable the prediction of where PTS might occur, they should not be used for the basis of any assessment of impact significance. As per stakeholder advice, the impact assessment will present TTS ranges and areas based on underwater noise modelling and published thresholds, as well as number of animals within these areas, but no assessment of the magnitude of TTS, marine mammal sensitivity to TTS or of the overall significance of the impact of TTS will be presented.
11.13	Electro-magnetic Fields (O&M)	Based on the data available to date, there is no evidence of electromagnetic fields (EMF) related to marine renewable devices having any impact (either positive or negative) on marine mammals (Copping 2018). There is no evidence that seals can detect or respond to EMF, however, some species of cetaceans may be able to detect variations in magnetic fields (Normandeau et al. 2011). To date, the only marine mammal known to show any response to EMF is a non-UK species, the Guiana dolphin (*Sotalia guianensis*) which has been shown to possess an electroreceptive system, which uses the vibrissal crypts on their rostrum to detect electrical stimuli similar to those generated by small to medium sized fish (Czech-Damal et al. 2013). However, this has not been shown in any other species of marine mammal.

IMPACT NO	IMPACT	JUSTIFICATION FOR SCOPING OUT
11.14	Barrier Effects	A number of recent studies have reported the presence of marine mammals within wind farm footprints. For example, at the Horns Rev and Nysted offshore wind farms in Denmark, long-term monitoring showed that both harbour porpoise and harbour seals were sighted regularly within the operational OWFs, and within two years of operation, the populations had returned to levels that were comparable with the wider area (Diederichs et al. 2008). Similarly, a monitoring programme at the Egmond aan Zee OWF in the Netherlands reported that significantly more porpoise activity was recorded within the OWF compared to the reference area during the operational phase (Scheidat et al. 2011) indicating the presence of the windfarm was not adversely affecting harbour porpoise presence. Other studies at Dutch and Danish OWFs (Lindeboom et al. 2011) also suggest that harbour porpoise may be attracted to increased foraging opportunities within operating offshore wind farms. In addition, recent tagging work by Russell et al. (2014) found that some tagged harbour and grey seals demonstrated grid-like movement patterns as these animals moved between individual WTGs, strongly suggestive of these structures being used for foraging. Previous reviews have also concluded that operational wind farm noise will have negligible barrier effects (Madsen et al. 2006, Teilmann et al. 2006a, Teilmann et al. 2006b, CEFAS 2010, Brasseur et al. 2012). All evidence for harbour porpoise and seal species collated to date shows that while individuals may be displaced in the short-term during construction activities, they return to the area of impact after the cessation of activities (e.g. Russell et al. 2016b, Brandt et al. 2018, Benhemma-Le Gall et al. 2020). Therefore while disturbance leading to temporary displacement may occur, this is expected to be spatially and temporally small scale and thus it is not expected that any stage of the VE project will result in a permanent barrier to the movement of marine mammals in the area.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

11.5.4 As part of the design process for VE, a number of embedded mitigation measures are proposed to reduce the potential for impacts on marine mammal receptors. These are presented below. These will evolve over the development process as the EIA progresses and in response to consultation.

11.5.5 VE OWFL are committed to implement these measures, and also various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/out presented in Table 11.3 and Table 11.4.

11.5.6 Measures adopted as part of the project will include:

- Development of, and adherence to, a Vessel Management Plan;
- Implementation of a Site Integrity Plan for the management of potential impacts on the Southern North Sea harbour porpoise SAC;
- Implementation of a piling Marine Mammal Mitigation Protocol;
- Implementation of a UXO Marine Mammal Mitigation Protocol[61];
- During the construction phase, piling operations of foundations (for both turbine and substation/platform foundation installations) will undergo a soft-start;
- Development of, and adherence to, an appropriate; and
- Development of, and adherence to, a Decommissioning Programme.

POTENTIAL CUMULATIVE IMPACTS

11.5.7 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For marine mammals, cumulative interactions may occur with other planned OWF as well as other activities in the study areas.

11.5.8 For marine mammal receptors the approach to cumulative impact assessment will be holistic and combine all potential sources of underwater noise. This will include pile driving of OWFs together with disturbance and collision risk from vessels at OWFs, UXO detonations, seismic surveys and any other offshore construction developments where information is available within the relevant MUs for each species for the anticipated periods of construction, O&M and decommissioning of VE.

[61] Note: UXO clearance activities will not be licenced in the DCO, a separate Marine Licence will be submitted once there is more information on the number and size of UXOs in the area.

11.5.9 The key cumulative impact is likely to relate to underwater noise from pile driving and UXO. There is the potential for this impact to have a large spatial footprint (with regard to disturbance effects). This could have cumulative impacts spatially (i.e. if two or more piling operations are undertaken simultaneously) or temporally (i.e. if piling operations are happening consecutively). It is necessary to consider that even if a piling programme is scheduled for many months, the actual duration of pile driving will be limited to a few hours per pile given the experience of other projects in the southern North Sea. A range of realistic scenarios for cumulative underwater noise impacts will be developed for the CIA, based on publicly available information, liaison with other developers where possible, as well as consultation with the regulators and stakeholders.

11.5.10 The impacts of fishing and shipping will not be considered in the CIA since these activities occurred throughout the baseline and are therefore already accounted for in the existing marine mammal baseline characterisation abundance and density estimates.

POTENTIAL TRANSBOUNDARY IMPACTS

11.5.11 A description of how potential transboundary effects will be assessed is outlined in Chapter 4: Environmental Impact Assessment approach and methodology. As presented in Chapter 4, the limits of the Dutch, Belgian and French Exclusive Economic Zones (EEZ) are located approximately 16 km (south east), 25 km (south) and 18 km (north east) of the VE array areas respectively.

11.5.12 There is the potential for transboundary impacts upon marine mammals due to the mobile nature of marine mammal species and the proximity of VE to the borders of surrounding EEZ States, which are movement ranges of certain species.

11.5.13 Direct impacts may occur due to underwater noise generated during construction and decommissioning, particularly piling during the installation of foundations. Indirect impacts may case disturbance to prey (fish) species from loss of fish spawning and nursery habitat and suspended sediments and deposition. The operation and maintenance phase is considered less likely to result in significant transboundary impacts.

11.5.14 The probability of transboundary impacts to marine mammals occurring during construction, particularly as a result of underwater noise from piling, is potentially high although the extent cannot be determined at this stage and will be subject to assessment in the EIA. Behavioural disturbance resulting from underwater noise during construction could occur over large ranges (tens of kilometres) and therefore there is the potential for transboundary effects to occur where subsea noise arising from VE could extend into waters of other EEZ| states. These impacts are predicted to be short term and intermittent, with recovery of marine mammal populations to affected areas following completion of all piling activities.

11.5.15 HRA screening will be conducted to identify all possible transboundary effects relating to marine mammals. The transboundary SACs likely to be included for consideration include:

- Klaverbank SCI – grey seal, harbour seal, harbour porpoise;
- Dutch Doggersbank SCI and German Doggerbank SCI – grey seal, harbour seal, harbour porpoise;
- Waddenzee SAC - grey seal, harbour seal;
- Noordzeekustzone SAC – grey seal, harbour seal, harbour porpoise; and
- Noordzeekustzone II pSCI – grey seal, harbour seal, harbour porpoise.

11.5.16 It is proposed that impacts upon marine mammals and their nature conservation interests, in so far as they are scoped into the main EIA process will also be subject to transboundary assessment and are not screened out at this time. Likely significant effects upon European Sites with marine mammals as qualifying features, will be assessed within the HRA (VE OWLF 2021).

11.6 NEXT STEPS

11.6.1 Production of marine mammal baseline characterisation and agreement with stakeholders on the density and abundance estimates selected for impact assessment.

11.6.2 Identification of noise modelling locations and development of approach to underwater noise modelling to inform PTS and disturbance impact assessments.

11.7 FURTHER CONSIDERATIONS FOR CONSULTEES

- Do you agree that the data sources identified are sufficient to inform the marine mammal baseline for the VE PEIR and ES?
- Do you agree that all the marine mammal protected areas within the study area have been identified?
- Have all potential impacts resulting from VE been identified for marine mammal receptors?
- Do you agree that the impacts described in Table 11.4 can be scoped out?
- For those impacts scoped in (Table 11.3), do you agree that the methods described are sufficient to inform a robust impact assessment?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of VE on marine mammal receptors?
- Do you have any additional specific requirements for the underwater noise modelling and assessment methodology?

12. ORNITHOLOGY

12.1 INTRODUCTION

12.1.1 This chapter of the Scoping Report identifies the offshore ornithology receptors of relevance to the VE array areas and offshore cable corridor Area of Search (offshore AoS). It describes the potential effects from the construction, operation and maintenance, and decommissioning of VE on offshore ornithology and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

12.1.2 Impacts on birds in the intertidal and onshore areas are considered in Chapter 19: Terrestrial Ecology and Nature Conservation.

12.2 STUDY AREA

12.2.1 The offshore ornithology study area is the area considered to represent a realistic maximum spatial extent of potential impacts on Important Ornithological Features (IOFs). The study area includes the north and south VE array areas and their 4 km buffers, plus the offshore AoS (Figure 12.1).

12.2.2 It should be noted that the study area may be subject to review and amendment for future stages (PEIR and subsequently ES) as a result of such matters as refinement of the offshore AoS and the identification of additional environmental or engineering constraints.

12.3 BASELINE DATA

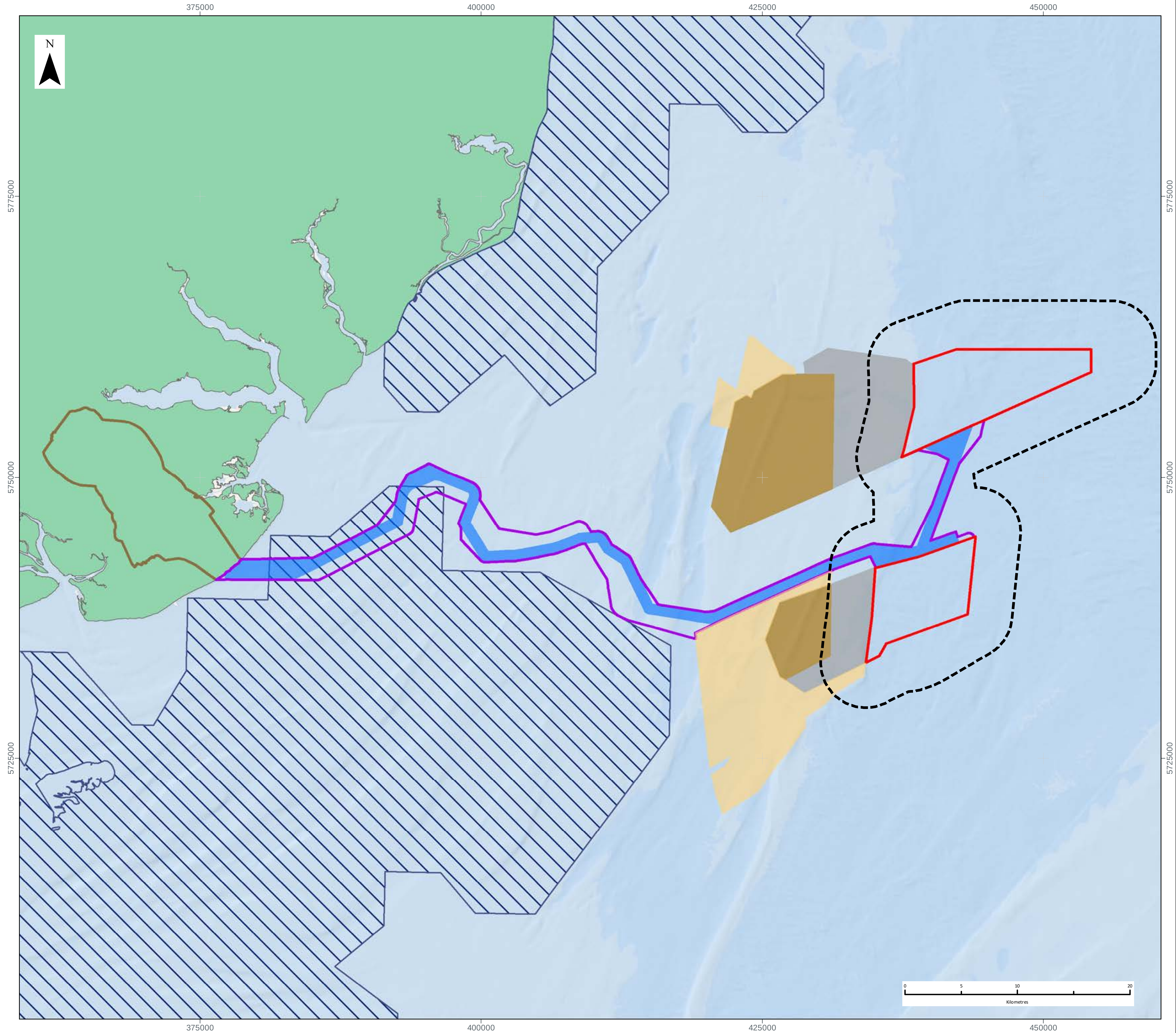
12.3.1 A series of project-specific aerial surveys were undertaken between March 2019 to February 2021 by HiDef Aerial Surveying Limited ('HiDef'). The survey area encompassed the VE array areas and a 4 km buffer (Figure 12.1); the aerial survey transect lines were each separated by 2.5 km^2 across the 606 km^2 survey area to achieve a minimum target of 10% coverage. The two-year programme carried out a total of 24 surveys, one per month, to provide distribution and density/abundance data for all observed species. In 18 months a higher coverage rate of 15% was obtained, since these surveys coincided with those conducted for post-construction monitoring of the adjacent Galloper OWF.

12.3.2 Reported ornithology data for the adjacent Galloper OWF and Greater Gabbard OWF have been drawn upon to inform this desk-based characterisation of the study area for the purposes of this Scoping Report. Any additional data from ongoing post-construction and characterisation surveys from adjacent projects will also be fully considered, where available, as part of the VE impact assessment. These comprise surveys which overlapped with, or were in proximity to the study area, as detailed in Table 12.1.

12.3.3 A variety of sources of information (Table 12.1) will also be considered as part of a desk-based survey to describe the baseline environment, including both peer-reviewed scientific literature and the 'grey literature' such as other OWF project submissions and reports. Published literature on seabird ecology and distribution, and on the potential impacts of wind farms will also be considered.

12.3.4 Owing to the short-term nature and small spatial scale of potential impacts on IOFs from installation of the offshore export cable, no specific surveys in the offshore AoS were conducted (outside of the survey area defined above), and therefore the above data sources, which are considered to provide an appropriate level of detail for impact assessment purposes, will be used to inform the baseline characterisation and impact assessment for the offshore AoS.

12.3.5 Information on statutory sites and their interest features has been drawn from the web-based resource Multi-Agency Geographic Information for the Countryside [MAGIC www.magic.defra.gov.uk], Natural England [www.naturalengland.org.uk] and JNCC [www.jncc.defra.gov.uk] websites.



LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- Onshore Area of Search
- Galloper OWF site
- Greater Gabbard OWF
- North Falls OWF
- Outer Thames Estuary (Special Protection Area)
- Survey Area

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

VE Study Area

VER	DATE	REMARKS	Drawn	Checked
2	17/09/2021	Second Issue	LNF	MT
1	20/07/2021	First Issue	LNF	MT

DRAWING NUMBER:

12.1

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

FIVE ESTUARIES
OFFSHORE WIND FARM

Table 12.1 - Key sources of information for ornithology that will be considered for PEIR where available

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Galloper OWF baseline (2009-10, vessel based), pre-construction (2014-15, aerial), construction (2016-18, aerial) and post-construction (2019 onwards, aerial).	Vessel-based and aerial seabird surveys.	Partial coverage of VE array areas, 4 km study area and offshore AoS.
Galloper OWF lesser black-backed gull tagging.	Post-construction monitoring study of foraging birds.	Potential for spatial overlap of records with VE array areas, 4 km study area and offshore AoS.
Greater Gabbard OWF baseline (2004-06), pre-construction (2008-09) and post-construction surveys (2009-10).	Vessel-based seabird surveys.	Partial coverage of offshore AoS and overlap/adjacent to 4 km study area.
Survey data from other southern North Sea OWFs, e.g. East Anglia projects, London array, Thanet.	Vessel-based and aerial seabird surveys (pre-, during-, post-construction).	Possible partial overlap with offshore AoS.
Information on Special Protection Areas (SPAs) such as Natural England site condition assessments, MAGIC and JNCC websites.	To determine seabird sites with potential connectivity	Individuals from SPA colonies may utilise VE array areas and offshore AoS.
Essex Wildlife Trust, Landguard Bird Observatory, British Trust for Ornithology and any other relevant nature organisations.	Information on breeding records, ringing recoveries etc.	Records may help determine movements of migratory species or foraging birds within VE array areas and offshore AoS.
Aerial survey of the Outer Thames SPA in 2018 (Irwin *et al*. 2019)	Flown on two survey days in February 2018, with the core objective being to ascertain numbers of red-throated divers, although other species were also recorded.	Covers the area of the SPA, with partial overlap with the offshore AoS.
2004-05, 2005-06, 2007-08 aerial surveys of the Thames Strategic Area (Department of Trade and	Regional and large-scale datasets of seabird activity.	May overlap with the VE array areas and the offshore AoS.

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Industry, 2006; Department of Energy & Climate Change, 2009), and SeaMaST (Bradbury *et al*. 2014).		
Garthe and Hüppop 2004; Drewitt and Langston 2006; Stienen *et al*. 2007; Speakman *et al*. 2009; Langston 2010; Band 2012; Cook *et al*. 2012; Furness and Wade 2012; Wright *et al*. 2012; Furness *et al*. 2013; Johnston *et al*. 2014a,b; Cook *et al*. 2014; Dierschke *et al*. 2017; SNCB, 2017; Jarrett *et al*. 2018; Leopold & Verdaat, 2018; Mendel *et al*. 2019.	Scientific literature describing potential impacts of OWFs on birds.	Species studied and types of study are likely to be applicable for impacts associated with the VE array areas and offshore AoS.
Mitchell *et al*. 2004; BirdLife International 2004; Holling *et al*. 2011; Frost *et al*. 2019; Musgrove *et al*. 2013; Furness 2015; Horswill *et al*. 2017.	Scientific literature describing bird population estimates and demographic rates.	Species studied will include those associated with the VE array areas and offshore AoS.
Cramp and Simmons 1977-94; Del Hoyo *et al*. 1992-2011; Robinson 2005.	Scientific literature on bird breeding ecology.	Species studied will include those associated with the VE array areas and offshore AoS.
Stone *et al*. 1995; Brown and Grice 2005; Kober *et al*. 2010; Balmer *et al*. 2013.	Scientific literature on bird distribution.	Areas covered by studies include the VE array areas and offshore AoS.
Wernham *et al*. 2002; Thaxter *et al*. 2012; Woodward *et al*. 2019.	Scientific literature on bird migration and foraging movements.	Areas covered by studies include the VE array areas and offshore AoS.

12.4 BASELINE ENVIRONMENT

12.4.1 This section provides information on the baseline marine ornithological environment, gathered from a desk-based assessment of information available to date.

DESIGNATED SITES

12.4.2 The impact assessment will consider potential connectivity of the VE with sites with statutory designation for nature conservation, which have birds listed as qualifying features. Four classes of statutory designated sites will be considered: SPAs, Proposed Special Protection Areas (pSPAs), Ramsar sites and Sites of Special Scientific Interest (SSSIs).

12.4.3 Sites which may have connectivity to the VE array areas and offshore AoS include those designated for breeding seabirds and those for terrestrial, coastal or marine bird interests (typically overwintering aggregations).

12.4.4 The VE array areas do not directly overlap with any ornithological designations (Figure 12.1). However, as breeding seabirds can travel considerable distances it is necessary to give consideration to designated sites beyond the array boundaries. The extent of connectivity between seabird SPAs and offshore wind farms during the breeding season is largely a function of distance and species-specific foraging ranges. Outside the breeding season, patterns of migration are used to infer the origins of species recorded. Terrestrial / coastal sites designated for migrant species outside the breeding season may therefore be connected on the grounds of passage movements through the VE array areas.

12.4.5 Full consideration of connectivity of European Sites (SPAs and Ramsar sites) is being provided in a separate Habitats Regulations Assessment (HRA) Screening report (VE OWFL, 2021). This will cover in more detail matters associated with European designations and will also be discussed with Natural England and RSPB as part of the DCO application process (see also Chapter 5). For the EIA, a review of SSSIs will be undertaken to consider potential connectivity with VE. This will include consideration of terrestrial sites along the English coast which host over-wintering and migratory populations of waders and wildfowl which have the potential to undertake migratory flights across the VE array areas.

12.4.6 The VE array areas are located at least 17km from the Outer Thames Estuary SPA to the west, and the offshore AoS overlaps with this SPA (Figure 12.1). Potential impacts on qualifying features will therefore need consideration. The SPA qualifies under Article 4.1 of the Birds Directive (2009/147/EC) as it is used regularly by 1% or more of the Great Britain populations of the following species listed in Annex I:

- Red-throated diver (non-breeding): 6,466 individuals (1989 – 2006/07), 38.0% of GB population;
- Little tern (breeding): 746 individuals (2011 – 2015), 19.64% of GB population; and
- Common tern (breeding): 532 individuals (2011 – 2015), 2.66% of GB population.

12.4.7 Species likely to be taken forward to impact assessment as IOFs will be those which have been recorded during surveys within the study area and which are considered to be at potential risk either due to their abundance, potential sensitivity to wind farm impacts or due to biological characteristics (e.g. commonly fly at rotor heights) which make them potentially susceptible. Aerial surveys of the array areas have now been completed, however data analysis has not been completed. Therefore, a list of species most likely to be considered IOFs is presented in Table 12.2, as determined from available information outlined in Table 12.1, in particular the Galloper OWF and Greater Gabbard OWF survey results and EIAs. This species list may be subject to change based on the final analysis of the VE aerial surveys and stakeholder consultation.

Table 12.2 – Nature conservation value summary of species considered at risk of impacts

SPECIES	NATURE CONSERVATION VALUE
Red-throated diver, *Gavia stellata*	Outer Thames Estuary SPA species, Birds of Conservation Concern (BoCC) (Eaton *et al.*, 2015) Green listed, Birds Directive Migratory Species, Birds Directive Annex I, International Union for Conservation of Nature (IUCN) Red List 'Least Concern' status.
Fulmar, *Fulmarus glacialis*	BoCC Amber listed, Birds Directive Migratory Species, IUCN Red List 'Least Concern' status.
Gannet, *Morus bassanus*	BoCC Amber listed, Birds Directive Migratory Species, IUCN Red List 'Least Concern' status.
Common scoter, *Melanitta nigra*	BoCC Red listed, Birds Directive Migratory Species, IUCN Red List 'Least Concern' status.
Arctic skua, *Stercorarius parasiticus*	BoCC Red listed, Birds Directive Migratory Species, IUCN Red List 'Least Concern' status.
Great skua, *Catharacta skua*	BoCC Amber listed, Birds Directive Migratory Species, IUCN Red List 'Least Concern' status.
Kittiwake, *Rissa tridactyla*	BoCC Red listed, Birds Directive Migratory Species, IUCN Red List 'Vulnerable' status.
Little gull, *Hydrocoloeus minutus*	BoCC Green listed, Birds Directive Migratory Species, IUCN Red List 'Near Threatened' status.
Common gull, *Larus canus*	BoCC Amber listed, Birds Directive Migratory Species, IUCN Red List 'Least Concern' status.

SPECIES	NATURE CONSERVATION VALUE
Herring gull, *Larus argentatus*	BoCC Red listed, Birds Directive Migratory Species, IUCN Red List ‘Near Threatened’ status.
Lesser black-backed gull, *Larus fuscus*	BoCC Amber listed, Birds Directive Migratory Species, IUCN Red List ‘Least Concern’ status.
Great black-backed gull, *Larus marinus*	BoCC Amber listed, Birds Directive Migratory Species, IUCN Red List ‘Least Concern’ status
Little tern, *Sternula albifrons*	Outer Thames Estuary SPA species, BoCC Amber listed, Birds Directive Annex I, Migratory Species, IUCN Red List ‘Least Concern’ status.
Common tern, *Sterna hirundo*	Outer Thames Estuary SPA species, BoCC Amber listed, Birds Directive Annex I, Migratory Species, IUCN Red List ‘Least Concern’ status.
Guillemot, *Uria aalge*	BoCC Amber listed, Birds Directive Migratory Species, IUCN Red List ‘Least Concern’ status.
Razorbill, *Alca torda*	BoCC Amber listed, Birds Directive Migratory Species, IUCN Red List ‘Near Threatened’ status.

12.4.8 Data analysis for the EIA will consider seasonal variations in site usage by IOFs as well as the importance of the site for each species' different life stages. Table 12.3 provides an overview of relevant seasons for each species based on information from Furness (2015), where available.

12.4.9 Reference populations for each species and population sizes will be based on the best available information at the time of undertaking the assessment and will be agreed with relevant stakeholders. The conservation status (Table 12.2) of each species will also be taken into consideration.

Table 12.3 –Species specific definitions of biological seasons (from Furness 2015)

SPECIES	BREEDING	MIGRATION FREE BREEDING	MIGRATION - AUTUMN	MIGRATION – FREE WINTER	MIGRATION – SPRING (RETURN MIGRATION THROUGH UK WATERS)	NON-BREEDING
Red-throated diver	Mar-Aug	May-Aug	Sep-Nov	Dec-Jan	Feb-Apr	-
Fulmar	Jan-Aug	Apr-Aug	Sep-Oct	Nov	Dec-Mar	-
Gannet	Mar-Sep	Apr-Aug	Sep-Nov	-	Dec-Mar	-
Common scoter	Not included in Furness 2015 (but only present in the nonbreeding season)					
Arctic skua	May-Jul	Jun-Jul	Aug-Oct	Nov-Mar	Apr-May	Aug-Apr
Great skua	May-Aug	May-Jul	Aug-Oct	Nov-Feb	Mar-Apr	Sep-Apr
Kittiwake	Mar-Aug	May-Jul	Aug-Dec	-	Jan-Apr	-
Little gull	Not included in Furness 2015 (but only present in the nonbreeding season)					
Common gull	Not included in Furness 2015					
Herring gull	Mar-Aug	May-Jul	Aug-Nov	Dec	Jan-Apr	Sep-Feb
Lesser black-backed gull	Apr-Aug	May-Jul	Aug-Oct	Nov-Feb	Mar-Apr	-
Great black-backed gull	Mar-Aug	May-Jul	Aug-Nov	Dec	Jan-Apr	Sep-Mar
Little tern	May-Aug	Jun	Jul-Sep	Oct-Mar	Apr-May	Aug-Apr
Common tern	May-Aug	Jun-mid July	Jul-Sep	Oct-Mar	Apr-May	Sep– Apr
Guillemot	Mar-Jul	Mar-Jun	Jul-Oct	Nov	Dec-Feb	Aug-Feb
Razorbill	Apr-Jul	Apr-Jul	Aug-Oct	Nov-Dec	Jan-Mar	-

12.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

12.5.1 The impact assessment methodology will be based on that described in Chapter 4: Environmental Impact Assessment approach and methodology, tailored to make it applicable to ornithology IOFs, and aligned with the key guidance document produced on impact assessment of ecological/ornithological receptors (CIEEM 2018; updated 2019).

12.5.2 The assessment approach will use a 'source-pathway-receptor' model, which identifies likely impacts on IOFs resulting from the proposed construction, operation and decommissioning of the offshore infrastructure. The parameters of this model are defined as follows:

> Source – the origin of a potential impact (noting that one source may have several pathways and receptors), e.g. an activity such as cable installation and a resultant effect such as re-suspension of sediments.

> Pathway – the means by which the effect of the activity could impact an IOF, e.g. for the example above, re-suspended sediment could settle and smother the seabed.

> Receptor – the element of the receiving environment that is impacted, e.g. for the above example, bird prey species living on or in the seabed are unavailable to foraging birds.

12.5.3 The aerial surveys will provide information on species (or species-groups if species identification is not possible), abundance, distribution, behaviour, location, numbers, sex and age (where possible) and direction (although it should be noted that flight height estimation from aerial survey is subject to a large degree of uncertainty and these data are not currently supported for use in assessment of collision risk). The EIA will identify the nature of the use of the site by birds recorded - i.e. seasonal differences and activities (i.e. foraging, overwintering, migrating or other) in order to determine the importance of the site relative to the wider area for seabird populations throughout the year.

12.5.4 Detailed analysis will include density and abundance estimates (with associated confidence intervals and levels of precision).

12.5.5 Flight height data will be reported, however, owing to the technical difficulties in estimating flight height from aerial imagery, it is anticipated that generic flight data (Johnston *et al*. 2014a, 2014b) will be used in the collision risk model (subject to discussion with stakeholders). Thus, CRM will be conducted using the Band (2012) CRM, Option 2.

12.5.6 Reference populations for each species and population sizes will be based on the best available information at the time of undertaking the assessment and will be agreed with key stakeholders.

12.5.7 The sensitivity of each species will be determined based on the size of its population, its conservation status and its known sensitivity to offshore wind farms. Species identified as IOFs will be subject to full impact assessment against the impacts listed below. The impact assessment will be undertaken in line with guidance by CIEEM (2018; updated 2019) and expert opinion.

POTENTIAL PROJECT IMPACTS

12.5.8 A range of potential impacts on offshore ornithology have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 12.4, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) to enable an assessment of the impact.

12.5.9 Based on the baseline environment information currently available and the project description (outlined in Chapter 3: Project Description) a number of impacts are proposed to be scoped out of the EIA for offshore ornithology. These impacts are outlined in Table 12.5, together with a justification for scoping them out

Table 12.4 - Impacts proposed to be scoped in to the assessment for offshore ornithology

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
Construction			
12.1	Direct temporary habitat loss/ disturbance due to construction	Construction activities such as increased vessel activity and underwater noise may result in direct disturbance or displacement of birds from important feeding and roosting areas, potentially resulting in direct habitat loss.	VE array areas: VE OWFL commissioned monthly digital video aerial surveys across the VE array areas and a minimum 4 km buffer. These surveys commenced in March 2019 and were completed in February 2021. An analysis of existing survey data for the Greater Gabbard OWF and Galloper OWF areas will be conducted and this will supplement the site-specific bird surveys, for use in determining numbers of individuals of each IOF potentially affected. Offshore AoS: It is considered that there is sufficient existing data (available from the sources outlined above in Table 12.1) to describe the ornithological baseline of the offshore components of the offshore AoS and no further specific surveys are proposed. In order to focus the assessment of disturbance and displacement, a screening exercise will be undertaken to identify those species most likely to be at risk. Any species recorded only in very small numbers within the study area or with a low determined sensitivity to displacement (as per e.g. Furness & Wade, 2012; Furness *et al*. 2013) will be screened out of further assessment. The assessment of remaining IOFs will be based on relevant disturbance-displacement scientific studies which will aid determination of magnitude of displacement and resultant effects.
12.2	Indirect impacts on IOFs due to impacts on prey	Impacts include those resulting from underwater noise (e.g. during piling) or	A review of the data and impact assessments for Benthic and Intertidal Ecology (Chapter 10) and Fish and Shellfish Resource (Chapter 11) will

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
	species due to construction	the generation of suspended sediments (e.g. during preparation of the seabed for foundations) that may alter the distribution, physiology or behaviour of bird prey species and thereby have an indirect effect. These mechanisms could potentially result in less prey being available in the area adjacent to active construction works to foraging seabirds.	be conducted within the context of the potential impacts on offshore ornithology. This will relate to the VE array areas and preferred OECR.
OPERATION			
12.3	Operational disturbance and displacement	The presence of Wind Turbine Generators (WTGs) has the potential to disturb and displace birds from within and around the VE array areas. This will have the potential to reduce the area available to birds for feeding or loafing. Vessel activity and the lighting of	VE array areas: Information on the assessment of disturbance-displacement is included in the proposed assessment methodology in paragraphs 12.5.1 to 12.5.7 above.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		WTGs and associated ancillary structures could also attract (or repel) certain species of birds and affect migrating birds.	
12.4	Indirect impacts on IOFs through direct effects on prey species and habitats	Indirect impacts could potentially include those resulting from the production of underwater noise and the generation of suspended sediments (e.g. due to scour or maintenance activities) that may alter the distribution or behaviour of bird prey species. There is also evidence that fish and mobile invertebrates may be attracted to the operational area (Kerckhof *et al.*, 2010; Emu Limited 2008; Krone *et al.*, 2013; Linley *et al.*, 2008 and Wilhelmsson, 2006) and so beneficial impacts may occur.	VE array areas: an analysis of the data and impact assessments for Benthic and Intertidal Ecology (Chapter 10) and Fish and Shellfish Resource (Chapter 11) will be conducted within the context of the potential impacts on offshore ornithology.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
12.5	Collision Risk	There is a risk of birds in flight colliding with rotating WTG blades. The susceptibility of species to collision risk depends upon physiological and behavioural characteristics of the species, in addition to the project design specifications.	VE array areas: collision risk modelling (CRM) will be undertaken using industry-standard approaches (i.e. Band, 2012, Donovan 2018) to predict potential collision rates from this impact. The population-level impacts of the resulting potential additional mortality will be considered. The exact option and version of the collision risk model to be used, avoidance rates, flight height data, nocturnal activity rates and parameters for modelling will be based upon the best available evidence and will be agreed with stakeholders and clearly defined within the EIA and HRA.
DECOMMISSIONING			
12.6	Decommissioning Impacts	During decommissioning, the potential impacts are anticipated to be similar to those described above for the construction phase but on a smaller scale. There may also be an incremental reduction of impact as the permanent structures are removed from the site.	See descriptions of approach to assessment under impacts 13.1 and 13.2.

Table 12.5 – Impacts proposed to be scoped out of assessment for offshore ornithology

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
12.7	Construction indirect impacts through effects on prey species and habitats: Accidental pollution	The impact of pollution including accidental spills and contaminant releases associated with the construction of infrastructure and use of supply/service vessels may lead to direct mortality of birds or a reduction in prey availability either of which may affect species' survival rates. With implementation of an appropriate Project Environmental Management Plan (PEMP) it has been agreed with stakeholders on consent applications for other OWFs, that complete mortality within the equivalent extent of a wind farm's array plus buffer area is considered very unlikely to occur, and a major incident that may impact any species at a population level is considered very unlikely. It was predicted that any impact will be of local spatial extent, short term duration, and not significant in EIA terms. This is considered to be equally applicable to VE for which construction will be comparable in scale and operation and within the same environment, whilst implementing an appropriate PEMP. Therefore, subject to consultation with the stakeholders and feedback received on this Scoping Report, it is intended to scope this impact out of further consideration within the EIA.
12.8	Construction collision risk with installed but no commissioned turbines and construction vessels	Following turbine installation, but in advance of commissioning, the rotors may rotate and therefore present potential risks of collision to seabirds. However, the additional period when this risk will be present (turbine installation will be expected to be completed within a few months at most), combined with fact that a smaller number of turbines will be involved for most of this period, means that this is considered to be a comparatively small additional risk on top of the period of operational collision risk (which is scoped in). Against a backdrop of a 30 year operational phase, a period of months with a lower associated collision risk will not materially alter the conclusions of the operational assessment. Therefore turbine collision risk during construction is scoped out. There is a possibility that seabirds may collide with construction vessels, however for several reasons this is considered likely to be a very small risk which does not require assessment. Species most at risk will be expected to be those which fly low with direct flight and lower manoeuvrability (e.g. auks, red-throated divers, etc.). However, these species are also those which are expected to avoid vessels to the greatest extent, and therefore will be at low risk of collisions. Species which

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
		more commonly approach vessels, such as gulls, have high manoeuvrability and are therefore also at very low risk of collision with vessels.
12.9	Operational disturbance and displacement (offshore AoS)	Given that potential impacts along the offshore export cable route will be highly localised and episodic (i.e. limited to any maintenance or repair of the export cables) it is proposed that this impact should be scoped out from further consideration within the EIA in relation to the offshore AoS, with the focus of operational disturbance-displacement on the VE array areas only. Best practice operations and maintenance vessel operation will be agreed with relevant stakeholders and secured in the appropriate documents (e.g. Deemed Marine License, DML, and Development Consent Order, DCO), covering sensitive areas and specified periods of the year to ensure minimal disturbance to species such as red-throated diver.
12.10	Barrier Effects (operation)	For the purposes of assessment of displacement for resident birds, it is usually not possible to distinguish between displacement and barrier effects - for example to define where individual birds may have intended to travel to, or beyond an offshore wind farm, even when tracking data are available. Therefore, in the impact assessment the effects of displacement and barrier effects on resident IOFs are considered together.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

12.5.10 As part of the design process for VE a number of designed-in measures are proposed to reduce the potential for impacts on offshore IOFs. These are presented below. These will evolve over the development process as the EIA progresses and in response to consultation.

12.5.11 VE OWFL are committed to implement these measures, as well as various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/out presented in Table 12.4 and Table 12.5.

12.5.12 A key driver for the identification of the preferred OECR was the location of key ornithological designations present along the coastline to the west of this area (see paragraphs 12.4.2 to 12.4.6 Designated Sites), and avoidance of these while minimising overlap with the Outer Thames Estuary SPA as far as possible. Furthermore, with respect to the Outer Thames Estuary SPA, the OECR is aligned with deeper water channels which is both less preferred habitat for red-throated divers and also already subject to higher levels of vessel traffic. Therefore, additional disturbance to this species will be kept to a minimum.

12.5.13 Further mitigation measures that will be adopted for the VE that are relevant to offshore ornithology include:

- Use of larger and more widely spaced WTGs than older developments, following advances in wind turbine technology, to achieve the required overall maximum export capacity, which typically reduces collision risks, and is also likely to reduce displacement effects;
- Development of, and adherence to, a PEMP to reduce direct and indirect disturbance-displacement effects;
- Implementation of a best practice protocol for minimising disturbance to the Outer Thames Estuary SPA (or any other potentially affected designated site) qualifying features during construction and operation, which will comprise restrictions of vessel movements to and from the VE array areas (including determining best practice on vessel movements through the SPA when red-throated divers are present), and any offshore AoS construction activity within the SPA. This will be agreed with relevant stakeholders and secured in the appropriate documents (e.g. DML and DCO); and
- During the construction phase, piling operations of foundations (for both WTG and Offshore Substation Platform, OSP) will undergo a soft start and ramp-up to help reduce disturbance impacts on IOFs.

12.5.14 The need for any further mitigation (and the feasibility of this) will be dependent on the results of site-specific survey and the impact assessment. Consultation with key ornithological stakeholders will be ongoing throughout the EIA process and will include the need for mitigation and the feasibility of potential options.

POTENTIAL CUMULATIVE IMPACTS

12.5.15 The cumulative impact assessment methodology will be based on that described in Chapter 4: Environmental Impact Assessment approach and methodology, adapted to make it applicable to offshore ornithology. The proposed format and approach for this is set out below.

12.5.16 The methodology will also be aligned with the approach to the assessment of cumulative impacts for offshore ornithology that has been applied by the Secretary of State when consenting offshore windfarms and confirmed in recent consent decisions. It also follows the approach set out in guidance from the Planning Inspectorate (Planning Inspectorate 2015) and from the renewables industry (RenewableUK 2013 and The Crown Estate, 2019).

12.5.17 Impacts proposed to be scoped into the cumulative assessment are:

- Operational disturbance;
- Displacement; and
- Collision risk.

12.5.18 There is a potential for cumulative impacts on birds due to operational, consented and planned offshore wind farms. As many bird species are highly mobile, there is the potential for the same bird populations to be affected by several wind farms. Of particular relevance to the cumulative assessment will be operational and consented wind farms in the southern North Sea and any further projects which may enter the consenting process during the period of the VE EIA.

12.5.19 Overall, the potential for cumulative impacts will be species-specific as the impacts will be dependent upon the individual sensitivities of each species, where the birds have originated from, and their potential to interact with other wind farms (i.e. on migratory or foraging travel).

12.5.20 Wherever possible the cumulative assessment will be quantitative (i.e. where data in an appropriate format have been obtained). However, the level of data available and the ease with which impacts can be combined across the windfarms is quite variable, reflecting the availability of relevant data for older projects and the approach to assessment taken. Where this has not been possible (e.g. for older projects), a qualitative assessment will be undertaken.

12.5.21 Other activities that could potentially have a cumulative impact on offshore IOFs include:

- Marine aggregate extraction;
- Oil and gas exploration and extraction;
- Sub-sea cables and pipelines; and
- Commercial shipping.

12.5.22 With respect to the other activities listed above, the cumulative assessment will take into account the fact that birds may already be habituated to on-going activities and therefore these may be considered to be part of the baseline conditions to avoid double-counting or exaggeration of potential impacts. Currently it is not expected that VE will contribute to cumulative effects with the above list of other activities and therefore these are scoped out.

12.5.23 The following impacts are also proposed to be scoped out of the cumulative impacts assessment out as the likelihood that other projects will overlap to create a cumulative effect is low:

- Cumulative construction; and
- Decommissioning.

12.5.24 This is based on the fact that the contribution from the proposed project to cumulative construction and decommissioning effects is likely to be small and is dependent on a temporal and spatial co-incidence of disturbance / displacement from other plans or projects (significant additive effects associated with simultaneous construction phases considered unlikely based on project information presented in the Crown Estate's (2019) OWF Extensions Plan-level Habitats Regulations Assessment).

POTENTIAL TRANSBOUNDARY IMPACTS

12.5.25 The potential transboundary impacts assessment will be based on that described in Chapter 4: Environmental Impact Assessment approach and methodology, adapted to make it applicable to offshore ornithology

12.5.26 There is a potential for collisions and displacement of IOFs at wind farms outside UK territorial waters, and for international seabird populations being affected by VE. This includes, in particular, Dutch and Belgian OWF projects located within the North Sea, and Dutch and Belgian seabird populations. Potential impacts relating to OWFs and seabird populations from other countries are considered less likely due to larger distances involved.

12.5.27 A quantitative/qualitative assessment will be undertaken depending on the level of data availability. As the spatial scale of assessment will be increased, the inclusion of non-UK seabird populations for a transboundary assessment will also increase the reference population sizes.

12.6 SUMMARY OF NEXT STEPS

12.6.1 Full and detailed methodology for the EIA will be agreed with stakeholders (including Natural England and RSPB). This will include the production of EIA method statements and Expert Topic Group (ETG) meetings where the methodology will be discussed and adopted accordingly based on relevant advice and perceived risk, progressed as part of the Evidence Plan Process (see chapter 5). The process and record of agreements and any unresolved issues will be presented within the Environmental Statement (ES) chapter. A Preliminary Environmental Impact Report (PEIR) will be produced in advance of the final assessment. This will be submitted to relevant stakeholders for review and with the final assessment informed by the comments received.

12.6.2 For the PEIR, the 24 months of aerial bird surveys covering the VE array areas (and associated 4 km buffer) between March 2019 to February 2021 will provide the key data source for the ornithology site characterisation and quantification of parameters for the impact assessment (e.g. CRM). The surveys have been conducted to provide a minimum of 10% coverage, although this level has been exceeded in 18 of the 24 months, for which 15% coverage was obtained due to the surveys being combined with post-construction monitoring of the Galloper OWF. Following early discussions on data collection methods with Natural England which focused on the percentage coverage, preliminary analysis of the survey data has been conducted to provide comfort that all of the survey data (i.e. including those months with 10% coverage) are robust and provide a reliable basis for assessment. This report, which demonstrates that 10% coverage exceeds the level at which robust density estimation is achieved, has been provided to Natural England and other ETG members for comment.

12.6.3 In addition, information from previous surveys in the wider area will be collated and provide further contextual information, alongside the literature and information sources outlined in Table 12.1.

12.6.4 Density (birds/km^2) and abundance will be estimated using design-based methods, with the density estimated for the surveyed area (i.e. the sum of all the aerial image footprints) and multiplied up to the total area to obtain an abundance estimate. This method makes the assumption that the surveyed sample is representative of the unsurveyed region, thus the design of survey is important (hence 'design based').

12.6.5 Confidence intervals for each species will be obtained using a bootstrap resampling method. For each survey, aerial survey images will be drawn randomly (with replacement) from the dataset until the same number of images as the original sample is obtained (e.g. if the survey for a particular month comprised 350 images, each resampled dataset also contained 350 images, drawn with replacement from the original dataset). This process will be repeated 1,000 times and then density and abundance will be calculated for each resampled dataset. The upper and lower 95% confidence limits will be calculated across the 1,000 samples to estimate sampling variation. The width of the confidence interval obtained using this method reflects the degree of aggregation in the species, with highly aggregated species estimated with lower precision (i.e. species observed frequently as individuals will have a small range of estimated densities, while species recorded in occasional large groups will have a wide range of estimated densities).

12.6.6 Any birds recorded during the aerial surveys that cannot be identified to species level will be assigned to a species. To do this, the density of each unidentified bird grouping (e.g. large gulls, small gulls, etc.) will be estimated (using the methods described above) and then added proportionately to each member species of that group. The proportions will be calculated from the ratios of positively identified birds in that group.

12.6.7 Density and abundance estimates will be adjusted to account for the number of guillemots and razorbills under the surface of the water at the time of the aerial surveys and therefore not recorded in the aerial images.

12.6.8 CRM will be conducted using the Band (2012) CRM, Option 2 with flight heights obtained from the BTO generic flight height dataset (Johnston et al. 2014a,b).

12.7 FURTHER CONSIDERATIONS FOR CONSULTEES

- Do you agree that the data sources identified are sufficient to inform the offshore ornithological baseline for the VE PEIR and ES?
- Have all potential impacts resulting from VE been identified for offshore IOFs?

Do you agree that the impacts described in Table 12.5 can be scoped out?

- For those impacts scoped in (Table 12.4), do you agree that the methods described are sufficient to inform a robust impact assessment?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of VE on offshore ornithology IOFs?
- Do you have any specific requirements for the CRM methodology?

13. COMMERCIAL FISHERIES

13.1 INTRODUCTION

13.1.1 This section of the Scoping Report identifies the commercial fisheries receptors of relevance to the VE array areas and offshore AoS. It describes the potential effects from the construction, operation and maintenance, and decommissioning of VE on commercial fisheries and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

13.1.2 This chapter should be read alongside the following chapters of this Scoping Report:

- Chapter 10: Fish and Shellfish Ecology, which includes consideration of potential impacts on species of commercial importance;
- Chapter 14: Shipping and Navigation, which includes consideration of potential impacts on vessel routing and navigational safety; and
- Chapter 18: Other Marine Users and Activities, which includes consideration of potential impacts on recreational sea angling.

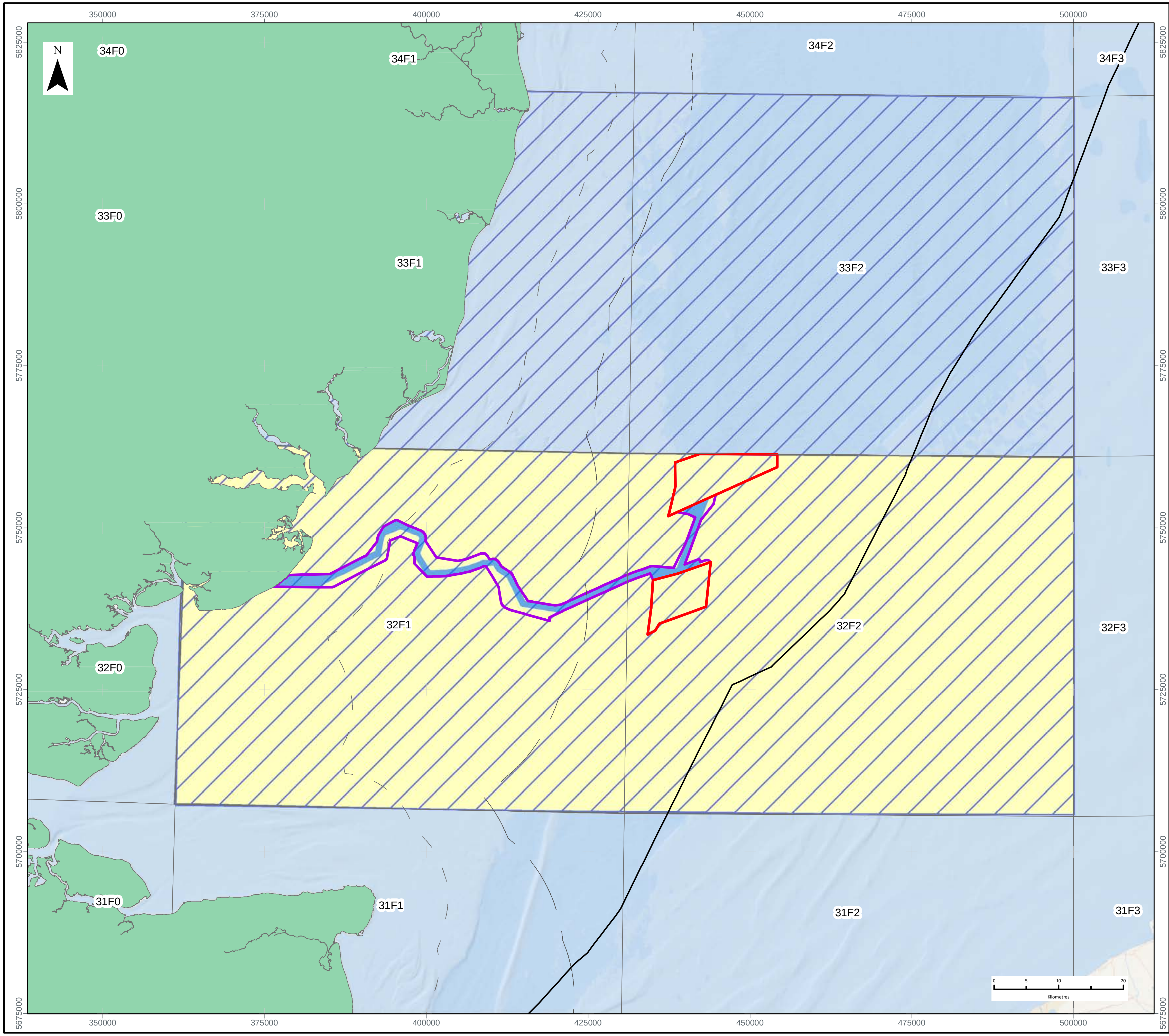
13.2 STUDY AREA

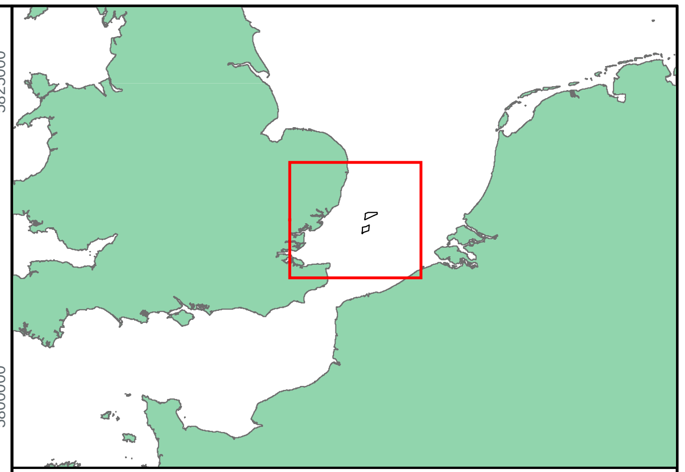
13.2.1 VE is located within the southern portion of the International Council for the Exploration of the Sea (ICES) Division 4c (Southern North Sea) statistical area[62]; within the UK Exclusive Economic Zone (EEZ) waters, with the array areas located outside the 12 nautical mile (NM) limit. For the purpose of recording fisheries landings, ICES Division 4c is divided into statistical rectangles which are consistent across all Member States operating in the North Sea.

13.2.2 The VE array areas are located within ICES rectangle 32F2 and the offshore AoS is within rectangle 32F1, as shown in Figure 13.1. VE occupies approximately 4 per cent of these two ICES rectangles.

13.2.3 Since the northernmost VE array area lies immediately adjacent to ICES rectangle 33F2, the commercial fisheries study area has been defined as ICES rectangles 32F2, 33F2, 32F1 and 33F1 as shown in Figure 13.1.

[62] ICES standardise the division of sea areas to enable statistical analysis of data. Each ICES statistical rectangle is '30 min latitude by 1-degree longitude' in size (approximately 30 x 30 nautical miles). A number of rectangles are amalgamated to create ICES statistical areas.





LEGEND

Array Areas
Offshore Area of Search
Preferred Offshore Export Cable Route
ICES Statistical Rectangles
ICES Rectangles 32F1 and 32F2
Commercial Fisheries Study Area
Fishing Limits
6 NM
12 NM
200 NM

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Commercial Fisheries Study Area

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	FN	SM

DRAWING NUMBER:

13.1

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:600,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

C:\1. Work 2021\Five Estuaries\VE mdx files SCOPING\15 Sep 2021\VE_CF_Fig1_Study area.mxd

13.3 BASELINE DATA

13.3.1 An initial desk-based review of literature and data sources was undertaken to support this scoping exercise, as presented in Table 13.1 below. Table 13.1 also identifies additional sources of information that will be expected to inform the assessment in the PEIR and ES.

Table 13.1 - Key sources of information for commercial fisheries

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Landings statistics for the period 2015-2019. Sourced from the Marine Management Organisation (MMO) and the European Union Data Collection Framework (EU DCF). Note EU DCF data is only available up to 2016.	Fisheries landings data for nationally registered fishing vessels landing to their home nation ports.	National dataset providing full coverage of the commercial fisheries study area.
Vessel Monitoring System (VMS) data, for the period 2015-2019. Sourced from ICES (2017 data) and the MMO (2015-2019 data). Each annual VMS dataset will be analysed to inform the PEIR and ES.	VMS data for fishing vessels greater than 12 or 15 m in length.	National dataset providing full coverage of the commercial fisheries study area.
First sale value of fisheries landings for the period 2012-2016. Sourced from the EU Market Observatory for Fisheries and Aquaculture (EUMOFA) database.	Landings sales values.	National dataset providing full coverage of the commercial fisheries study area.
UK Fisheries Information Mapping (UKFIM), with data covering a wide time series. Sourced from The Crown Estate. Data has been acquired and will be analysed and presented in the PEIR and ES.	Commercial fishing activity data based upon vessel plotter data.	Full coverage of the commercial fisheries study area.
Key species stock assessments. Sourced from ICES and the Eastern and Kent and Essex Inshore Fisheries and Conservation Authorities. Data yet to be sourced.	Reports on the stock status of commercially fished species.	Coverage of the commercial fisheries study area to be confirmed.
Non-UK vessel landings and VMS data (time period to be confirmed).	Fisheries landings and VMS data (to be confirmed).	Coverage of the commercial fisheries

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Sourced from the Netherlands Institute of Marine Research and the Belgian Institute for Agriculture, Fisheries and Food and other EU Member State agencies as appropriate. Data yet to be sourced.		study area to be confirmed.
Galloper Wind Farm Environmental Statement (2011).	Commercial fisheries impact assessment. Now dated but provides useful context.	Full coverage of the commercial fisheries study area.

13.3.2 It should be noted that the quantitative datasets identified in Table 13.1 may not fully capture or be representative, of all fishing activity in the commercial fisheries study area. For instance, it should be noted that the VMS datasets only covers vessels ≥12 m (ICES data) or ≥15 m (MMO data) in length. However, other published information is expected to provide a useful insight into fishing activity undertaken in inshore areas (e.g., including a number of Inshore Fisheries and Conservation Authority (IFCA) publications and aerial surveillance data). Information provided by the VE Fisheries Liaison Officer (FLO), such as the findings of fisheries scouting surveys across the VE array areas and offshore AoS, will also be reviewed. Consultation with fisheries stakeholders (via forums such as the established commercial fisheries working group) will further inform assessment in the PEIR/ES; consultation will be undertaken to gather additional baseline information and to provide insight into specific fishing grounds and activity of any vessels active in the area. Consultation will also be important to inform gear specifications for vessels active in the area, which will allow a full understanding of how they may be affected.

13.3.3 Variations and trends in commercial fisheries activity are an important aspect of the baseline assessment and forms the principal reason for considering up to five years of key baseline data. Given the time periods assessed, existing baseline data does not capture any potential changes in commercial fisheries activity resulting from notable recent events, namely the withdrawal of the UK from the EU and the COVID pandemic. However, information received by VE OWFL's FLO will be reviewed to further understand fishing activity in the area in 2021.

13.3.4 Following withdrawal, the UK and the EU have agreed to a Trade and Cooperation Agreement (TCA), applicable on a provisional basis from 1 January 2021. The TCA sets out fisheries rights and confirms that from 1 January 2021 and during a transition period until 30 June 2026, UK and EU vessels will continue to access respective Excusive Economic Zones (EEZs, 12-2000 NM) to fish. In this period, EU vessels with historic access rights will also be able to fish in specified parts of UK waters between 6-12 NM.

13.3.5 Existing baseline data also does not capture any potential changes in activity resulting from the 2020-2021 COVID pandemic, which has temporarily affected market demand and supply chains.

13.3.6 The PEIR/ES will further consider likely changes to the future baseline, primarily associated with withdrawal from the EU, taking into account planned changes in quota allocation.

13.4 BASELINE ENVIRONMENT

13.4.1 Landings from the study area had an approximate average annual value of €41 million for all EU Member States including the UK (based on five-years data from 2012 – 2016; EU DCF, 2019 and EU MOFA, 2019). Figure 13.2 shows the top twelve species landed from the study area by value; the proportion of value by vessel nationality and by species is shown. Landings of sole *Solea solea* accounted for over 60 percent of total landings values across the 2012 to 2016 period. Landings by non-UK vessels, and in particular by Dutch-registered vessels, accounted for a significant proportion of total landings values.

13.4.2 Figure 13.3 shows the top twelve species landed from the study area by weight from 2012 to 2016. The key species in terms of weight are plaice *Pleuronectes platessa*, sole and cockles *Cerastoderma edule*, though it is noted that cockles are targeted out with the VE array areas and offshore AoS as part of the Thames cockle fishery to the south. When compared to the value of landings, it can be seen that whilst catches of sole are lower by weight than plaice, their value far exceeds that of plaice owing to a higher market price. Similarly, whilst bass *Dicentrarchus labrax* are not within the top twelve species landed by weight, their market price means that they can be considered a key target species within the study area, especially for smaller vessels using drift and fixed nets.

13.4.3 Figure 13.4 displays the annual average landings weight between 2012 and 2016 by ICES rectangle and vessel nationality. Landings from ICES rectangle 32F2, in which the array areas are located, are greatest by weight and the majority of landings are made by Dutch-registered vessels. In ICES rectangle 33F2 to the north, landings weights are lower but similarly dominated by Dutch vessels. Inshore, in rectangles 32F1 and 33F1, the majority of landings are made by UK-registered English fishing vessels.

13.4.4 Key species targeted by UK-registered fishing vessels in ICES Rectangles 32F1 and 32F2 are identified in Figure 13.5 and Figure 13.6. Setting aside the cockle fishery, whelk *Buccinum undatum* dominate landings in terms of landed volume (Figure 13.5). Landings from ICES Rectangles 32F1 and 32F2 by UK-registered vessels had an approximate annual average value of £3 million (based on five-years data from 2015 – 2019; MMO, 2021). Figure 13.6 shows the top twelve species landed by UK vessels from ICES Rectangles 32F1 and 32F2 by value; the sole fishery generates an annual average value of approximately £640,000, the whelk fishery of approximately £410,000 and the bass fishery of approximately £230,000 (based on five-years data from 2015 – 2019; MMO, 2021). Recent engagement with stakeholders via the commercial fisheries working group, and the findings of fisheries scouting surveys undertaken across the array areas and offshore AoS in summer 2021, indicate that potting for whelk is a principal fishery within and adjacent to VE.

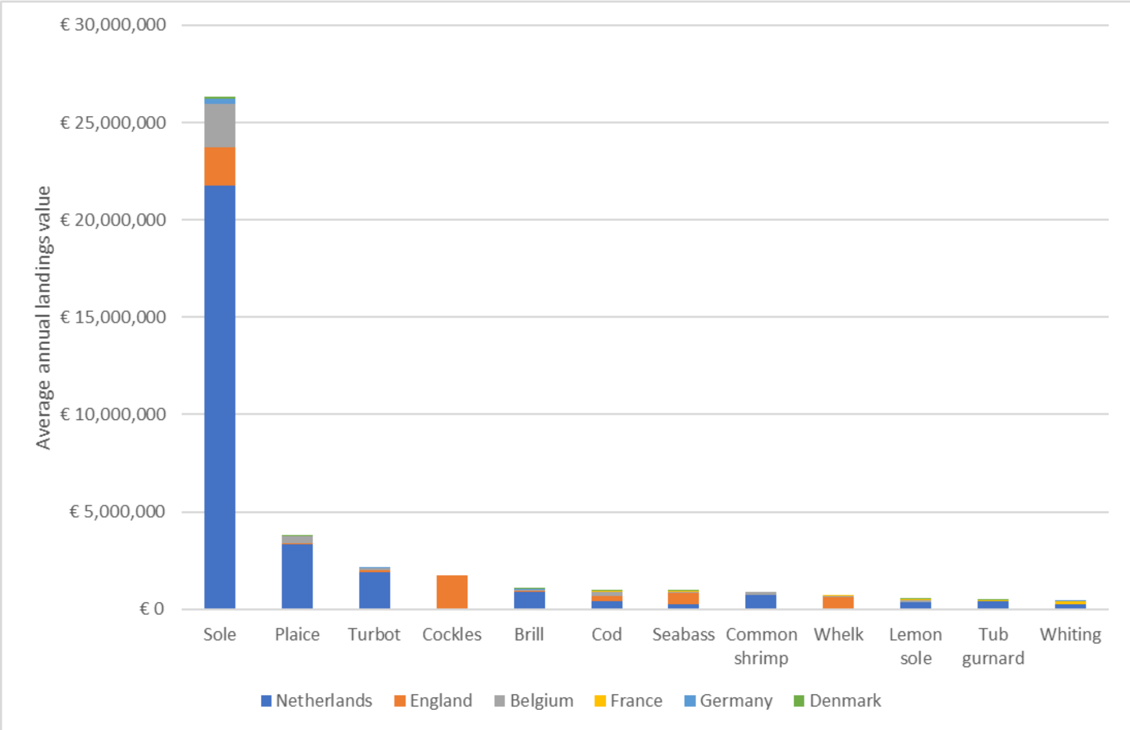


Figure 13.2 - Average annual value of landings from the study area by species and vessel nationality between 2012 and 2016. Source: EU DCF, 2021 and EU MOFA, 2021.

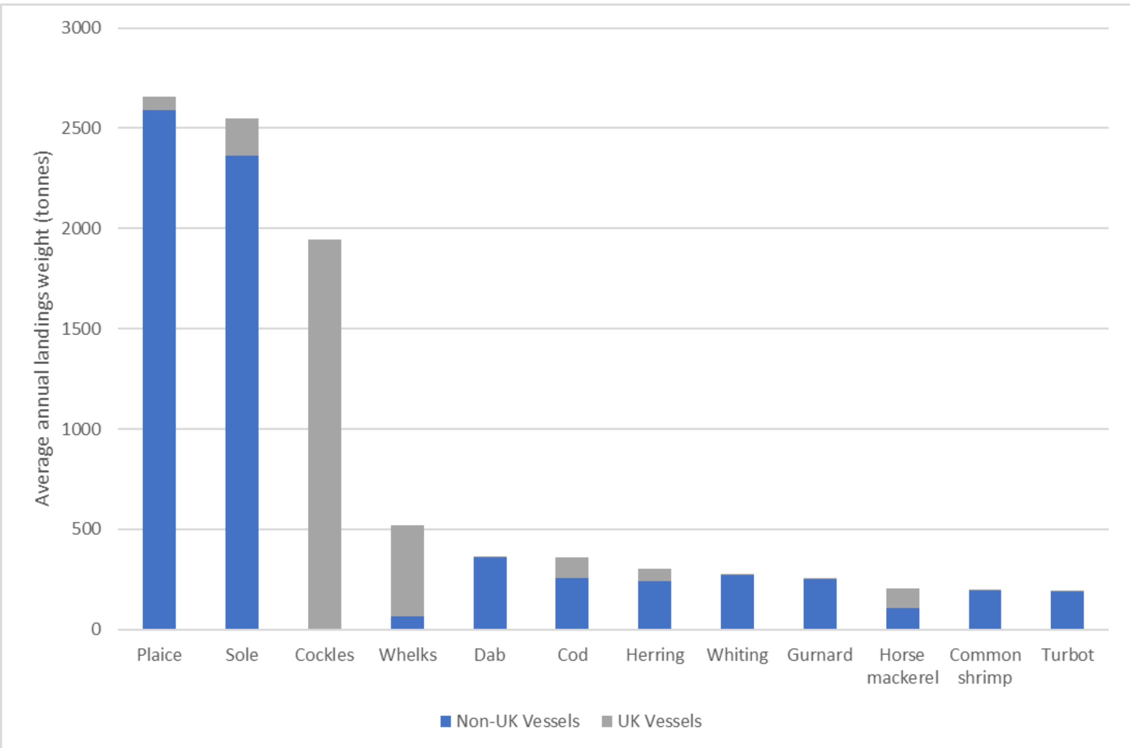


Figure 13.3 - Average annual weight of landings from the study area by species and vessel nationality between 2012 and 2016. Source: EU DCF, 2021.

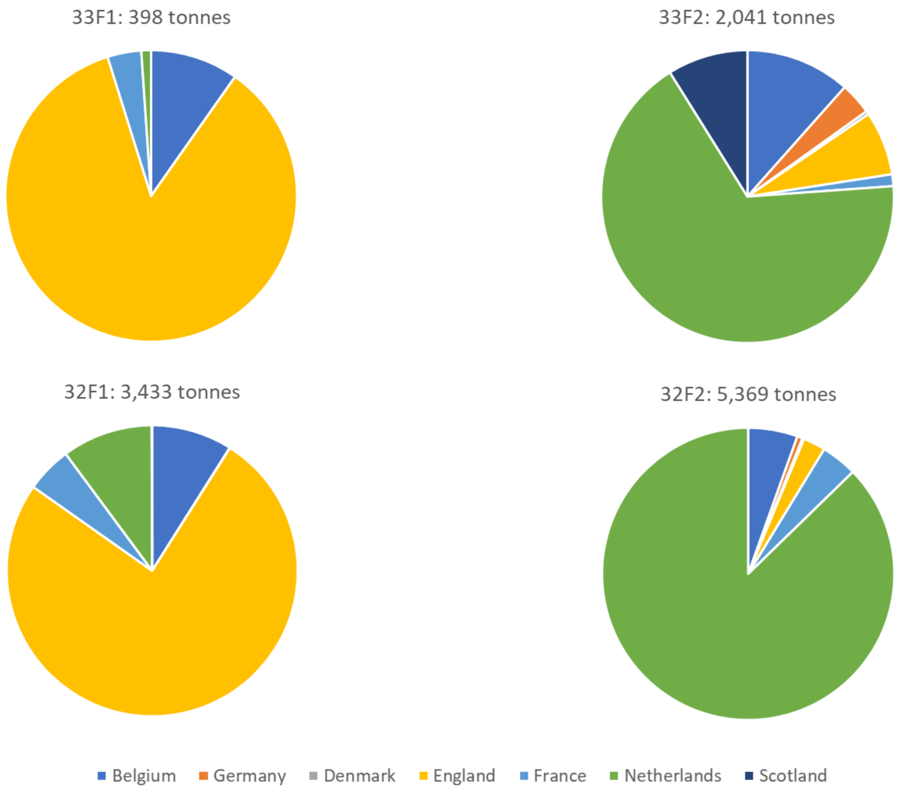


Figure 13.4 - Average annual weight of landings from the study area by ICES rectangle and vessel nationality between 2012 and 2016. Source: EU DCF, 2021.

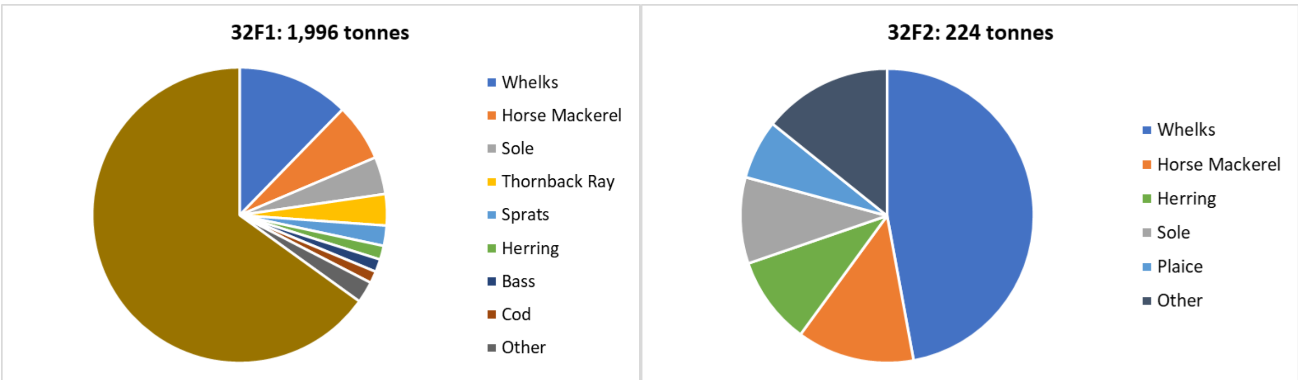


Figure 13.5 - Average annual weight of landings by UK-registered vessels from the ICES Rectangles 32F1 and 32F2by species between 2015 and 2019. Source: MMO, 2021.

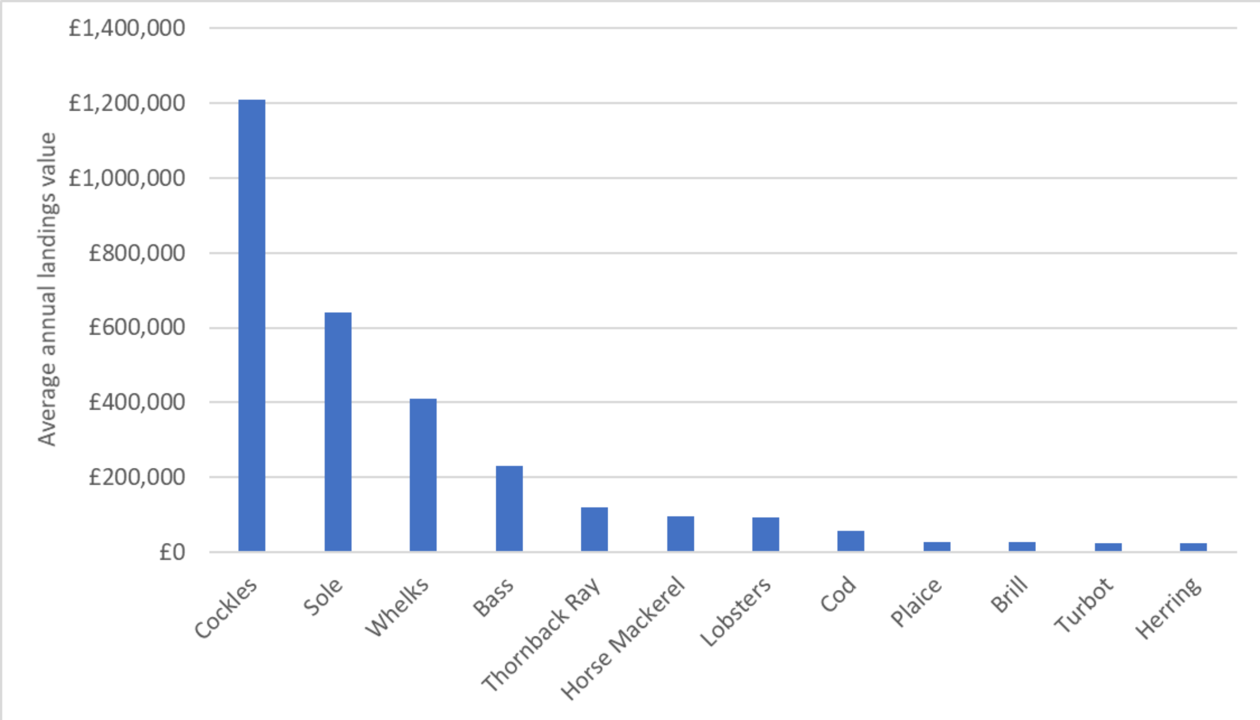


Figure 13.6 - Average annual value of landings by UK-registered vessels from the ICES Rectangles 32F1 and 32F2by species between 2015 and 2019. Source: MMO, 2021.

13.4.5 The landings data presented above indicates that the array areas are characterised by trawling by non-UK, predominantly Dutch, vessels. Activity is dominated by large (>15m length) vessels beam trawling for plaice and sole, and to a lesser extent pelagic trawling for species including herring *Clupea harengus*, whiting *Merlangius merlangus* and horse mackerel *Trachurus trachurus*. Fishing takes place year-round, with landings peaking between October and March. The Dutch beam trawl fleet operates widely across the Southern North Sea, beyond the UK 12 NM limit. Dutch vessels have used both traditional beam trawls and pulse wings, but a European Parliament ban was placed on pulse fishing in February 2019, with pulse fishing licences to be entirely withdrawn by July 2021. The Belgian fleet, also dominated by beam trawlers targeting sole and plaice, access fishing grounds in specific areas between the UK 6 NM and 12 NM limits as a result of their historic fishing rights. The French fleet similarly has historic rights to access specific areas between the UK 6 NM and 12 NM limits. A smaller number of UK-registered vessels are also active offshore, including beam trawlers and potting vessels. It is noted that very limited trawling activity and limited non-UK vessel activity was observed across the array areas during the summer 2021 fisheries scouting surveys.

13.4.6 Inshore, across the offshore AoS, a number of UK and non-UK fleets are in operation. UK potting vessels of various sizes target whelks year-round with landings peaking in spring and winter months. Smaller (<10m length) UK vessels target bass, sole and other species using fixed nets year-round with peak landings in spring months. Smaller vessels also use longlines to target bass, cod *Gadus morhua* and rays, again operating year-round with landings peaking in spring. Many of these smaller vessels typically switch between gears on a seasonal basis. Larger vessels from the UK, Netherlands, Belgium and France trawl for (and to a lesser extent use nets to target) a variety of species including flatfish species named above, and skates and rays, cod and common shrimp *Crangon crangon*.

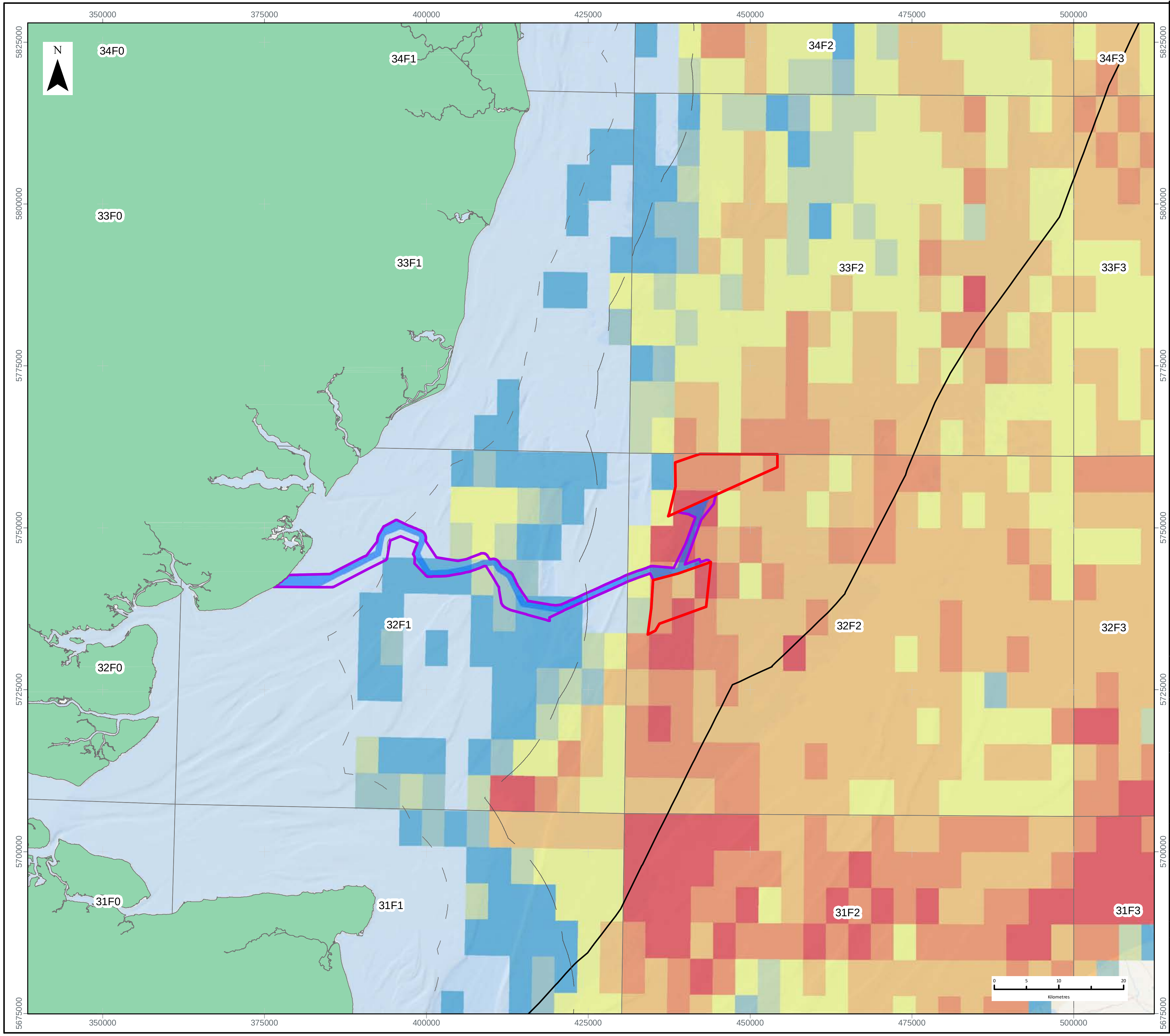
13.4.7 In addition to landings data, VMS data have been mapped for EU vessels (including the UK) within the commercial fisheries study area. Figure 13.7 indicates that EU beam trawlers are the most active type of fishing vessel across the array areas, reflecting the dominance of trawling for plaice and sole identified by the landings data. Figure 13.8, which presents the 2019 VMS dataset for UK potting activity does not include vessels less than 15 m in length, which form a significant portion of the UK fleet.

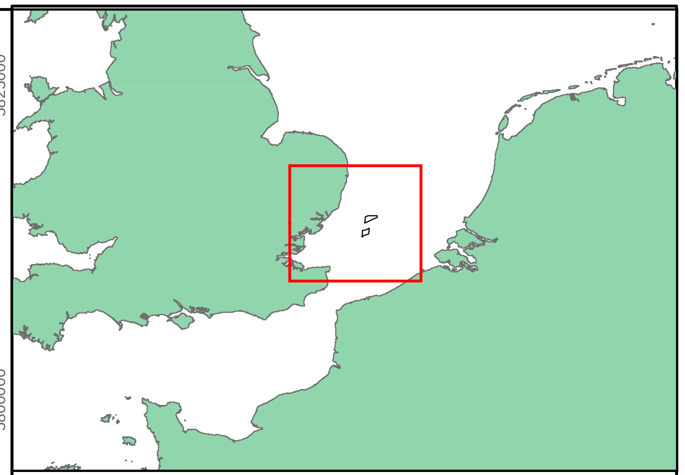
13.4.8 Figure 13.8 is therefore highly likely to significantly under-represent the potting activity in the region – particularly in inshore waters - and additional data (e.g. surveillance and landings data), together with stakeholder consultation will inform the assessment of impacts on this fleet for the PEIR and EIA stages.

13.4.9 Figure 13.9 indicates that demersal trawling by EU vessels takes place primarily in the southern half of the study area. Figure 13.10 indicates some activity by UK vessels deploying mobile gear in the study area, though very limited activity within the array areas and offshore AoS.

13.4.10 In summary, based on the data gathered to inform this scoping exercise, the key fleets operating across the study area include (in no particular order):

- UK-registered vessels, principally under 10m in length, operating from a number of local ports and using a range of gear types and often switching between them, including pots, nets, longlines and trawls, typically inside of the 6 NM limit;
- Large Dutch-registered vessels, beam trawling and occasionally seine netting, outside of the 12 NM limit;
- Belgian vessels beam trawling between the 6 NM and 12 NM limits where they have historic rights, and outside of the 12NM limit; and
- Vessels from other nations, including German and French pelagic trawlers, and French, German and Danish netting vessels, and Scottish demersal trawlers, targeting a variety of species between the 6 NM and 12 NM limits where they have historic access rights and otherwise outside of the 12NM limit.





LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- ICES Statistical Rectangles

Fishing Limits

- 6 NM
- 12 NM
- 200 NM

EU* Beam Trawl Value (Euro), 2017 (vessels ≥12m)

- 0 - 5,000
- 5,001 - 10,000
- 10,001 - 20,000
- 20,001 - 50,000
- 50,001 - 100,000
- 100,001 - 150,000
- 150,001 - 1,900,000

* Including Belgium, Denmark, France, Germany, Ireland, the Netherlands, Norway, Sweden and UK

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

EU Beam Trawl Value

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	FN	SM

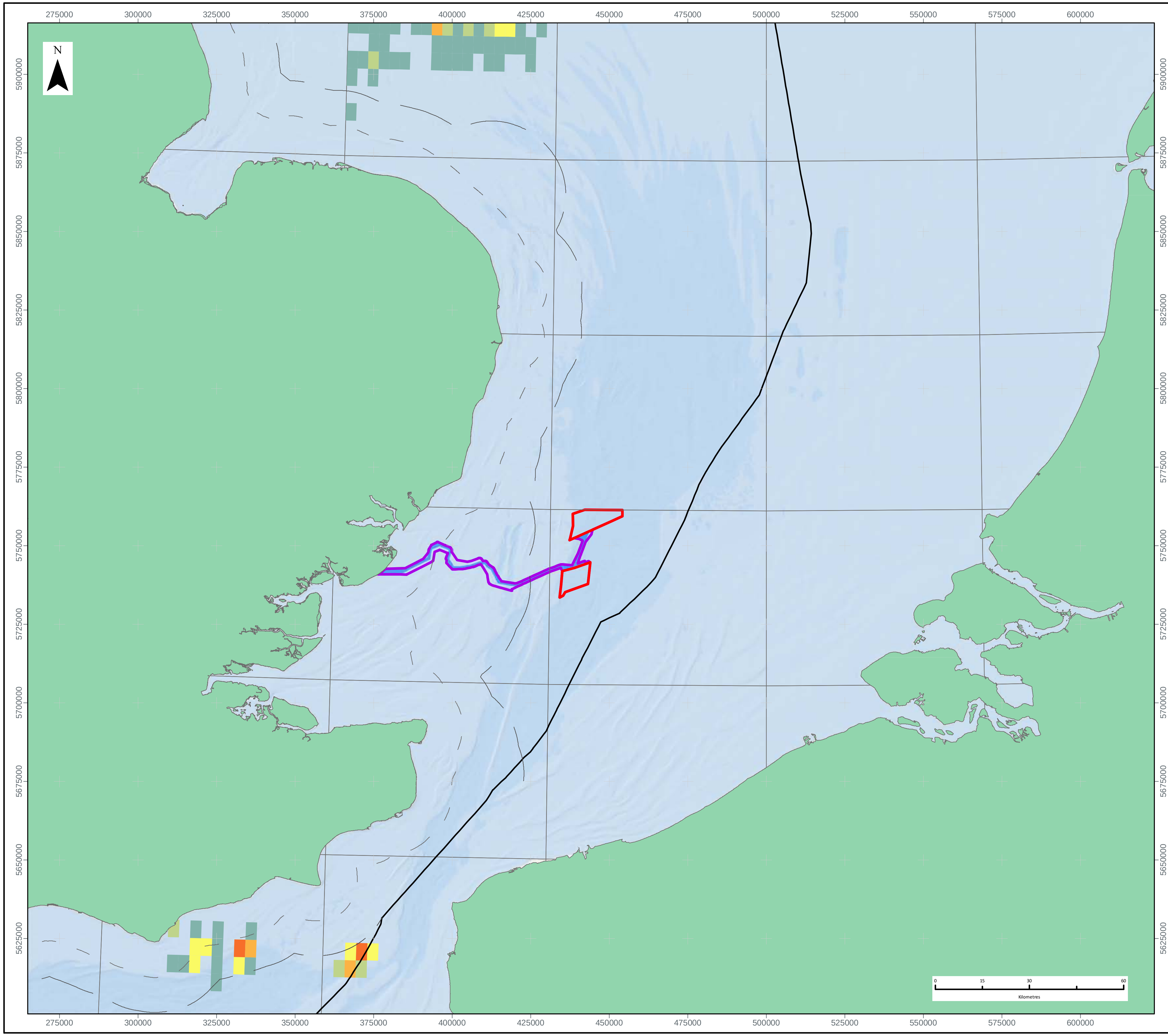
DRAWING NUMBER:

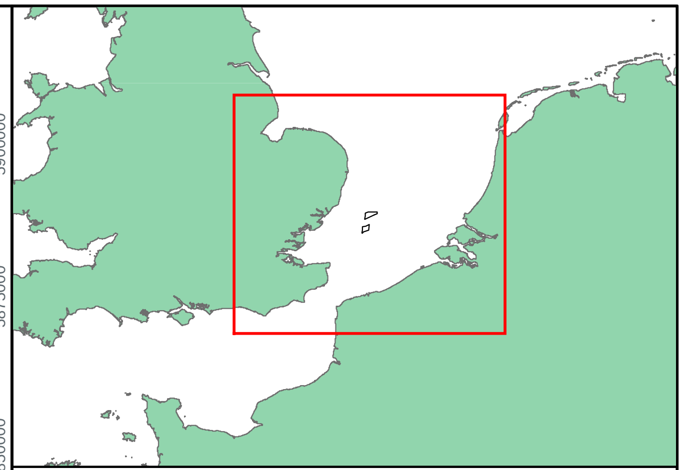
13.7

SCALE: 1:600,000 | PLOT SIZE: A3 | DATUM: WGS84 | PROJECTION: UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

C:\1. Work 2021\Five Estuaries\VE mdx files SCOPING\15 Sep 2021\VE_CF_Fig5_EU UK Beam trawl.mxd





LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- ICES Statistical Rectangles

Fishing Limits

- 6 NM
- 12 NM
- 200 NM

UK Potting Value (£), 2019 (vessels ≥15m)

- £0.01 - £5,000.00
- £5,000.01 - £10,000.00
- £10,000.01 - £25,000.00
- £25,000.01 - £50,000.00
- £50,000.01 - £75,000.00
- £75,000.01 - £145,000.00

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

UK Potting Value

VER	DATE	REMARKS	Drawn	Checked
1	22/09/2021	For Issue	FN	SM

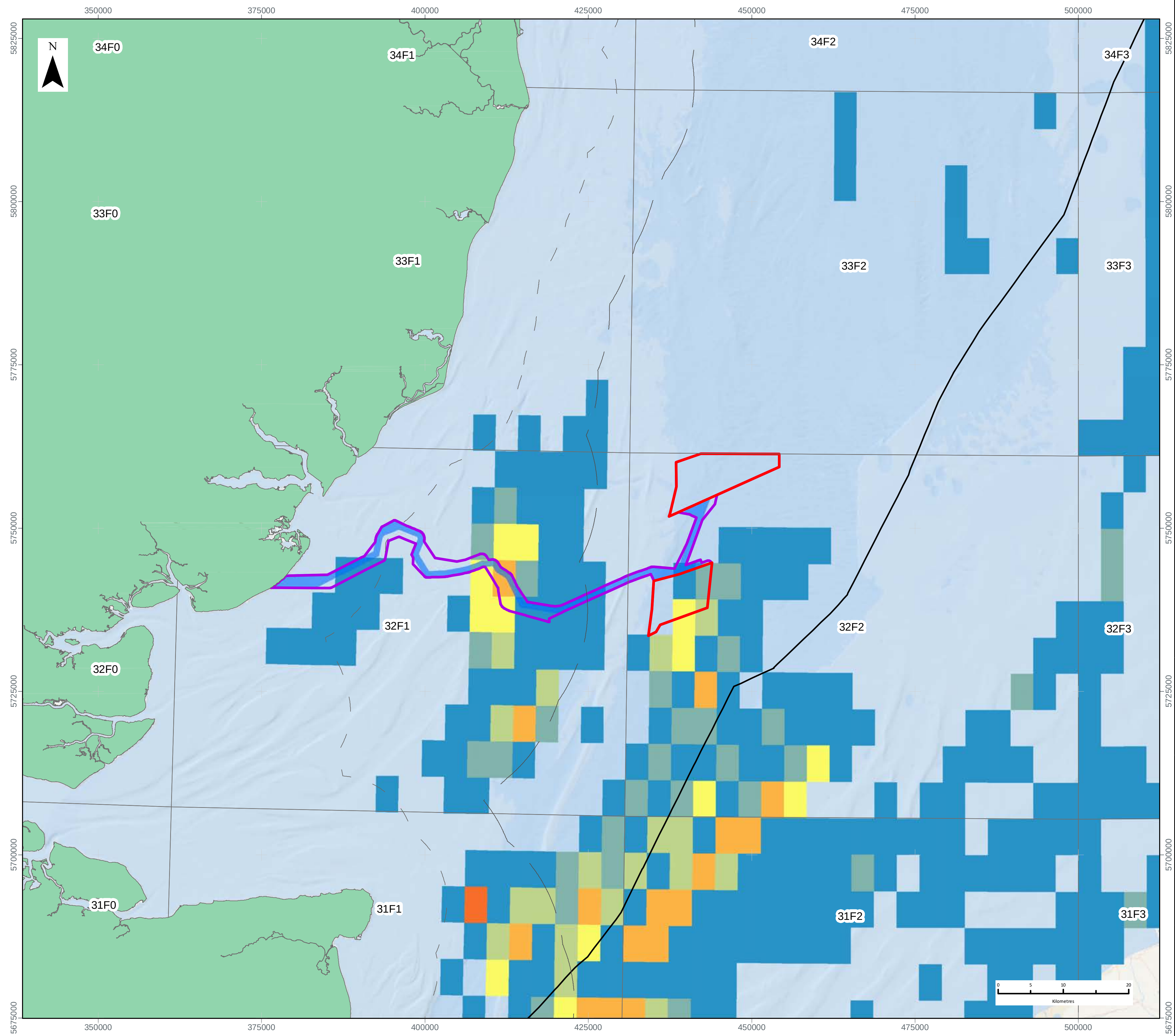
DRAWING NUMBER:

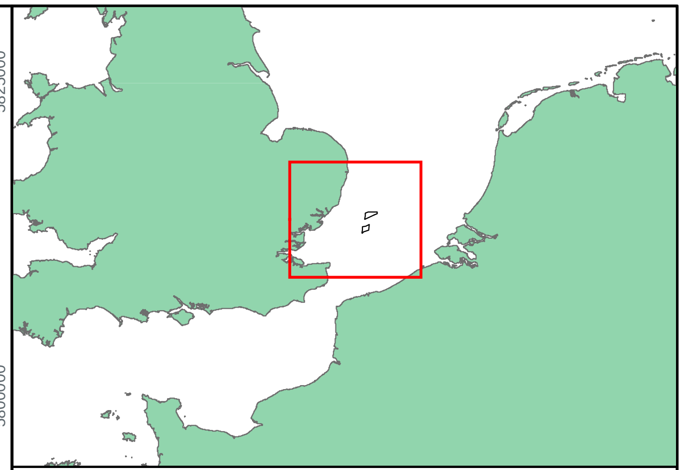
13.8

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:1,236,473	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

C:\1. Work 2021\Five Estuaries\VE mdx files SCOPING\21 Sep 2021\VE_CF_Fig6_UK Potting 2019.mxd





LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- Onshore Cable Corridor Area of Search
- ICES Statistical Rectangles

Fishing Limits

- 6 NM
- 12 NM
- 200 NM

EU* Otter Trawl Value (Euro), 2017 (vessels ≥12m)

- 0 - 5000
- 5001 - 10000
- 10001 - 15000
- 15001 - 20000
- 20001 - 50000
- 50001 - 100000
- 100001 - 251000

* Including Belgium, Denmark, France, Germany, Ireland, the Netherlands, Norway, Sweden and UK

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

EU Otter Trawl Value

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	FN	SM

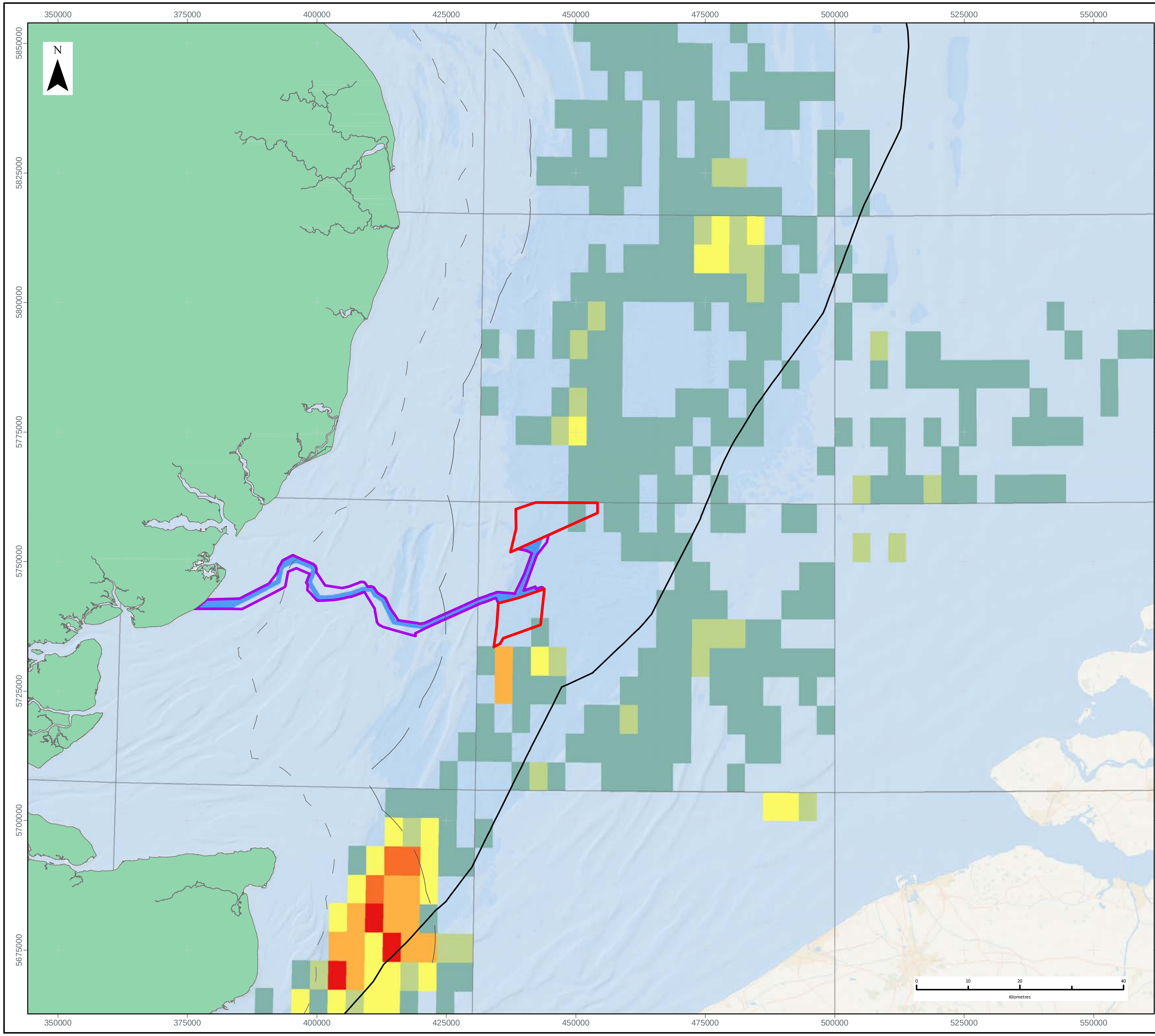
DRAWING NUMBER:

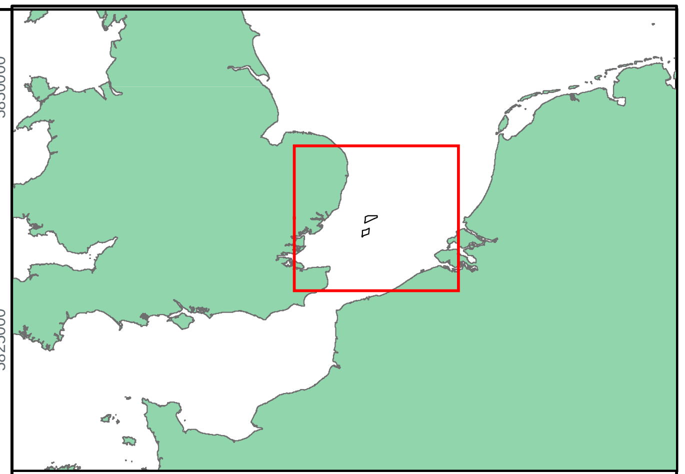
13.9

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:600,000	A3	WGS84	UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

C:\1. Work 2021\Five Estuaries\VE mdx files SCOPING\15 Sep 2021\VE_CF_Fig7_EU UK Otter trawl.mxd





LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- ICES Statistical Rectangles

Fishing Limits

- 6 NM
- 12 NM
- 200 NM

UK Mobile Gear Value (£), 2019 (vessels ≥15m)

- £0.01 - £5,000.00
- £5,000.01 - £10,000.00
- £10,000.01 - £50,000.00
- £50,000.01 - £100,000.00
- £100,000.01 - £150,000.00
- £150,000.01 - £315,000.00

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

UK All Mobile Gear Value

VER	DATE	REMARKS	Drawn	Checked
1	22/09/2021	For Issue	FN	SM

DRAWING NUMBER:

13.10

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:750,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

C:\1. Work 2021\Five Estuaries\VE mdx files SCOPING\21 Sep 2021\VE_CF_Fig9_UK 2019 mobile gear.mxd

DESIGNATED SITES

13.4.11 In order to protect particular features of designated sites, fisheries management mechanisms may be put in place. These mechanisms can include spatial closures, permit schemes, effort controls, vessel size and fishing gear restrictions and seasonal fishing restrictions. These mechanisms are implemented by the relevant IFCA in waters out to 6 NM and by the MMO in waters between 6 and 12 NM.

13.4.12 Within designated sites that are coincident or proximate to VE, several spatial closures to protect designated features have been established via IFCA byelaws that are relevant to fisheries activity within the study area. These include closures to fishing vessels >15 m length using towed nets within 3 NM of the coast, and closures to vessels >14m length fishing for molluscs using towed gear with 6 NM of the coast. Within specified areas of the Margate and Long Sands Special Area of Conservation (SAC), a byelaw prohibits the use of bottom towed gear. Any fisheries management measures within Marine Conservation Zones (MCZs) designated in 2019 and coincident with the study area (i.e. Orford Inshore MCZ and Kentish Knock East MCZ) are yet to be determined.

13.5 PROPOSED APPROACH TO ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

13.5.1 Detailed analysis of baseline datasets will be undertaken in the EIA to characterise long-term (i.e. over several years) patterns in commercial fisheries activity across the study area and predict potential impacts upon commercial fishing activities. Consultation with the commercial fishing industry has commenced and will continue in order to ground-truth available baseline data and gain further understanding of fishing activity by smaller vessels across the inshore portion of the study area. Analysis of data and the results of consultation will provide an extended baseline characterisation of the study area, which will underpin impact assessment.

13.5.2 The commercial fisheries impact assessment will follow the EIA methodology set out in Chapter 4. Specific to commercial fisheries, the following guidance documents will also be considered:

- Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments (United Kingdom Fisheries Economic Network [UKFEN] and Seafish, 2012);
- Fisheries Liaison with Offshore Wind and Wet Renewables group (FLOWW) Recommendations for Fisheries Liaison: Best Practice guidance for offshore renewable developers (FLOWW, 2014 and BERR, 2008);
- FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds (FLOWW, 2015);
- Options and opportunities for marine fisheries mitigation associated with wind farms (Blyth-Skyrme, 2010a);
- Developing guidance on fisheries Cumulative Impact Assessment for wind farm developers (Blyth-Skyrme, 2010b);
- Cumulative impact assessment guidelines, guiding principles for cumulative impacts assessments in offshore wind farms (RenewableUK, 2013);
- Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects. Contract report: ME5403 (Cefas, 2012);

- Fisheries Liaison Guidelines - Issue 6 (UK Oil and Gas, 2015);
- Fishing and Submarine Cables - Working Together (International Cable Protection Committee, 2009); and
- Offshore Wind Farms – Guidance note for Environmental Impact Assessment in respect of Food and Environment Protection Act (FEPA) and Coast Protection Act (CPA) requirements (Centre for Environment, Fisheries and Aquaculture Science [CEFAS], Marine Consents and Environment Unit [MCEU], Department for Environment, Food and Rural Affairs [DEFRA] and Department of Trade and Industry [DTI], 2004).

13.5.3 Impacts will be assessed for each relevant fleet/fishery active in the study area, and where relevant, impacts associated with the array areas and the offshore AoS will be separately assessed.

POTENTIAL PROJECT IMPACTS

13.5.4 A range of potential impacts on commercial fisheries have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 13.2, together with a description of any proposed additional data collection to enable an assessment of the impact.

13.5.5 Based on the commercial fisheries information currently available and the project description, some impacts are proposed to be scoped out of the EIA for this topic. These impacts are described in Table 13.3, together with a justification for scoping them out.

Table 13.2 - Impacts proposed to be scoped in to the assessment for commercial fisheries

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
13.1	Reduction in access to, or exclusion from established fishing grounds	Installation activities and physical presence of constructed VE infrastructure leading to reduction in access to, or exclusion from established fishing grounds. Potential for some loss of fishing opportunities over the construction period, though effect is expected to be short-term and localised, and the operational range of relevant fleets will not typically be limited to the array areas / offshore AoS.	Baseline data analysis and consultation will be undertaken in order to characterise commercial fisheries activity in the study area and consider the dependence of fleets on grounds in the array area and offshore AoS, and access to alternative grounds. The effects of exclusion/reduced access will be assessed. Understanding of the baseline will be informed by the most up-to-date versions of publicly available data (see Table 13.1) and consultation with fleets active in the study area to understand the specifics of fleet operation and grounds targeted.
13.2	Displacement leading to gear conflict and increased fishing pressure on adjacent grounds	Displacement from the VE array area and offshore AoS leading to gear conflict and increased fishing pressure on adjacent grounds. Potential for displacement of fishing activity, though effect is expected to be localised, and the operational range of relevant fleets will not typically be limited to the array areas / offshore AoS.	Baseline data analysis and consultation will be undertaken in order to characterise commercial fisheries activity in the study area and consider the dependence of fleets on grounds in the array areas and offshore AoS, and access to alternative grounds. The nature and extent of displacement and implications for/of gear conflict will be assessed. Understanding of the baseline will be informed by the most up-to-date versions of publicly

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			available data (see Table 13.1) and consultation with fleets active in the study area to understand the specifics of fleet operation and grounds targeted.
13.3	Displacement or disruption of commercially important fish and shellfish resources	Array area and offshore AoS construction activities leading to displacement or disruption of commercially important fish and shellfish resources.	Assessment will be informed by the outcomes of the Fish and Shellfish Ecology impact assessment and it will be assumed that commercial fisheries will be affected as a result of any loss of resources. The conclusions presented in the Fish and Shellfish Resource impact assessment regarding impact significance will be taken into account in determining the magnitude of impact on commercial fisheries.
13.4	Increased vessel traffic associated with VE within fishing grounds leading to interference with fishing activity	Movement of vessels associated with VE adding to the existing volume of marine traffic in the area, leading to interference of fishing activity.	Assessment will be informed by the outcomes of the Shipping and Navigation impact assessment (NRA); the conclusions presented in the Shipping and Navigation impact assessment will be considered in determining the magnitude of impact on commercial fisheries.
OPERATION			
13.5	Reduction in access to, or exclusion from established fishing grounds	Physical presence of constructed VE infrastructure leading to reduction in access to, or exclusion from established fishing grounds.	Baseline data analysis and consultation will be undertaken in order to characterise commercial fisheries activity in the study area and consider the dependence of fleets on grounds in the array area and offshore AoS and access to alternative

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		It is assumed fishing will resume along the offshore export cable route and can resume to a degree within the array areas. The effect will be long-term but localised, and the operational range of relevant fleets will not typically be limited to the array areas / offshore AoS.	grounds. The effects of exclusion/reduced access will be assessed. Understanding of the baseline will be informed by the most up-to-date versions of publicly available data (see Table 13.1) and consultation with fleets active in the study area to understand the specifics of fleet operation and grounds targeted.
13.6	Displacement leading to gear conflict and increased fishing pressure on adjacent grounds	Displacement from the VE area leading to gear conflict and increased fishing pressure on adjacent grounds. It is assumed fishing will resume along the offshore export cable route and can resume to a degree within the array areas. The effect will be long-term but localised, and the operational range of relevant fleets will not typically be limited to the array areas / offshore AoS.	Baseline data analysis and consultation will be undertaken in order to characterise commercial fisheries activity in the study area and consider the dependence of fleets on grounds in the array areas and offshore AoS, and access to alternative grounds. The nature and extent of displacement and implications for/of gear conflict will be assessed. Understanding of the baseline will be informed by the most up-to-date versions of publicly available data (see Table 13.1) and consultation with fleets active in the study area to understand the specifics of fleet operation and grounds targeted.
13.7	Displacement or disruption of commercially important	Array area and offshore AoS operation and maintenance activities leading to	Assessment will be informed by the outcomes of the Fish and Shellfish Resource impact assessment and it will be assumed that

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
	fish and shellfish resources	displacement or disruption of commercially important fish and shellfish resources.	commercial fisheries will be affected as a result of any loss of resources. The conclusions presented in the Fish and Shellfish Resource impact assessment regarding impact significance will be taken into account in determining the magnitude of impact on commercial fisheries.
13.8	Physical presence infrastructure leading to gear snagging	Standard industry practice and protocol (e.g. seabed infrastructure will be buried and/or marked on nautical charts) will minimise the risk of gear snagging, but it remains likely to be an area of industry concern.	Baseline data analysis and consultation will be undertaken in order to characterise commercial fisheries activity in the study area and consider the dependence of fleets on grounds in the array areas and offshore AoS , and access to alternative grounds. The potential nature of gear snagging and associated implications will be assessed. Understanding of the baseline will be informed by the most up-to-date versions of publicly available data (see Table 13.1) and consultation with fleets active in the study area to understand the specifics of fleet operation and grounds targeted. Safety aspects associated with this impact, including snagging risks, will be assessed within the Shipping and Navigation impact assessment (NRA).

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
13.9	Increased vessel traffic associated with VE within fishing grounds leading to interference with fishing activity	Movement of vessels associated with VE adding to the existing volume of marine traffic in the area, leading to interference of fishing activity.	Assessment will be informed by the outcomes of the Shipping and Navigation impact assessment (NRA); the conclusions presented in the Shipping and Navigation impact assessment will be considered in determining the magnitude of impact on commercial fisheries.
DECOMMISSIONING			
13.10	Reduction in access to, or exclusion from established fishing grounds	Decommissioning activities and physical presence of any VE infrastructure leading to reduction in access to, or exclusion from established fishing grounds. Potential for some loss of fishing opportunities over the decommissioning period, though effect is expected to be short-term and localised, and the operational range of relevant fleets will not typically be limited to the array areas / offshore AoS.	Baseline data analysis and consultation will be undertaken in order to characterise commercial fisheries activity in the study area and consider the dependence of fleets on grounds in the array areas and offshore AoS, and access to alternative grounds. The effects of exclusion/reduced access will be assessed. Understanding of the baseline will be informed by the most up-to-date versions of publicly available data (see Table 13.1) and consultation with fleets active in the study area to understand the specifics of fleet operation and grounds targeted.
13.11	Displacement leading to gear conflict and increased fishing pressure on adjacent grounds	Displacement from the VE array area and offshore AoS leading to gear conflict and increased fishing pressure on adjacent grounds.	Baseline data analysis and consultation will be undertaken in order to characterise commercial fisheries activity in the study area and consider the dependence of fleets on grounds in the array areas and offshore AoS, and access to alternative grounds. The nature and extent of

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		Potential for displacement of fishing activity, though effect is expected to be short-term and localised, and the operational range of relevant fleets will not typically be limited to the array areas / offshore AoS.	displacement and implications for/of gear conflict will be assessed. Understanding of the baseline will be informed by the most up-to-date versions of publicly available data (see Table 13.1) and consultation with fleets active in the study area to understand the specifics of fleet operation and grounds targeted.
13.12	Displacement or disruption of commercially important fish and shellfish resources	Array area and offshore AoS decommissioning activities leading to displacement or disruption of commercially important fish and shellfish resources.	Assessment will be informed by the outcomes of the Fish and Shellfish Resource impact assessment and it will be assumed that commercial fisheries will be affected as a result of any loss of resources. The conclusions presented in the Fish and Shellfish Resource impact assessment regarding impact significance will be taken into account in determining the magnitude of impact on commercial fisheries.
13.13	Physical presence infrastructure leading to gear snagging	Relevant during decommissioning should any infrastructure be left *in-situ*. Standard industry practice and protocol (e.g. seabed infrastructure will be buried and/or marked on nautical charts) will minimise the risk of gear snagging, but it remains likely to be an area of industry concern.	Baseline data analysis and consultation will be undertaken in order to characterise commercial fisheries activity in the study area and consider the dependence of fleets on grounds in the array areas and offshore AoS, and access to alternative grounds. The potential nature of gear snagging and associated implications will be assessed.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			Understanding of the baseline will be informed by the most up-to-date versions of publicly available data (see Table 13.1) and consultation with fleets active in the study area to understand the specifics of fleet operation and grounds targeted.
13.14	Increased vessel traffic associated with VE within fishing grounds leading to interference with fishing activity	Movement of vessels associated with VE adding to the existing volume of marine traffic in the area, leading to interference of fishing activity.	Assessment will be informed by the outcomes of the Shipping and Navigation impact assessment (NRA); the conclusions presented in the Shipping and Navigation impact assessment will be considered in determining the magnitude of impact on commercial fisheries.

Table 13.3 - Impacts proposed to be scoped out of assessment for commercial fisheries

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
13.15	Additional steaming to alternative fishing grounds for vessels that will otherwise fish within the VE area	This effect will be localised to safety zones and installed structures and therefore limited deviations to steaming routes are expected. Given adequate notification, it is expected that vessels, which typically have an operational range beyond that of VE (as indicated by VMS data presented above), will be in a position to avoid temporary construction/decommissioning areas and installed infrastructure with no or minimal impact on their steaming times. The impact is not expected to be significant in EIA terms.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

13.5.6 As part of the design process for VE a number of designed-in measures are proposed to reduce the potential for impacts on commercial fisheries; these are summarised below.

13.5.7 VE OWFL are committed to implementing these measures (noting they may evolve over the development process as the EIA progresses and in response to consultation), and also various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/out presented in Table 13.2 and Table 13.3.

13.5.8 Measures adopted as part of the project will include:

- VE OWFL is committed to ongoing liaison with fishermen throughout all stages of the project, based upon FLOWW (2014, 2015) guidance (and any subsequent updates to this guidance) and the following:
  - Appointment of a company Fisheries Liaison Officer (FLO) to maintain effective communications between the project and fishermen. A VE OWFL FLO has already been appointed and is currently acting as a point of liaison between the project and fishermen;
  - Appropriate liaison with relevant fishing interests to ensure that they are fully informed of development planning and any offshore activities and works;
  - Timely issue of notifications including Notice to Mariners (NtMs), Kingfisher Bulletin notifications and other navigational warnings to the fishing community to provide advance warning of project activities and associated Safety Zones and advisory safety distances; and
  - Development, prior to construction, of a fisheries liaison and co-existence plan, setting out in detail the planned approach to fisheries liaison and means of delivering any other relevant mitigation measures. It is intended that a fisheries liaison and co-existence plan will be submitted at the point of consent application.
- VE OWFL is committed to marking and lighting the project in accordance with relevant industry guidance and as advised by relevant stakeholders including the Maritime and Coastguard Agency (MCA), Civil Aviation Authority (CAA) and Trinity House. VE OWFL will also ensure the project is adequately marked on nautical charts.
- VE OWFL will ensure that objects dropped on the seabed during works associated with the project are reported in accordance with a Dropped Object Procedure that will be prepared prior to construction. Recovery of any objects that pose a hazard to other marine users will be carried out wherever feasible, with any marking agreed with relevant authorities.
- Where practicable, cable burial will be the preferred means of cable protection.

POTENTIAL CUMULATIVE IMPACTS

13.5.9 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For commercial fisheries, cumulative interactions may occur with other planned projects and developments in the study area. The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described in Table 13.2 for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e. they occur only within the VE boundary) or where management measures in place for VE and other projects will reduce the risk of impacts occurring.

13.5.10 For the purposes of cumulative impact assessment, it will be assumed that already-operational offshore wind farms and active licensed activities constitute part of the existing baseline environment, as commercial fisheries will already be adapted to them and any effect they might have had will be reflected in the baseline characterisation undertaken to inform impact assessment.

13.5.11 The likely scope of other offshore wind projects and other activities to be included in cumulative impact assessment is set out immediately below, though this will be confirmed by the aforementioned screening exercise.

13.5.12 The cumulative impact assessment will consider other relevant offshore wind farm projects across the North Sea. The key cumulative impacts are expected to result from loss or restricted access to established fishing grounds and displacement of fishing activity.

13.5.13 There is the potential for other activities occurring in the region surrounding VE to create cumulative impacts; these include aggregate dredging activity, oil and gas activity and infrastructure, subsea cabling and the implementation of restrictions to fishing in Marine Protected Areas (MPAs). As for offshore wind projects, the key cumulative impacts are expected to result from loss or restricted access to established fishing grounds and displacement of fishing activity.

POTENTIAL TRANSBOUNDARY IMPACTS

13.5.14 A description of how potential transboundary effects will be assessed is outlined in Chapter 4: Environmental Impact Assessment approach and methodology. As presented in Chapter 4, the limits of the Dutch, Belgian and French Exclusive Economic Zones are located approximately 16 km (south east), 25 km (south) and 18 km (north east) of the VE array areas respectively. International fishing fleets – notably Dutch and Belgian fleets - are known to operate in the study area. As such, transboundary impacts will be considered and their assessment will be integrated into the construction, operation, decommissioning and cumulative impact assessments.

13.5.15 Consultation with stakeholders in other relevant Member States, and data gathered from other relevant Member States, will inform the assessments.

13.6 SUMMARY OF NEXT STEPS

13.6.1 It is intended that full acquisition and analysis of the baseline data sources listed in Table 13.1 is completed. Data analysis will then be corroborated and expanded upon by consultation with the fishing industry and other relevant stakeholders, including the following:

- MMO;
- National Federation of Fishermen's Organisations (NFFO);
- Eastern and Kent and Essex IFCAs;
- Local Fishermen's Associations and Producer Organisations;
- VisNed (Netherland), Rederscentrale (Belgium) and any other EU Member State representative organisations as identified during baseline data analysis; and
- Individual fishermen as identified by the Company FLO/other means.

13.6.2 Consultation, which has commenced and will continue throughout the application process, will not only seek to validate the baseline, but to identify key stakeholder concerns to inform the impact assessment.

13.7 FURTHER CONSIDERATION FOR CONSULTEES

13.7.1 The following questions are posed to consultees to help them frame and focus their response to the commercial fisheries scoping exercise, which will in turn inform the Scoping Opinion:

- Do you agree that the data sources identified are sufficient to inform the commercial fisheries baseline for the VE PEIR and ES?
- Have all potential impacts on commercial fisheries resulting from VE been identified within this Scoping Report?
- Do you agree that the impacts described in Table 13.3 can be scoped out?
- For those impacts scoped in (Table 13.2), do you agree that the methods described are sufficient to inform a robust impact assessment?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of VE on commercial fisheries receptors?
- Do you agree that all relevant stakeholders with which consultation will be undertaken have been identified?

14. SHIPPING AND NAVIGATION

14.1 INTRODUCTION

14.1.1 This chapter of the Scoping Report identifies the shipping and navigation receptors of relevance to the VE array areas and the offshore AoS. Within this offshore AoS, a preferred OECR has been identified following discussions with stakeholders, but flexibility has been retained to microsite, if required. It describes the potential effects from the construction, operation and maintenance, and decommissioning of VE on shipping and navigation and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

14.1.2 This chapter should be read alongside the following chapters of this Scoping Report:

- Chapter 13: Commercial Fisheries;
- Chapter 15: Military and Civil Aviation; and
- Chapter 18: Other Marine Users and Activities.

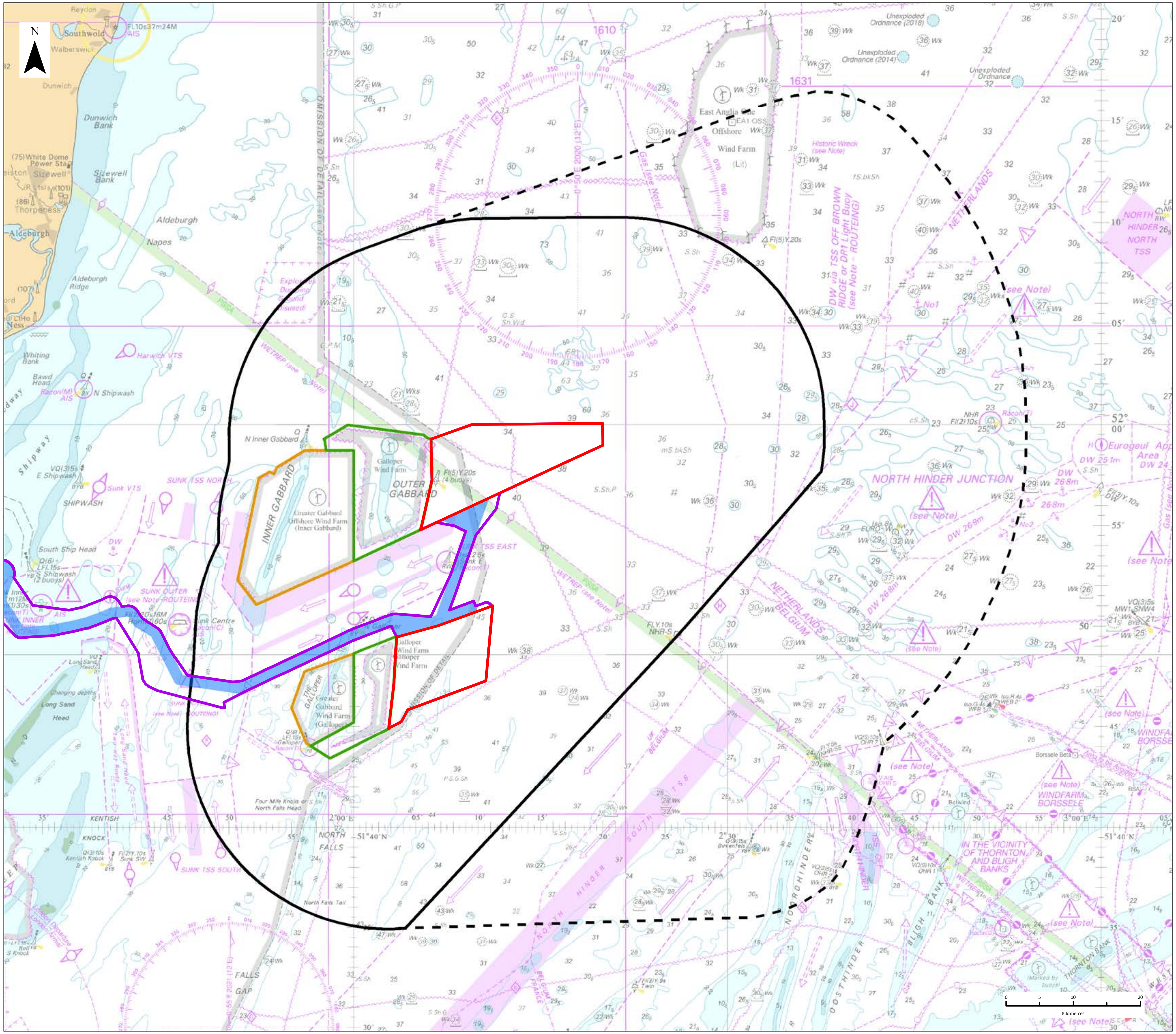
14.2 STUDY AREA

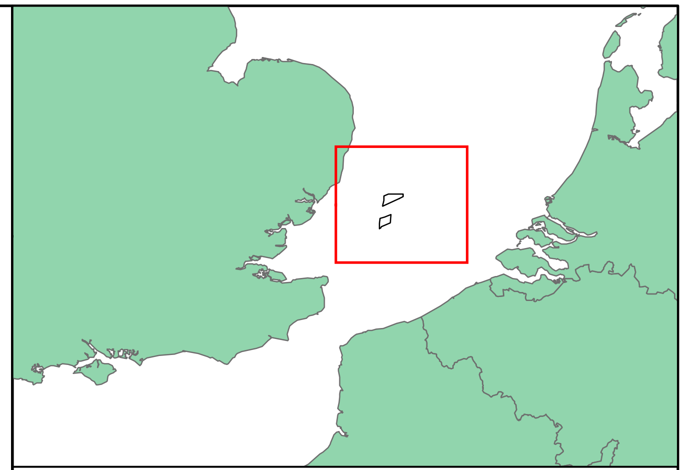
14.2.1 In the majority, vessel traffic data has been considered within a 10 nautical mile (nm) buffer of the array areas (the “Traffic Study Area”), as shown in Figure 14.1. Using a buffer of 10 nm is standard practice for shipping and navigation assessment study areas and has been used in the majority of UK offshore wind farm NRAs. However, the portion of a 10 nm buffer of the array areas intersecting the North Hinder Junction and North Hinder South TSS has been excluded given the high volume of vessel traffic known to utilise these areas which could potentially skew the analysis of vessel traffic local to the array areas. This approach to defining the Traffic Study Area has been agreed with the MCA and Trinity House during pre-scoping consultation.

14.2.2 Within the PEIR, it is intended that an additional study area extending up to 20 nm from the array areas to the east and south will be used for the purposes of establishing the main commercial routes operated in the region (the “Routeing Study Area”). This is also shown in Figure 14.1 and will assist in ensuring features that may impact vessel routeing but which are out with the Traffic Study Area are considered.

14.2.3 A study area for the offshore AoS will also be defined (and agreed with stakeholders) for the PEIR and will likely consist of a 2 nm buffer around the boundary of the preferred OECR to ensure analysis of vessel traffic is local to the preferred OECR. The NRA will be undertaken on the study area (once defined) for the offshore AoS.

14.2.4 These study areas will be reviewed and amended for future stages (PEIR and subsequently ES) in response to matters such as site refinement, feedback from consultees, and/or the identification of additional constraints (environmental and/or engineering).





LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- Galloper OWF Array Areas
- Greater Gabbard OWF Array Areas
- Routeing Study Area
- Traffic Study Area

Data Source:
Basemap:

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

General Overview

VER	DATE	REMARKS	Drawn	Checked
1	01/09/2021	For Issue	DS	JM
2	21/09/2021	Updated	DS	JM

DRAWING NUMBER:

14.1

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:600,000	A3	WGS84	World Mercator

FIVE ESTUARIES OFFSHORE WIND FARM

anatec

P:\Project\A4542 Five Estuaries (VE) GoBe\GIS\ESRI\Scoping Report\MXD\Rev 01\General Overview.mxd

14.3 BASELINE DATA

14.3.1 Table 14.1 provides details of the existing data used to inform the baseline environment, and which will be used in the PEIR and ES.

Table 14.1 - Key sources of information for shipping and navigation

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Automatic Identification System (AIS) data, July/ August 2019	Fourteen days of transmitted vessel-specific information (such as identity, position, speed, etc.) from onshore receivers.	This is an international dataset providing full coverage of the Traffic Study Area.
AIS data, December 2019	Fourteen days of transmitted vessel-specific information (such as identity, position, speed, etc.) from onshore receivers.	This is an international dataset providing full coverage of the Traffic Study Area.
United Kingdom Hydrographic Office (UKHO) admiralty charts 1183, 1504, 1543, 1610, 1630, 1975, and 2052	Provide details of offshore and coastal features relevant to shipping and navigation.	Provides full coverage of the region as a whole.
UKHO Sailing Directions – Dover Strait Pilot NP28 (UKHO, 2017)	Provides details of offshore and coastal features relevant to shipping and navigation.	Provides full coverage of the region as a whole.
Marine Accident Investigation Branch (MAIB) incident data (2010 to 2019)	Maritime incident data including the locations and nature of all MAIB reported incidents.	This is an international dataset providing full coverage of the Traffic Study Area.
Royal National Lifeboat Institution (RNLI) incident data (2010 to 2019)	Maritime incident data including the locations and nature of all RNLI reported incidents.	This is a national dataset providing full coverage of the Traffic Study Area.
British Marine Aggregate Producers Association (BMAPA) transit routes (2009)	Frequently used marine aggregate dredging routes.	This is an international dataset providing full coverage of the Traffic Study Area.
Royal Yachting Association (RYA) Coastal Atlas (RYA, 2019)	Tool for identifying areas of importance to recreational boaters.	This is a national dataset providing partial coverage of the Traffic Study Area.

14.3.2 AIS carriage and broadcast is not compulsory for fishing vessels less than 15 metres (m) length, or vessels of less than 300 Gross Tonnage (GT) (notably this includes most recreational vessels). It should therefore be considered that such traffic is likely to be underrepresented within the assessment undertaken for this scoping exercise. However, from various studies in recent years undertaken by Anatec, it is noted that smaller vessels are increasingly observed to utilise AIS voluntarily given the associated safety benefits. On this basis and noting that AIS is accepted as being comprehensive for other larger vessel types, the available data are considered as fit for the purposes of providing the high level baseline assessment presented in this Scoping Report. This includes consideration of the global effects of COVID-19 on vessel movements – since the AIS data considered pre-dates these effects it is considered reflective of the true baseline for vessel movements.

14.3.3 In line with Marine Guidance Note (MGN) 654 (MCA, 2021), it will be necessary to undertake a vessel traffic survey of the array areas to ensure all vessels (including those not broadcasting on AIS) are considered in the baseline environment. The nature of this survey will be agreed with stakeholders including the MCA and Trinity House, and it will be compliant with the requirements set out in MGN 654 which include a minimum of 28 days of data accounting for seasonal variation. The survey will therefore be undertaken across two 14-day periods in winter (between November and March 2021/22) and summer (between June and August 2022), as discussed with the Sunk Vessel Traffic Services (VTS) User Group in January 2021 and agreed upon with consultees. Vessel traffic data will be collected within the Traffic Study Area.

14.3.4 Furthermore, additional vessel traffic data recorded on AIS and covering a 12-month period (2019) is being considered and will be used to validate the findings of the site-specific surveys as well as identify any seasonal variation in vessel movements not immediately clear from the site-specific survey data. In the unlikely event that COVID-19 effects on vessel movements are present at the time of the site-specific surveys (not anticipated at the time of writing) this long-term dataset will offer a further means of validation.

14.3.5 The most recent version of the RYA Coastal Atlas (RYA, 2019) will also be considered in line with RYA preference for both the array areas and offshore AoS.

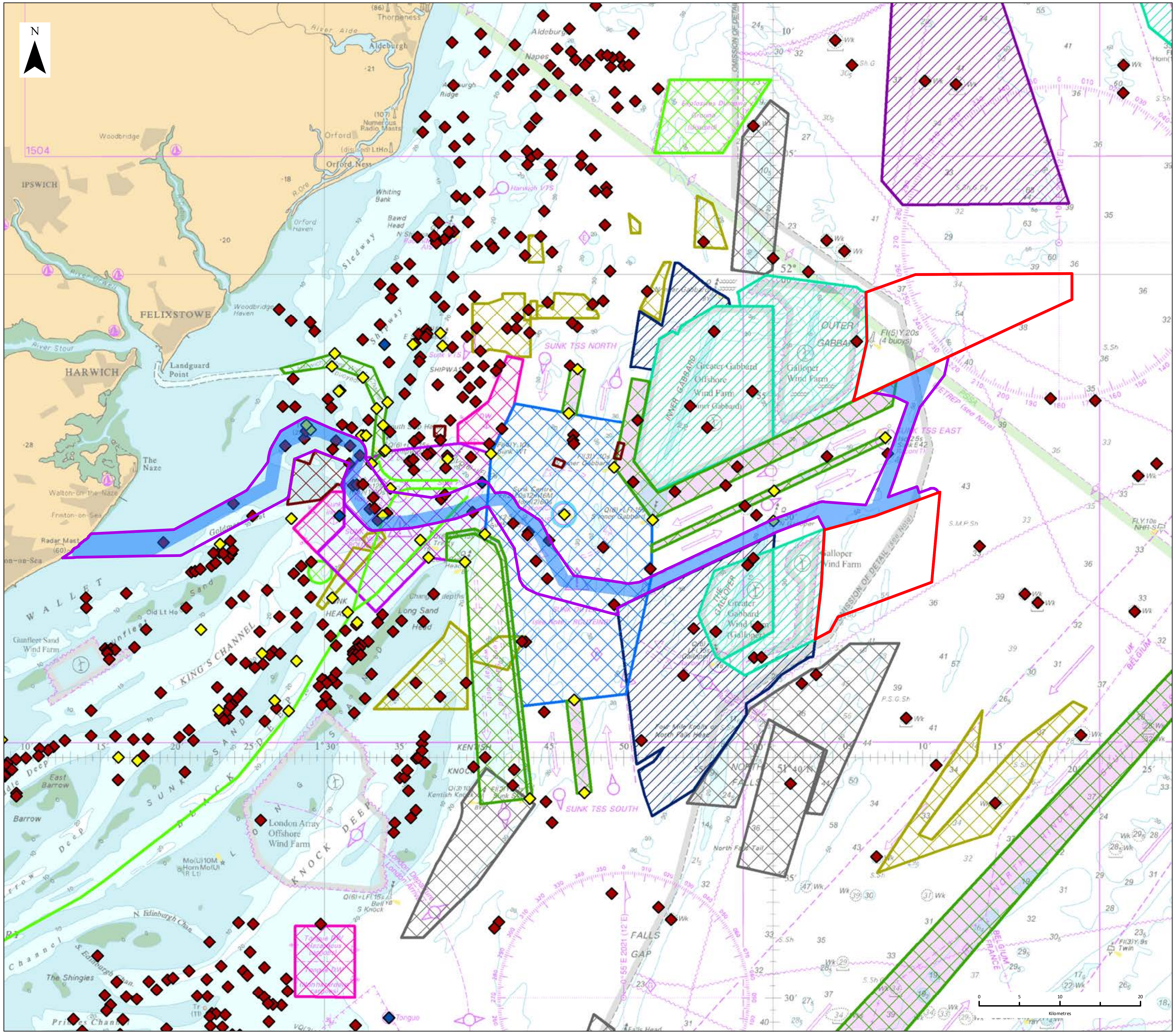
14.4 BASELINE ENVIRONMENT

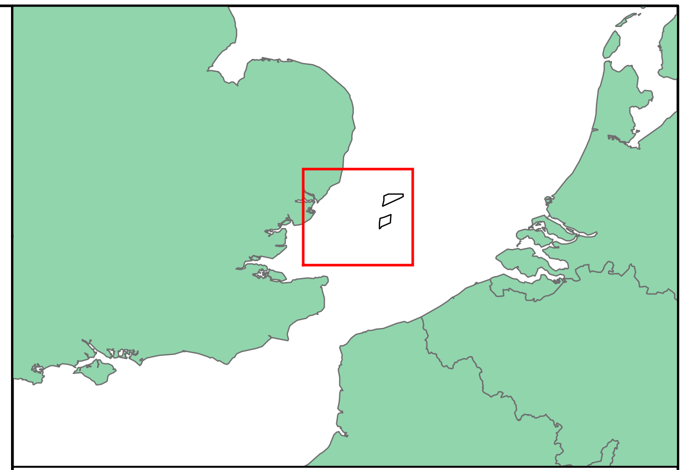
NAVIGATIONAL FEATURES

14.4.1 This section presents the baseline environment for navigational features, which have been identified via a review of UKHO admiralty charts and the local UKHO Admiralty Sailing Directions (UKHO, 2017) as per Table 14.1. An overview of the navigational features that were deemed relevant to the scoping exercise is shown in Figure 14.2, with key features discussed further below. Following from this, the navigational features specific to the offshore AoS are presented in Figure 14.3. It is noted that the area has numerous navigational features and therefore not all are shown. However, a detailed assessment will be undertaken in the Navigational Risk Assessment (NRA) (for relevant features) using the latest available sources will accompany the PEIR (and subsequent ES).

14.4.2 The key navigational features in the area are the International Maritime Organization (IMO) routeing measures within and near to the array areas and offshore AoS, which dictate the flow of vessel traffic in the region. Of particular note is the Sunk routeing measure, which includes three TSSs that converge upon a central precautionary area. The Sunk TSS East is located between the array areas.

14.4.3 The offshore AoS passes through the Sunk Outer and Inner Precautionary Areas where vessels are advised to navigate with caution given that pilotage operations are ongoing and vessels may be constrained by their draught. Within the Inner Precautionary Area, the offshore AoS crosses the Trinity deep water recommended route. The Sunk pilot boarding station is located within the offshore AoS (but not the preferred OECR) as it enters the Inner Precautionary Area. Further west, the offshore AoS passes around the Harwich Deep Water Channel, clear of the deep water recommended route that leads into the channel.





LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- Aids to Navigation
- Pilot Boarding Station
- Wreck or Obstruction
- Anchorage Area
- Area to Avoid
- Explosive Dumping Ground
- Recommended Deep Water Route
- Spoil Grounds
- SUNK Inner Precautionary Area
- SUNK Outer Precautionary Area
- TSS Lanes

Dredging Features

- Exploration and Option Area
- Production Agreement Area

Other Wind Farms

- Operational
- Awaiting Decision
- Pre Planning Application

Data Source:
Basemap:

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

High Level Navigational Features

VER	DATE	REMARKS	Drawn	Checked
1	01/09/2021	For Issue	DS	JM
2	21/09/2021	Updated	DS	JM

DRAWING NUMBER:

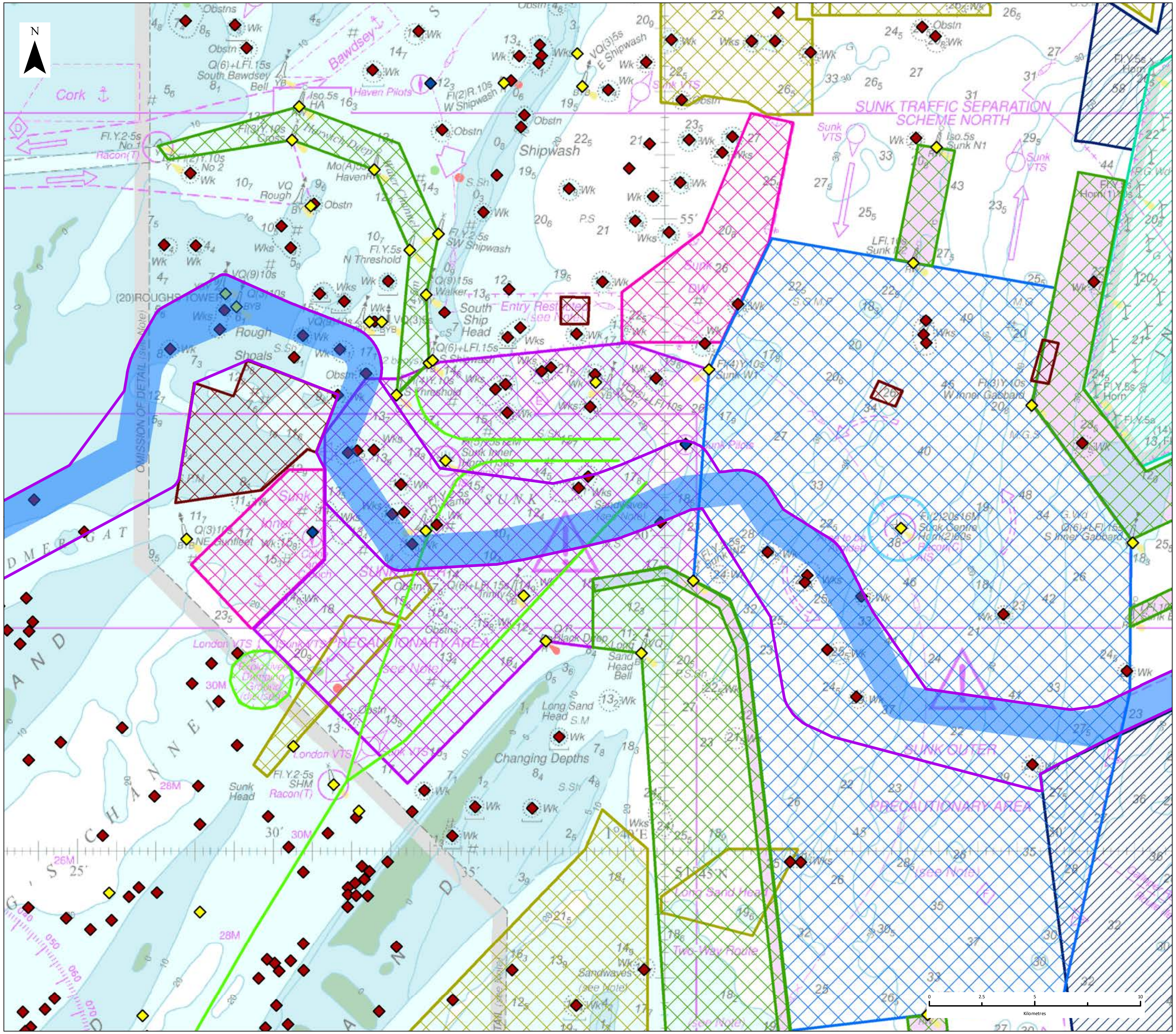
14.2

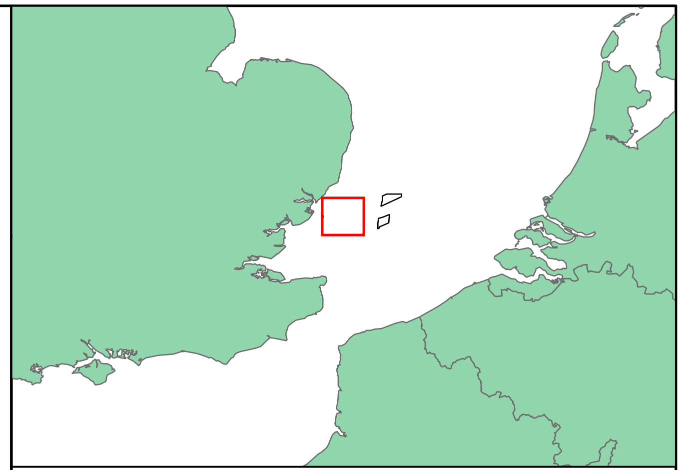
SCALE: 1:500,000 | PLOT SIZE: A3 | DATUM: WGS84 | PROJECTION: World Mercator

FIVE ESTUARIES OFFSHORE WIND FARM

anatec

P:\Project\A4542 Five Estuaries (VE) GoBe\GIS\ESRI\Scoping Report\MXD\Rev 01\Navigational Features.mxd





LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- Aids to Navigation
- Pilot Boarding Station
- Wreck or Obstruction
- Anchorage Area
- Area to Avoid
- Explosive Dumping Ground
- Recommended Deep Water Route
- Spoil Grounds
- SUNK Inner Precautionary Area
- SUNK Outer Precautionary Area
- TSS Lanes

Dredging Features

- Exploration and Option Area
- Production Agreement Area

Other Wind Farms

- Operational
- Pre Planning Application

Data Source:
Basemap:

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

High Level Navigational Features - Preferred OECR Specific

VER	DATE	REMARKS	Drawn	Checked
1	01/09/2021	For Issue	DS	JM
2	21/09/2021	Updated	DS	JM

DRAWING NUMBER:

14.3

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:190,797	A3	WGS84	World Mercator

FIVE ESTUARIES OFFSHORE WIND FARM

anatec

P:\Project\A4542 Five Estuaries (VE) GoBe\GIS\ESRI\Scoping Report\MXD\Rev 01\Navigational Features - OECR Specific.mxd

14.4.4 Three operational wind farms are currently in proximity to the array areas (as shown in Figure 14.2). The existing Galloper OWF (to which VE represents an extension) is situated on the western boundary of the array areas and has been operational since 2017. The Greater Gabbard OWF is located adjacent to Galloper OWF, approximately 3 nm from the array areas and has been operational since 2010. The East Anglia One Offshore Wind Farm is also located in proximity (approximately 10 nm to the north east) and has been operational since 2020. Potential future offshore wind farm developments in the region are outlined in Section 14.5 and illustrated in Figure 14.7.

14.4.5 There are six marine aggregate dredging areas located within 10 nm of the array areas (as shown in Figure 14.2), comprising of three exploration and option areas, and three production agreement areas. It is noted that certain BMAPA transit routes associated with either France or the United Kingdom (UK) pass through the array areas[63].

14.4.6 There is an explosives dumping ground (disused) located approximately 8 nm north west of the array areas (as shown in Figure 14.2).

14.4.7 No charted anchorage areas have been identified within or in proximity to the array areas. Likewise, there are no charted anchorage areas have been identified within the offshore AoS; however, the Sunk Inner and Sunk DW anchorage areas are located in proximity to the offshore AoS (as shown in Figure 14.2).

VESSEL TRAFFIC

14.4.8 The vessel traffic data collected during the summer and winter survey periods within the Traffic Study Area are shown in Figure 14.4 and Figure 14.5, respectively. It is noted that vessels deemed as representing temporary traffic (e.g., vessels engaged in surveys) have been removed. It has been assumed that wind farm vessels visiting the existing Greater Gabbard and Galloper OWFs represent operational traffic, and thus have been retained.

14.4.9 An average of 97 unique vessels were recorded per day within the Traffic Study Area during summer, with seven unique vessels per day intersecting the array areas. Of the vessels intersecting the array areas during the summer survey period, the most commonly recorded were cargo vessels (54%), passenger vessels (18%), and tankers (11%). An average of 102 unique vessels were recorded per day within the Traffic Study Area during winter, with nine unique vessels per day intersecting the array areas. Of the vessels intersecting the array areas during the winter survey period, the most commonly recorded were cargo vessels (58%), tankers (13%), passenger vessels (11%), and fishing vessels (10%). In general, the significant majority of vessels in the area avoided the existing Greater Gabbard and Galloper OWFs.

[63] The age of the BMAPA transit routes is noted and is considered a secondary source for establishing the movement of marine aggregate dredgers. However, in this case, the BMAPA transit routes mentioned show good agreement with the vessel traffic data analysed.

14.4.10 Noting the presence of the Sunk routeing measures, commercial traffic is prominent in the area (cargo vessels accounted for 54% of traffic overall within the Traffic Study Area, and tankers 20%). In particular, commercial vessels on the following heavy use routes were observed to intersect the array areas:

- In/out of the Sunk TSS East; and
- East-west between Harwich/Felixstowe and Rotterdam.

14.4.11 A vessel density heat map based on 12 months of AIS data recorded during 2019 is presented in Figure 14.6 and is used to show where commercial vessel traffic density is highest within the array areas for the heavy use routes in/out of the Sunk TSS East and to/from Harwich/Felixstowe. This 12-month dataset will be analysed in full in the NRA and serve as a data validation for the site-specific surveys.

14.4.12 Commercial vessel routeing was also observed north-south through the array areas (medium use) with further main routes located in proximity to the array areas.

14.4.13 Some of the vessels involved in commercial vessel routeing are commercial ferries operating fixed timetables and carrying either cargoes or passengers. These include a variety of operators and routes, with those most relevant to the array areas including:

- Killingholme–Zeebrugge (Cobelfret Ferries)
- Hull–Zeebrugge (P&O Ferries)
- Harwich–Rotterdam (Stena Line)
- Felixstowe–Rotterdam (DFDS Seaways)
- Grimsby–Zeebrugge (UECC); and
- Tyne–Zeebrugge (Euro Marine).

14.4.14 Recreational vessels evident in the AIS data were recorded at much higher levels during summer than winter, when such traffic was limited. During summer, recreational vessels intersected the array areas. It should be considered that recreational vessel activity may be underrepresented, noting that as per Paragraph 14.3.2 not all recreational vessels are required to broadcast via AIS.

14.4.15 Fishing vessels evident in the AIS data were recorded within the array areas during both the summer and winter study periods. This included both vessels in transit and actively engaged in fishing (i.e., gear deployed). Fishing vessel presence in the Traffic Study Area was much higher in winter compared to summer. As per Paragraph 14.3.2, fishing vessels of less than 15 m are not required to carry AIS, and therefore may be underrepresented in this data.

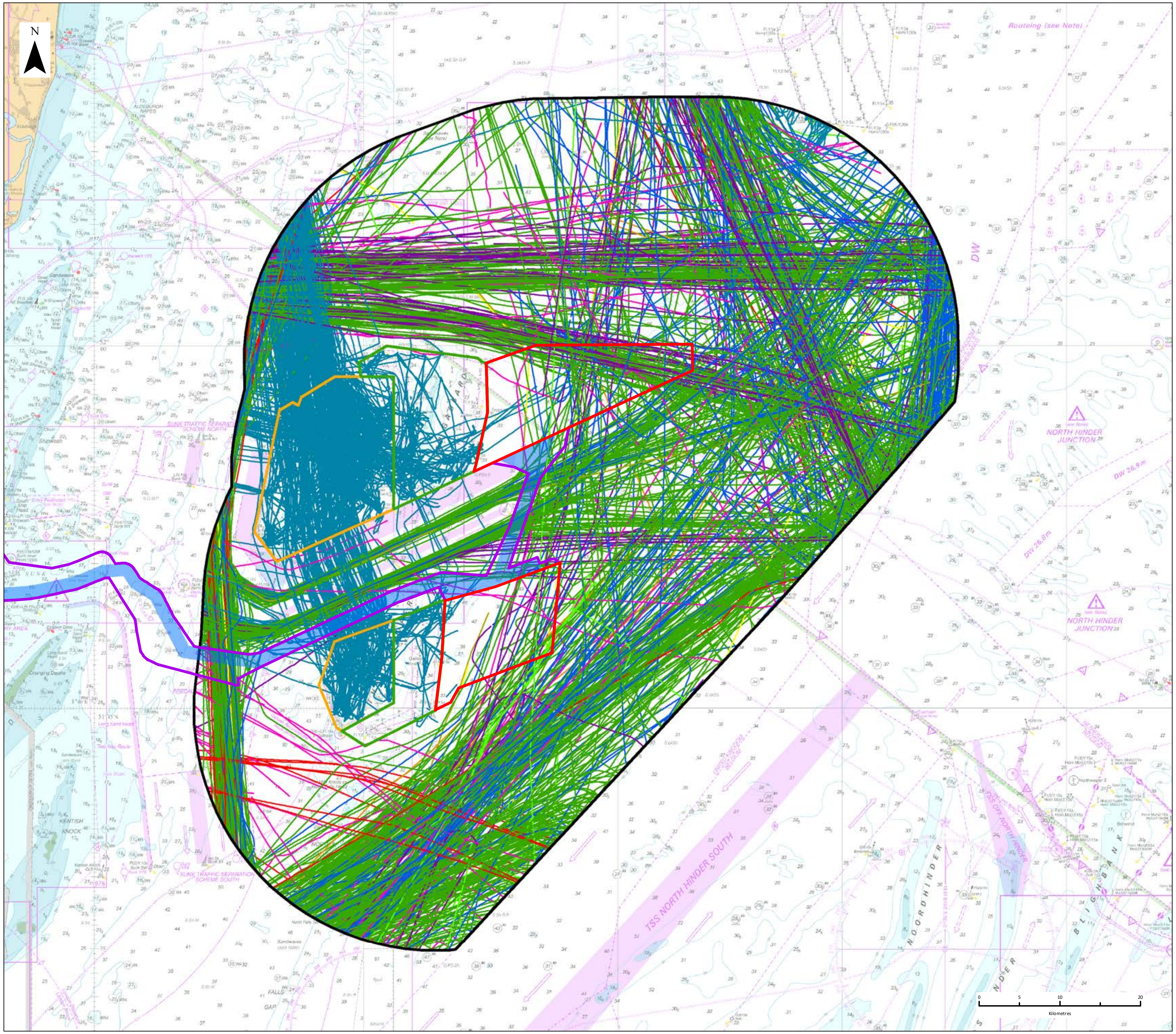
MARINE INCIDENTS

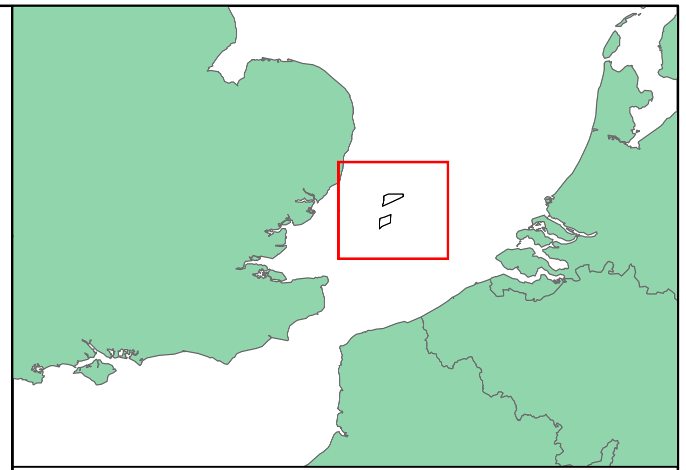
14.4.16 An analysis of MAIB incident data from 2010 to 2019 indicated that a total of 12 incidents were recorded within the Traffic Study Area. None were recorded within the array areas. Five incidents were recorded within the offshore AoS – three hazardous incidents (two of the incidents involved two vessels), one instance of contact, and one loss of control.

14.4.17 An analysis of RNLI incident data from 2010 to 2019 indicated that a total of 44 incidents were recorded within the Traffic Study Area. Two incidents were reported within the array areas and these are detailed below:

- In August 2011, a powered recreational vessel experienced a machinery failure in the southern array area but the incident was resolved with no aid required; and
- In July 2017, a powered recreational vessel got into difficulty in the northern array area with a lifeboat launched to aid the crew and the two people aboard rescued.

14.4.18 Nine incidents were recorded within the offshore AoS – four instances of machinery failure, and one each of types ‘adverse conditions’, ‘person in danger’, ‘steering failure’, and ‘vessel may be in trouble’. There was one incident which was unspecified.





LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- Galloper OWF Array Areas
- Greater Gabbard OWF Array Areas
- Traffic Study Area

Vessel Type

- Fishing
- Dredger
- Tug
- Passenger
- Cargo
- Tanker
- Other
- Recreational
- Oil and Gas
- Wind Farm

Data Source:
Basemap:

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Summer Traffic

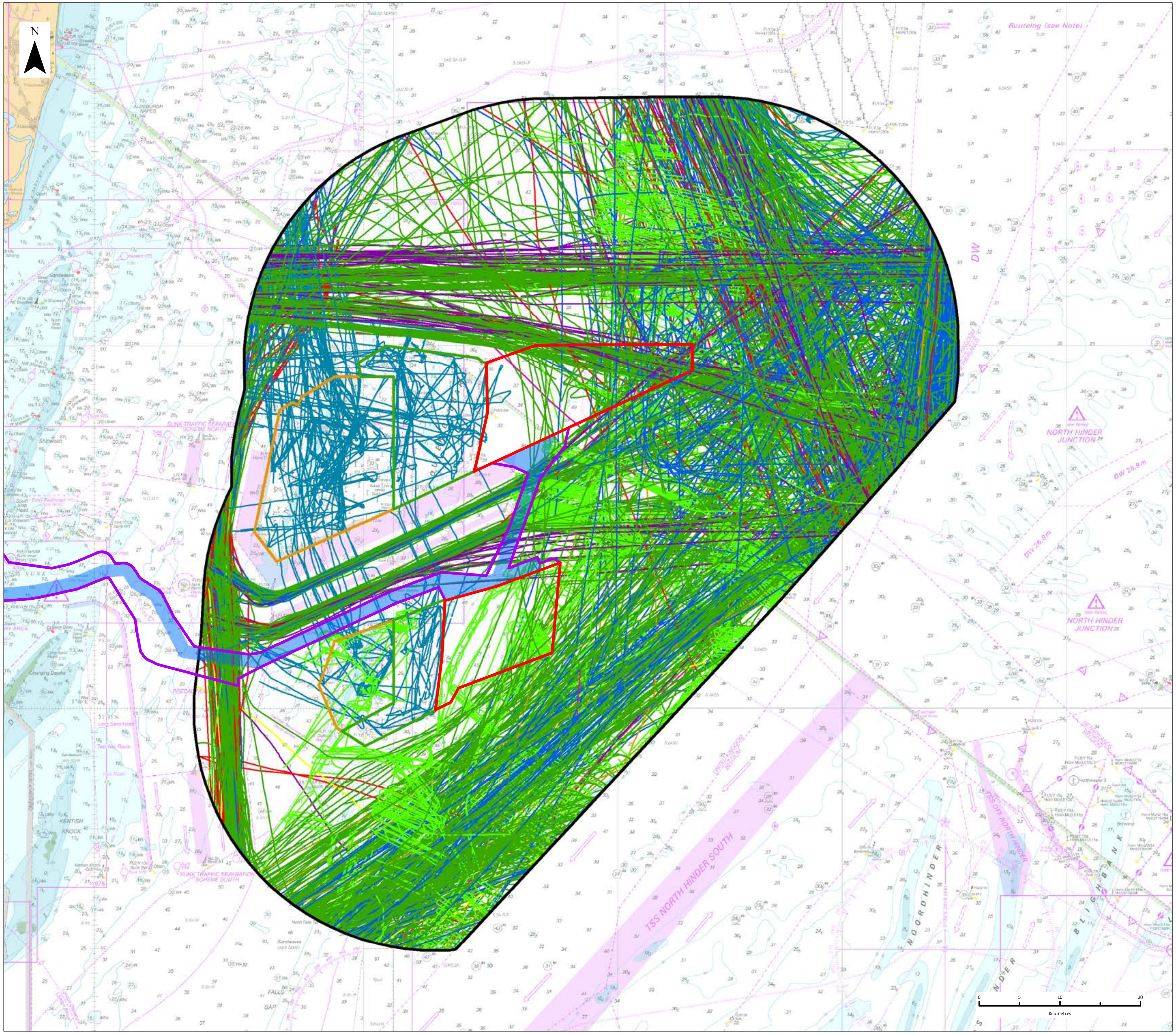
VER	DATE	REMARKS	Drawn	Checked
1	01/09/2021	For Issue	DS	JM
2	21/09/2021	Updated	DS	JM

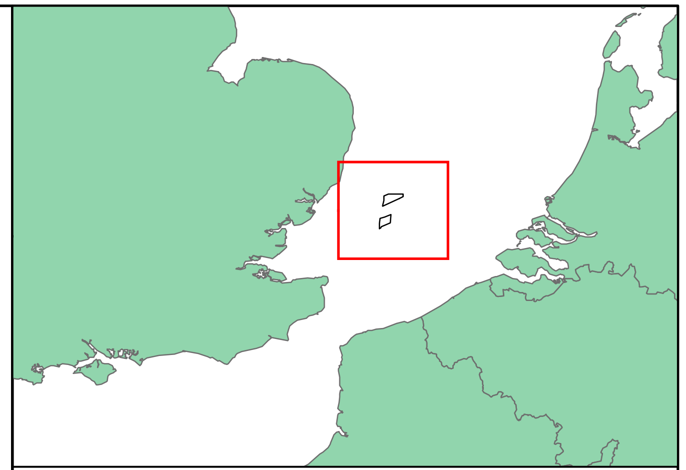
DRAWING NUMBER:

14.4

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	World Mercator

P:\Project\A4542 Five Esturies (VE) GoBe\GIS\ESRI\Scoping Report\MXD\Rev 01\Summer Traffic.mxd





LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- Galloper OWF Array Areas
- Greater Gabbard OWF Array Areas
- Traffic Study Area

Vessel Type

- Fishing
- Military
- Dredger
- Tug
- Passenger
- Cargo
- Tanker
- Other
- Recreational
- Oil and Gas
- Wind Farm

Data Source:
Basemap:

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Winter Traffic

VER	DATE	REMARKS	Drawn	Checked
1	01/09/2021	For Issue	DS	JM
2	21/09/2021	Updated	DS	JM

DRAWING NUMBER:

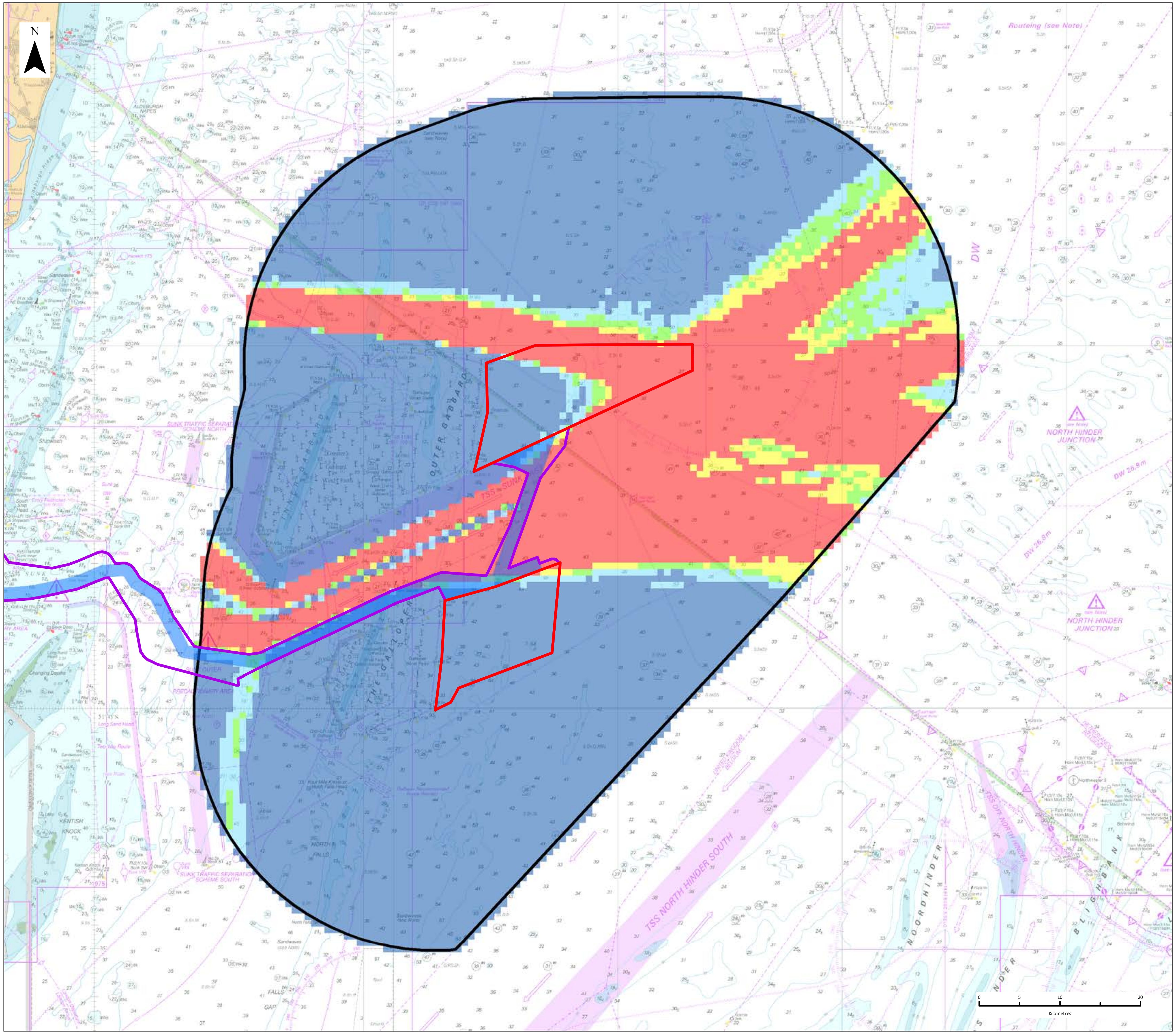
14.5

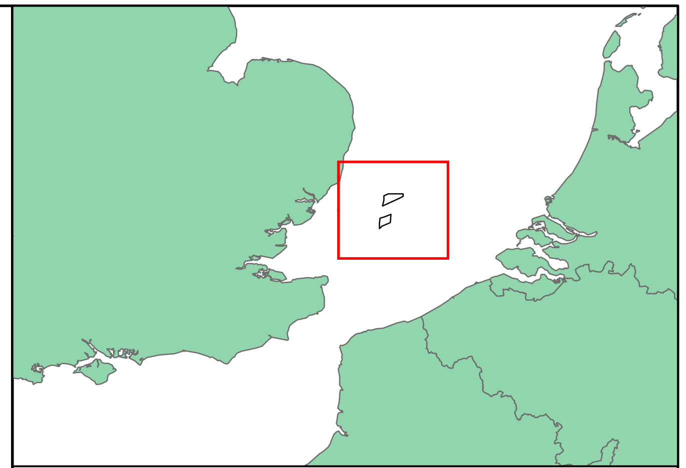
SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	World Mercator

FIVE ESTUARIES OFFSHORE WIND FARM

anatec

P:\Project\A4542 Five Estuaries (VE) GoBe\GIS\ESRI\Scoping Report\MXD\Rev 01\Winter Traffic.mxd





LEGEND

- Array Areas
- Offshore Area of Search
- Preferred Offshore Export Cable Route
- Traffic Study Area

Vessel Density

- Highest
- Lowest

Data Source:
Basemap:

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Vessel Density Heat Map

VER	DATE	REMARKS	Drawn	Checked
1	01/09/2021	For Issue	DS	JM
2	21/09/2021	Updated	DS	JM

DRAWING NUMBER:

14.6

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	World Mercator

FIVE ESTUARIES OFFSHORE WIND FARM

anatec

14.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

14.5.1 The approach to assessment for shipping and navigation including the EIA and NRA was presented and agreed at a high level with the MCA and Trinity House following several preliminary meetings between 2019 and 2021. Additionally, the approach to assessment was also presented to the Sunk VTS Group in January 2021.

14.5.2 The key guidance document that will be considered for shipping and navigation is MGN 654 and its annexes (MCA, 2021)[64]. Other key guidance is as follows:

- Revised Guidelines for Formal Safety Assessment (FSA) (IMO, 2018);
- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) – O-139 the Marking of Man-Made Offshore Structures (IALA, 2013);
- MGN 372 Offshore Renewable Energy Installations (OREIs) Guidance to Mariners Operating in the Vicinity of UK OREIs (MCA 2008); and
- The RYA's Position on Offshore Energy Developments: Paper 1 – Wind Energy (RYA, 2015).

14.5.3 As per the MCA methodology (MCA, 2021), a NRA will be undertaken, the output of which will form the primary input into the EIA. Given that the NRA includes a set of criteria under MGN 654 (MCA, 2021) which must be considered, no impacts will be scoped out of the NRA process. This has been agreed with MCA and Trinity House and the outputs of this Scoping process will inform the NRA.

14.5.4 The IMO's FSA methodology (IMO, 2018) is the internationally recognised approach for assessing impacts to shipping and navigation receptors, and is the approach required under the MCA methodology (MCA, 2021). This methodology is centred on risk control and assesses each impact in terms of its frequency and consequence in order that its significance can be determined as "broadly acceptable", "tolerable", or "unacceptable". Any impact assessed as "unacceptable" will require additional measures implemented beyond those considered embedded in order that the impact is reduced to within "tolerable" or "broadly acceptable" parameters.

[64] The Methodology for Assessing the Marine Navigational Safety Risks of Offshore Renewable Energy Installations (OREIs) was previously a standalone document but now serves as Annex 1 to MGN 654.

14.5.5 Impact significance within the PEIR (and subsequently the ES) will be determined via a risk ranking matrix dependent on the assessed frequency and consequence for each impact. The frequency and consequence, as part of the NRA process, will be related to the parameters required by the IMO FSA and agreed at the Hazard Workshop. The risk ranking matrix is illustrated in Table 14.2 below. The frequency and consequence rankings per impact will be determined using a number of inputs, notably:

- Quantitative modelling undertaken in the NRA (using Anatec's CollRisk software which has been used to support various successful offshore wind farm applications and is therefore considered acceptable by the MCA and other key stakeholders as a suitable means for quantitative modelling);
- Output of the baseline assessment including site-specific vessel traffic surveys;
- Consideration of embedded mitigation in place;
- Lessons learnt from other offshore wind farm developments;
- Level of stakeholder concern; and
- Consultation output.

Table 14.2 - Risk ranking matrix

CONSEQUENCE	**MAJOR**	Tolerable	Tolerable	Unacceptable	Unacceptable	Unacceptable
	SERIOUS	Broadly Acceptable	Tolerable	Tolerable	Unacceptable	Unacceptable
	MODERATE	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable
	MINOR	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable
	NEGLIGIBLE	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable
		NEGLIGIBLE	**EXTREMELY UNLIKELY**	**REMOTE**	**REASONABLY PROBABLE**	**FREQUENT**
		FREQUENCY				

CONSULTEES

14.5.6 The following statutory and non-statutory organisations deemed relevant to shipping and navigation will be included in further consultation, noting that if additional consultees are identified during the NRA process they will be engaged:

- MCA;
- Trinity House;
- UK Chamber of Shipping;
- RYA;
- Cruising Association (CA);
- BMAPA;
- National Federation of Fishermen's Organisations (NFFO);
- Deep sea pilot organisations;
- Port of London Authority (PLA);
- Harwich Haven Authority (HHA);
- Sunk VTS User Group;
- Commercial ferry operators; and
- Other Regular Operators identified from vessel traffic survey data.

14.5.7 Details of meetings held to date are included in Chapter 6: Consultation Process.

POTENTIAL PROJECT IMPACTS

14.5.8 A range of potential impacts on shipping and navigation have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 14.3, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) to enable an assessment of the impact. It is noted that impacts associated with active fishing activities are considered in Chapter 13: Commercial Fisheries.

14.5.9 Given that MGN 654 (MCA, 2021) and its associated checklist require a specific set of criteria to be applied to assessment of shipping and navigation impacts, no impacts have been identified at this stage to be scoped out for the assessment of shipping and navigation. This approach has been agreed with the MCA and Trinity House.

Table 14.3 - Impacts proposed to be scoped into the assessment for shipping and navigation

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
14.1	Vessel traffic displacement	Construction activities associated with the array areas may result in the displacement of all vessels from their existing routes/activity.	A site-specific vessel traffic survey will be undertaken to determine traffic levels, routeing and activities in the area. Worst case deviations to main commercial routes[65] will then be assessed with future case traffic levels determined through consultation.
14.2	Vessel traffic displacement	Construction activities associated with the offshore AoS may result in the displacement of all vessels from their existing routes/activity.	A desktop vessel traffic survey (AIS only) will be undertaken to determine traffic levels, routeing and activities in the area with future case traffic levels determined through consultation.
14.3	Increased vessel to vessel collision risk between a third-party vessel and a project vessel	Presence of vessels associated with construction activities for the array areas may result in increased risk of a collision between a third-party vessel and a project vessel.	A site-specific vessel traffic survey will be undertaken to determine traffic levels, routeing and activities in the area with future case traffic

[65] Main commercial routes will be identified using the principles set out in MGN 654 (MCA, 2021), with routes designated where (from assessment of vessel traffic data) vessels are transiting at similar headings and locations.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			levels determined through consultation.
14.4	Increased vessel to vessel collision risk between a third-party vessel and a project vessel	Presence of vessels associated with construction activities for the offshore AoS may result in increased risk of a collision between a third-party vessel and a project vessel.	A desktop vessel traffic survey (AIS only) will be undertaken to determine traffic levels, routeing and activities in the area with future case traffic levels determined through consultation.
14.5	Increased vessel to vessel collision risk between third-party vessels	Vessel traffic displacement and the proximity to IMO routeing measures may result in an increased risk of a collision between third-party vessels.	A site-specific vessel traffic survey will be undertaken to determine traffic levels, routeing and activities in the area. Worst case deviations to main commercial routes will then be used as input to quantitative collision risk modelling to estimate the change in collision risk compared to the baseline environment with future case traffic levels determined through consultation.
14.6	Reduced access to local ports	Construction activities associated with the array areas may result in reduced access to local ports.	A site-specific vessel traffic survey will be undertaken to determine traffic levels, routeing and activities in the area. Access patterns to local ports will be identified and

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			assessed against construction activities with future case traffic levels (including port developments) determined through consultation.
14.7	Reduced access to local ports	Construction activities associated with the offshore AoS may result in reduced access to local ports.	A desktop vessel traffic survey (AIS only) will be undertaken to determine traffic levels, routeing and activities in the area. Access patterns to local ports will be identified and assessed against construction activities with future case traffic levels (including port developments) determined through consultation.
OPERATION			
14.8	Vessel traffic displacement	Presence of structures within the array areas may result in the displacement of all vessels from their existing routes/activity.	As per Impact 14.1.
14.9	Increased vessel to vessel collision risk between a third-party vessel and a project vessel	Presence of vessels associated with operation and maintenance activities for the array areas may result in increased risk of a	As per Impact 14.3.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		collision between a third-party vessel and a project vessel.	
14.10	Increased vessel to vessel collision risk between a third-party vessel and a project vessel	Presence of vessels associated with operation and maintenance activities for the offshore AoS may result in increased risk of a collision between a third-party vessel and a project vessel.	As per Impact 14.4.
14.11	Increased vessel to vessel collision risk between third-party vessels	Vessel traffic displacement and the proximity to IMO routeing measures may result in an increased risk of a collision between third-party vessels.	A site-specific vessel traffic survey will be undertaken to determine traffic levels, routeing and activities in the area. Worst case deviations to main commercial routes will then be used as input to quantitative collision risk modelling to estimate the change in collision risk compared to the baseline environment with future case traffic levels determined through consultation.
14.12	Increased vessel to structure allision risk	Presence of structures within the array areas may result in the creation of a risk of allision (powered or drifting) for all vessels.	A site-specific vessel traffic survey will be undertaken to determine traffic levels, routeing and activities in the area. Worst case deviations to main commercial routes will then

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			be used as input to quantitative allision risk modelling (powered and drifting) to estimate the allision risk with future case traffic levels determined through consultation.
14.13	Reduced access to local ports	Presence of structures within the array areas and operation and maintenance activities associated with the array areas may result in reduced access to local ports.	A site-specific vessel traffic survey will be undertaken to determine traffic levels, routeing and activities in the area. Access patterns to local ports will be identified and assessed against operation and maintenance activities with future case traffic levels (including port developments) determined through consultation.
14.14	Reduced access to local ports	Operation and maintenance activities associated with the offshore AoS may result in reduced access to local ports.	A desktop vessel traffic survey (AIS only) will be undertaken to determine traffic levels, routeing and activities in the area. Access patterns to local ports will be identified and assessed against operation and maintenance activities with future case traffic levels (including port developments) determined through consultation.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
14.15	Reduction of under keel clearance	Presence of cable protection associated with export and inter-array cables may result in reductions to water depth and the creation of an under keel clearance risk for all vessels.	A desktop vessel traffic survey (AIS only) will be undertaken to determine traffic levels, vessel sizes, routeing and activities in the area with future case traffic levels determined through consultation. This will be compared against water depths within the offshore AoS and requirements for cable protection to determine the risk level for vessels.
14.16	Anchor interaction with subsea cables	Presence of export and inter-array cables may result in the creation of a risk of a vessel anchor making contact with a subsea cable[66].which could result in effects on vessel stability.	A desktop vessel traffic survey (AIS only) will be undertaken to determine traffic levels, vessel types and anchoring activities in the area with future case traffic levels determined through consultation.
14.17	Interference with marine navigation, communications and position fixing equipment	Presence of structures in the array areas and offshore AoS may result in interference with marine navigation, communication and	A site-specific vessel traffic survey will be undertaken to determine traffic levels in the area. Worst case deviations to main commercial routes and experience

[66] It is noted that the offshore AoS does not overlap with any designated anchorage areas, as shown in Figure 14.2.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		position fixing equipment used by all vessels.	from existing offshore wind farms will then be used as input to qualitatively assess effects (based on proximity to structures) with future case traffic levels determined through consultation.
14.18	Reduction of emergency response capability including Search and Rescue (SAR)	Presence of structures within the array areas and operation and maintenance activities associated with the array areas and offshore AoS may result in an increased likelihood of an incident occurring which requires an emergency response and may reduce access for surface and air responders, including SAR assets.	Incident rates for the baseline environment will be estimated based on historical incident data and existing emergency response resources will be identified. Anticipated project vessel movements will be taken into account as will the information provided in Annex 5 to MGN 654.
DECOMMISSIONING			
The impacts for the decommissioning phase will be similar to the impacts for the construction phase noting that from a shipping and navigation perspective the activities during both of these events will be similar and the subsequent effect on the movements of third-party vessel traffic are expected to be similar. These impacts will be scoped into the EIA.			

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

14.5.10 As part of the design process for VE a number of designed-in measures are proposed to reduce the potential for impacts on shipping and navigation receptors. These will evolve over the development process as the EIA progresses and in response to consultation.

14.5.11 VE OWFL are committed to implement these measures, and also various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence will be considered in the judgments as to which impacts can be scoped in/out of the PEIR (noting that as per Paragraph 14.5.3 no impacts will be scoped out of the NRA).

14.5.12 Measures adopted as part of the project will include:

- Compliance with MGN 654 (MCA, 2021) including SAR Annex 5 where applicable;
- Appropriate marking on UKHO admiralty charts;
- Promulgation of information as required (e.g., Notifications to Mariners, Kingfisher bulletin);
- Buoyed construction area in agreement with Trinity House;
- Application for safety zones during construction and periods of major maintenance;
- Marine coordination and communication to manage project vessel movements;
- Marking and lighting of the site in agreement with Trinity House, MCA and Civil Aviation Authority (CAA);
- Compliance of all project vessels with international marine regulations as adopted by the Flag State, notably the International Regulation for Prevention Collision at Sea (COLREGs) (IMO, 1972/77) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974);
- Minimum blade tip clearance of at least 22 m above Mean High Water Springs (MHWS); and
- Guard vessel(s) as required by risk assessment.

14.5.13 The requirement and feasibility of any additional mitigation measures will be consulted upon with statutory consultees throughout the EIA and NRA processes.

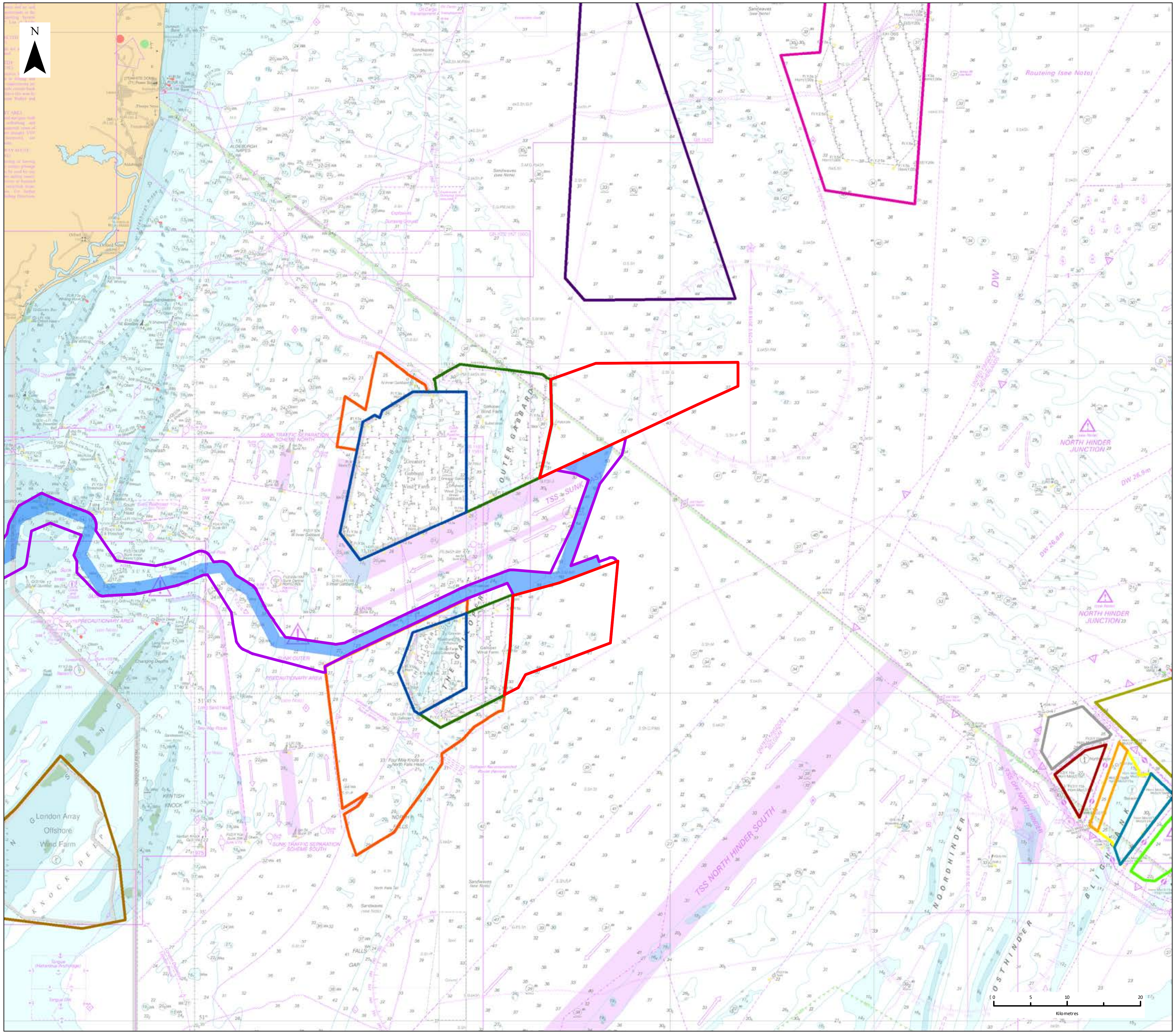
POTENTIAL CUMULATIVE IMPACTS

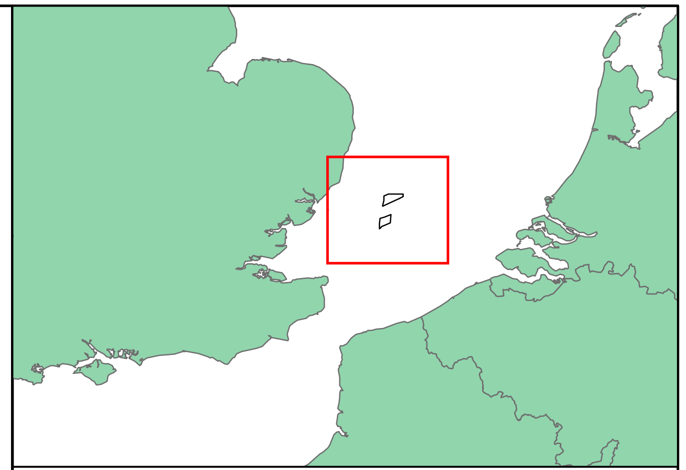
14.5.14 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the cumulative impact assessment (CIA). For shipping and navigation, cumulative interactions may occur with other planned projects and developments in the study area. Potential cumulative impacts with other projects and activities will be considered for each of the impacts considered in Table 14.3.

14.5.15 For shipping and navigation, a tiering system will be used to determine which developments are screened into the cumulative assessment and the extent of the assessment undertaken. Criterion applied may include development status, distance from VE, level of interaction with baseline vessel traffic relevant to VE, level of concern raised during consultation and data confidence.

14.5.16 Activities which will be considered in the shortlisting process include other offshore wind developments, oil and gas infrastructure, marine aggregate dredging activities and subsea cables and pipelines. Other offshore wind farm developments (both operational and in planning) are presented in Figure 14.7.

14.5.17 All impacts considered in the assessment of VE in isolation are proposed to be scoped into the cumulative assessment, in line with Paragraph 14.5.3.





LEGEND

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

Other Wind Farms

- Belwind phase 1
- Belwind phase 2 (Nobelwind) (Zone 1)
- Belwind phase 2 (Nobelwind) (Zone 2)
- Borssele IV Wind Farm
- East Anglia One Wind Farm
- East Anglia Two Wind Farm
- Galloper Wind Farm
- Greater Gabbard Wind Farm
- London Array Wind Farm
- Mermaid
- North Falls
- Northwester 2
- Seastar

Data Source:
Basemap:

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Other Wind Farms

VER	DATE	REMARKS	Drawn	Checked
1	01/09/2021	For Issue	DS	JM
2	21/09/2021	Updated	DS	JM

DRAWING NUMBER:

14.7

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:550,000	A3	WGS84	World Mercator

FIVE ESTUARIES OFFSHORE WIND FARM

anatec

P:\Project\A4542 Five Esturies (VE) GoBe\GIS\ESRI\Scoping Report\MXD\Rev 01\Other Wind Farms.mxd

POTENTIAL TRANSBOUNDARY IMPACTS

14.5.18 A description of how potential transboundary effects will be assessed is outlined in Chapter 4: Environmental Impact Assessment approach and methodology. As presented in Chapter 4, the limits of the Dutch, Belgian and French Exclusive Economic Zones are located approximately 16 km (south east), 25 km (south) and 18 km (north east) of the VE array areas respectively. For shipping and navigation, vessel routeing and ports will be considered at a transboundary level, including the offshore wind farm developments associated with other European Economic Zones states. It is noted that fishing, recreation and marine aggregate dredging impacts, although having the potential to be internationally owned or located, will be considered as part of the baseline assessment. As part of the pre-application process, VE OWFL will consult with transboundary stakeholders during the Section 42 process.

14.6 SUMMARY OF NEXT STEPS

14.6.1 As described in Section 14.3, a site-specific vessel traffic survey of the array areas compliant with the requirements of MGN 654 (MCA, 2021) will be undertaken to ensure all vessels are considered in the baseline environment established in the NRA. Desktop vessel traffic data will also be collected for the offshore AoS.

14.6.2 As described in Paragraph 14.5.6, consultation with statutory and non-statutory organisations deemed relevant to shipping and navigation will be undertaken and used as input to the PEIR/ES and NRA.

14.6.3 Using these inputs along with expert opinion and lessons learnt from existing offshore developments, the NRA will be drafted in support of the PEIR as required under the MCA methodology (MCA, 2021). The primary purpose of the NRA is to identify scoped in impacts that require further assessment within the PEIR.

14.7 FURTHER CONSIDERATIONS FOR CONSULTEES

14.7.1 Based on the findings of the scoping report, the following questions should be considered by stakeholders seeking to respond:

- Are the study areas appropriate to capture the impacts of VE noting that two different study areas are proposed to capture the main commercial routes on an appropriate scale?
- Are there any impacts to shipping and navigation receptors that should be considered in addition to those listed in Table 14.3?
- Are there any specific concerns on the use of the IMO routeing measures in the area or for heavy use routes currently passing through or in close proximity to the array areas due to the presence of VE, and if so, what mitigation measures could resolve these effects?
- Are there any alternative routes used by vessels in adverse weather conditions or in sensitive navigation areas (such as pilot boarding areas) that may not be captured in the datasets shown or proposed and if so what are those routes?
- Are there any mitigation measures not listed in Paragraph 14.5.1 that should be considered embedded?
- Are there any specific cumulative projects that are considered relevant to VE and do they create a specific cumulative risk that requires consideration in the NRA?
- Are there any organisations not listed in Paragraph 14.5.6 that should be consulted?
- Are the methods of assessment suggested appropriate for assessing the impacts of VE?
- Are there any additional events or activities in the area (e.g. specific fishing seasons or port activities) that may not be incorporated by the 28-day dataset suggested in Paragraph 14.3.3?
- Are there any port developments that should be taken into consideration when determining the future case traffic levels for any vessel types? At present the NRA will assess three scenarios consisting of increases of 0%, 10% and 20% to all vessel traffic.

15. MILITARY AND CIVIL AVIATION

15.1 INTRODUCTION

15.1.1 This chapter of the Scoping Report identifies the military and civil aviation receptors of relevance to the VE. It describes the potential effects from the construction, operation and maintenance, and decommissioning of VE on military and civil aviation and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

15.1.2 Both the northern and southern offshore array areas as depicted in Figure 15.1, are considered as one search area in establishing baseline data and aviation stakeholders except where changes to data requires individual attention. This section considers:

- The operations of civil airports;
- The types and operational coverage (including Air Traffic Service (ATS) therein) of civil and military aviation radar over the array areas;
- Civil aviation agencies;
- The use of helicopters in the construction and Operation and Maintenance (O&M) phases of VE,
- Search and Rescue (SAR) offshore helicopter operations; and
- The Ministry of Defence (MOD) aviation operations.

15.1.3 This chapter considers the orientation of route, approach and departure flight paths, physical safeguarding of flight, airspace characteristics and flight procedures as published in the UK Integrated Aeronautical Information Package (IAIP) (NATS, 2021) and the Military Aeronautical Information Publication (Mil AIP) (MOD, 2021). Initial considerations of aviation interests have been informed by the results of baseline studies and consultation, with reference to the existing evidence base regarding the effects of offshore wind farm development. Further details and the results are provided in Section 15.4 of this chapter.

15.2 STUDY AREA

15.2.1 The aviation and radar study area is shown in Figure 15.1 below and encapsulates the VE array areas, the airspace between the VE array areas, the UK mainland from the location of the NATS operated Cromer Primary Surveillance Radar (PSR) to the north (Norfolk) and the Southend Airport PSR to the south (Essex). Other aviation radar systems are located within the search area however these have been discounted due to the radar limited range of operation; details of those radar systems excluded from the analysis are provided in Table 15.3.

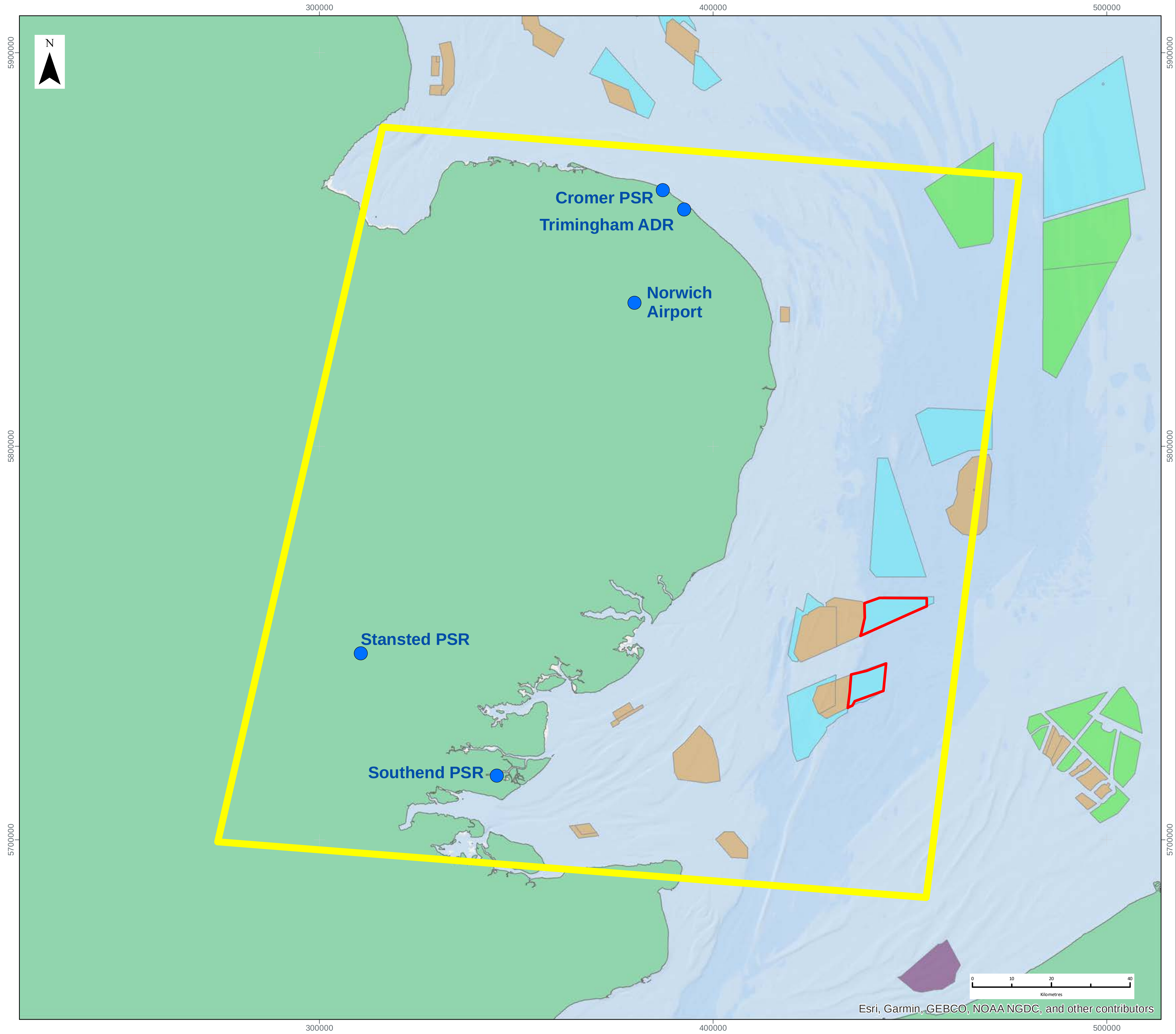
15.2.2 Whilst not definitive, Civil Aviation Authority (CAA), Civil Aviation Publication (CAP) 764 Policy and Guidelines on Wind Turbines (CAA, 2016), provides criteria for assessing whether any wind turbine development which might have an impact on civil aerodrome and radar related operations. Consideration of VE potential to impact on aviation stakeholders and receptors has been undertaken in accordance with the standard consultation distances stated in CAP 764 (CAA, 2016) and to inform the development of the military and civil aviation study area.

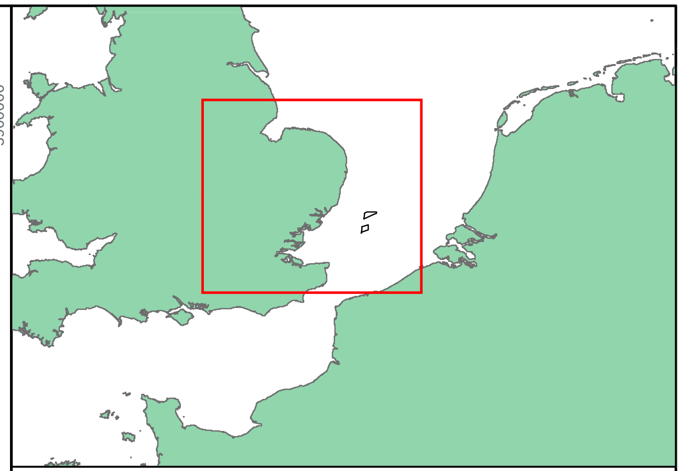
15.2.3 This chapter considers all radar systems within operational range of VE, as well as military areas of operation. For each identified receptor, the physical obstruction and/or radar effect, and subsequently the operational impacts were considered along with any other potential impacts. A number of receptors were scoped out from the consultation process as they were out-with the stated CAP 764 consultation zones or criteria which include:

- Within 30 kilometres (km) of a civil aerodrome with PSR - although it is acknowledged that the distance quoted in CAP 764 can be greater than 30 km dependent on a number of factors at individual aerodromes, including type and coverage of radar utilised;
- Airspace coincident with published airfield Instrument Flight Procedures (IFP) to take into account the requirement for an aerodrome's responsibility to safeguard its IFPs; and
- Within 17 km of a non-radar equipped licensed aerodrome with a runway of 1,100 metres (m) or more.

15.2.4 The operational range of a radar system is dependent on the type of radar used and its operational requirement. CAP 764 provides a guide of 30 km for assessment of civil aviation radar impact; however, any impact (military or civil aviation radar) is dependent on radar detectability of operational wind turbines, the radars operational range and the use of airspace in which the development sits .

15.2.5 Based on professional judgement of the author of this section of the Scoping Report, there are no other potentially affected stakeholders outside of the search area.





LEGEND

- Array Areas
- Aviation Study Area
- Key Aviation Locations

Offshore Wind Farms:

- Concept/Early Planning
- Consented
- In Planning
- Operational
- Under Construction

Data Source:

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Aviation Study Area

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	BPHB	FM

DRAWING NUMBER:

15.1

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

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Aviation\VE_AV_Fig1_Study_Area.mxd

15.3 BASELINE DATA

15.3.1 A desk study was undertaken to obtain information on civil and military stakeholders and radar systems. A variety of aviation publications contain information and guidance relating to the potential effects of an offshore wind development on aviation stakeholders. Data sources and guidance documents considered as part of the desktop review in the establishment of the baseline aviation situation include the documents and charts listed in Table 15.1.

Table 15.1 - Key sources of information for Military and Civil Aviation

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
National Policy Statement (NPS) for Energy (EN-1) (DECC, 2011) and NPS for Renewable Energy Infrastructure EN-3 (DECC, 2011a).	Planning policy for offshore renewable energy Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to aviation and radar[67].	This is a national dataset providing full coverage of the military and civil aviation study area.
CAA Visual Flight Rules (VFR) Chart (March 2021).	Provides topographical air chart information on aerodrome, airspace and areas of air traffic control responsibilities.	This is a national dataset providing full coverage of the military and civil aviation study area.
NATS UKIAIP Aeronautical Information Service (AIS) Aeronautical Information Regulation And Control (AIRAC) 09/21.	The main resource for information and flight procedures at all licensed UK airports as well as airspace, en-route procedures, charts and other air navigation information.	This is a national dataset providing full coverage of the military and civil aviation study area.
CAA CAP 764 Policy and Guidelines on Wind Turbines (February 2016).	Aids aviation stakeholders in understanding and addressing wind energy related issues thereby ensuring greater consistency in the consideration of the potential effect of proposed wind farm developments.	This is a national dataset providing full coverage of the military and civil aviation study area.
CAA CAP 168 Licensing of Aerodromes (March 2019).	Sets out the standards required at UK licensed aerodromes relating to its management systems,	This is a national dataset providing full coverage of the military and civil aviation study area.

[67] As noted in Chapter 1: Introduction VE OWFL are aware that the NPSs are currently under review. The EIA on Military and Civil Aviation will be undertaken in accordance with the latest NPSs available at the time.

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
	operational procedures, physical characteristics, assessment and treatment of obstacles, and visual aids.	
CAA CAP 393 The Air Navigation Order (ANO) 2016 and Regulations (January 2021).	Sets out the provisions of the ANO as amended together with regulations made under the Order. It is prepared for those concerned with day-to-day matters relating to air navigation that require an up-to-date reference document of the air navigation regulations and is edited by the Legal Advisers Department of the CAA. CAP 393 also includes the use of aviation obstruction lighting to wind turbines in UK territorial waters.	This is a national dataset providing full coverage of the military and civil aviation study area.
CAA CAP 437 Standards for Offshore Helicopter Landing Areas (July 2021).	Provides the criteria applied by the CAA in assessing helicopter landing areas for worldwide use by helicopters registered in the UK. It includes design of winching area arrangements located on wind turbine platforms to represent current best practice.	This is a national dataset providing full coverage of the military and civil aviation study area.
CAA CAP 670 Air Traffic Services Safety Requirements (June 2019).	Sets out the safety regulatory framework and requirements associated with the provision of an ATS.	This is a national dataset providing full coverage of the military and civil aviation study area.
MOD UK MIL AIP (AIRAC 09/21).	The main resource for information and flight procedures at all military aerodromes as well as airspace, en-route procedures, charts and other air navigation information.	This is a national dataset providing full coverage of the military and civil aviation study area.
International Civil Aviation Authority (ICAO), Document 8168 Ops/611 Procedures	Describes operational procedures recommended for the guidance of flight	This is an international civil dataset and provides full coverage of the

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
for Air Navigation Services Aircraft Operations (PANS-OPS) (ICAO 2018).	operations personnel worldwide. The main resource for guidance at all licensed UK airports as well as airspace, en-route procedures, charts and other air navigation information. It defines international standards of guidance for operational personnel including flight crew to adhere strictly to published procedures to achieve and maintain an acceptable level of safety in operations.	military and civil aviation study area.
Osprey Radar Line of Sight (LOS) analysis.	Provides analysis results of theoretical detectability of wind turbines by aviation radar at the worst case blade tip height of 400 m above mean sea level (amsl)68.	Partial coverage of the military and civil aviation study area (array areas).

15.4 BASELINE ENVIRONMENT

AIRSPACE DESIGNATIONS

The airspace above and around VE is used by both civil and military aircraft, which are tracked by radar systems including those operated by NATS and the MOD. The VE northern array area will be located in an area of Class G uncontrolled airspace, which is established above the array area from the surface up to a ceiling of Flight Level[69] (FL) 85 (approximately 8,500 feet (ft). The Class G airspace ceiling lowers to FL 65 above the southern array area. Above this Class G airspace, Class A Controlled Airspace (CAS) (airways) forms the Clacton Control Area (CTA) which is established from various levels up to FL 195 (19,500 ft), further CAS is established above FL 195. Figure 15.2 below provides an illustration of the airspace structure above the array areas together with the dividing line between the London and Amsterdam Flight Information Regions[70] (FIR).

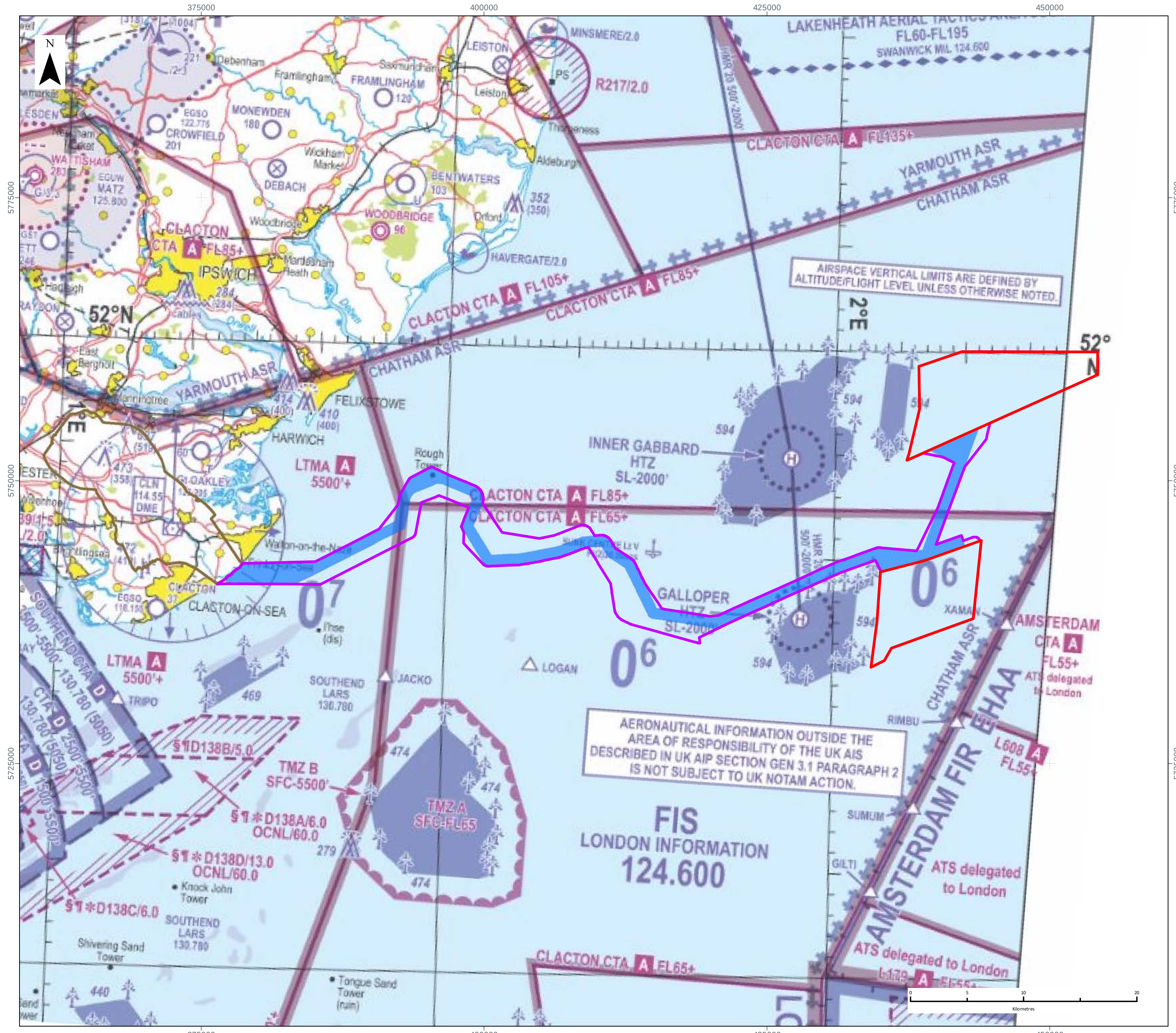
[68] As presented in Chapter 3, the maximum upper blade tip height above Mean High Water Springs (MHWS) is 397 m. However, the radar line of site analysis tool has a minimum of 5 m increment fidelity and requires inputs relating to mean sea level. Therefore, 400 m (amsl) was applied in the analysis to ensure that was precautionary, this equates to approximately 398.42 m above MHWS.
[69] A Fight Level (FL) is a surface of constant atmospheric pressure related to a specific pressure datum, 1013.2hPa, and is separated from other such surfaces by specific pressure intervals. Altitude above the sea-level is measured in 100 feet (ft) units according to the standard atmosphere. In lay terms the FL corresponds approximately to the nearest 100 ft of altitude at which the airspace begins.
[70] A Flight Information Region (FIR) is a specified region of airspace in which a flight information service and an alerting service are provided. ICAO delegates which country is responsible for the operational control of a given FIR.

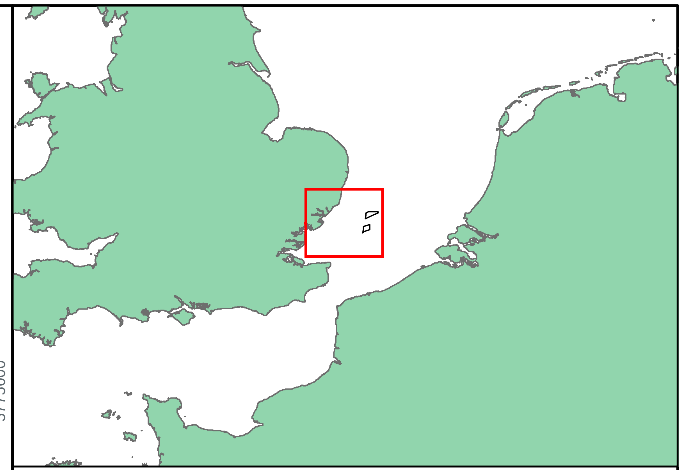
15.4.1 The airspace within, above and surrounding the array areas is used by aircraft which observe the airspace rules dependent on the classification of airspace within which they are operating as follows:

- Class G uncontrolled airspace: any aircraft can operate in an area of uncontrolled airspace without any mandatory requirement to be in communication with Air Traffic Control (ATC). Pilots of aircraft operating under VFR[71] in Class G airspace are ultimately responsible for seeing and avoiding other aircraft, terrain and obstructions; and
- Class A CAS: all aircraft operating in this airspace must be in receipt of an ATS in which instructions provided are mandatory.

15.4.2 In aviation and airspace terms the world is divided into FIRs for the responsibility of the provision of ATS to aircraft. The boundary between London FIR (under the regulation of the UK CAA) and Amsterdam FIR (under the regulation of the Netherlands Inspectie Leefomgeving en Transport (ILT)) is located to the east of the array areas which both lie within the lateral confines of the London FIR.

[71] Visual Flight Rules (VFR) are a set of regulations under which a pilot operates an aircraft in weather conditions which allow the pilot to see and avoid other aircraft, obstructions and terrain.





LEGEND

- Offshore Area of Search
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Area of Search

Data Source:

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Airspace above Array Areas

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	BPHB	FM

DRAWING NUMBER:

15.2

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

FIVE ESTUARIES OFFSHORE WIND FARM

\\gobe-dc.gobe.local\Company\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Aviation\VE_AV_Fig2_Airspace.mxd

AIR TRAFFIC SERVICE (ATS) OUTSIDE OF CAS

15.4.3 A non-radar based Flight Information Service (FIS) is provided within Class G uncontrolled airspace within the area of the offshore array areas for those General Aviation (GA), military and commercial aircraft which wish to use it. The service is provided by NATS and the MOD for basic and alerting purposes as well as providing on request, routine and airfield meteorological information to pilots. The development of VE will not impact the provision of this service.

15.4.4 A Lower Airspace Radar Service (LARS) is available by Norwich and Southend Airport radar controllers to all aircraft requesting it and operating outside of CAS (up to FL 100) within the limits of the airfield radio and radar cover. The provision of LARS is at the discretion of the airport controllers concerned because they may be fully engaged in their primary tasks therefore, occasionally, the service may not be available. The array areas are outside of the LARS service provision range of these two radar systems (Norwich 30 Nautical Mile (NM) radius, Southend 25 NM radius) (UK IAIP, 2021). Both airports may operate their radar systems outside of the range of LARS provision (subject to appropriate radar coverage being provided) for the control of aircraft inbound and outbound from their respective airfields or for tactical awareness of the air traffic situation.

MILITARY LOW FLYING OPERATIONS

15.4.5 The UK Low Flying System (UKLFS), used for Military Low Flying activity, covers the open airspace over the entire UK land mass and surrounding sea areas generally out to 2 NM from the coastline, from the surface to 2,000 ft above ground level (agl) or amsl; however, military low flying activities can take place further from the coastline out to sea. The development has the potential to impact low flying operations due to the creation of an obstruction therefore impact to low flying operations is scoped in as detailed in Table 15.4.

MILITARY PRACTICE AND EXERCISE AREAS

15.4.6 The offshore array areas are not within, or underneath any military aviation PEXA and therefore no assessment is required within the EIA and military aviation PEXA are scoped out as detailed in Table 15.5 .

AIRBORNE SEARCH AND RESCUE (SAR) OPERATIONS

15.4.7 The SAR helicopter force provides 24-hour aeronautical SAR cover in the UK which is provided from ten strategically located bases. The bases are positioned close to SAR hotspots so that aircraft can provide support as quickly and efficiently as possible. Bristow Helicopters were awarded the contract to provide SAR helicopter services for the UK in 2013; the closest SAR helicopter base is located at Lydd Airport (Kent). The development has the potential to impact airborne SAR operations due to the creation of an obstruction therefore impact to airborne SAR operations is scoped in as detailed in Table 15.4.

KENT INTERNATIONAL AIRPORT (MANSTON)

15.4.8 The Kent International Airport, now closed, is located approximately 38 NM southwest of the south array area. A Development Consent Order (DCO) was submitted for the redevelopment of Manston Airport, this was granted on the 20th July 2020. Following an Order of the High Court this decision was quashed, the Secretary of State will now redetermine the application therefore the baseline aviation environment is one which does not include an airport at Manston. The future aviation related infrastructure has yet to be defined; notwithstanding the DCO decision, there is potential for VE to be detected by a Manston Airport ATC PSR. However, at the time of writing the Airport remains closed and is scoped out as detailed in Table 15.5.

RADAR LOS ANALYSIS

15.4.9 In order to inform the baseline a radar LOS analysis has been completed on airfield-based radar systems at a 'worst case' scenario of 400m amsl which is slightly in excess of the maximum upper blade tip height, as detailed in Chapter 3. The aim of the LOS analysis is to determine which radar systems have the potential to theoretically detect wind turbines at the maximum blade tip height placed within the offshore array areas. The final layout of the structures within the array areas will be designed post-consent. Therefore, to enable the radar LOS analysis to be undertaken to inform this scoping chapter; points of reference in the form of a grid pattern were established. The following paragraphs provide theoretical radar LOS results to assessed radar systems.

15.4.10 Radar detectable wind turbines are a significant cause of radar false plots, or clutter, as the rotating blades can trigger the Doppler threshold (e.g., minimum shift in signal frequency) of the Radar Data Processor (RDP) and therefore may be interpreted as aircraft targets. Significant effects have been observed on radar sensitivity caused by the substantial Radar Cross Section (RCS) of the wind turbine structural components (blades, tower and nacelle) which can exceed that of a large aircraft; the effect 'blinds' the radar (or the operator) to wanted targets in the immediate vicinity of the wind farm. False plots and reduced radar sensitivity may diminish the effectiveness of radar to an unacceptable level and compromise the provision of a safe radar service to participating aircraft and detection of aircraft targets.

15.4.11 Osprey utilised the Advanced Terrain Digital Imaging (ATDI) ICS LT (Version 22.4.7 x64) tool to model the terrain elevation profile between the identified PSR systems and the array areas. Otherwise known as a point-to-point radar LOS analysis, the result is a graphical representation of the intervening terrain and the direct signal LOS (considering earth curvature and radar signal properties). This is a limited and theoretical desk-based radar modelling study which is frequently used to establish the potential for individual wind farm developments to create an effect to aviation PSR systems. However, there are unpredictable levels of atmospheric signal diffraction and attenuation within a given radar environment that can influence the probability of a wind turbine being detected. The analysis is designed to give an indication of theoretical likelihood of a wind turbine being detected by the assessed radar system. The qualitative definitions utilised in the radar LOS assessment are defined in Table 15.2. It should be noted that these definitions do not indicate significance of effect in EIA but whether a WTG is likely to be 'seen' by a radar.

15.4.12 Radar detectability of wind turbines does not automatically provide justification for an objection from radar stakeholders. Other factors will determine the nature and severity of the operational impact on the receptor, for example:

> The consideration of airspace structure and classification in the wind turbine vicinity;
> The operational significance of the airspace to the operator;
> The range of the development from the radar source;
> Aircraft traffic patterns and procedures; and
> The type of radar service provided to air traffic using the airspace.

Table 15.2 – Qualitative definitions of radar LOS

RESULT	DEFINITION
Yes	The wind turbine is highly likely to be detected by the radar: direct LOS exists between the radar and the wind turbine.
Likely	The wind turbine is likely to be detected by the radar at least intermittently.
Unlikely	The wind turbine is unlikely to be detected by the radar but cannot rule out occasional detection.
No	The wind turbine is unlikely to be detected by the radar as significant intervening terrain exists.

SOUTHEND AIRPORT

15.4.13 Radar LOS analysis was completed to the London Southend Airport (LSA) PSR which is located on a bearing of 257°/54 NM from the closest edge of south array area and 235°/55.7 NM from the north array area. Theoretically the LSA PSR is likely to detect wind turbines at the assessed blade tip height in the western half of the north array area; although occasional detection cannot be ruled out from other areas to the east. The western half of the south array area at a blade tip height of 400 m amsl (approximately 398.42 m MWHS) is theoretically highly likely to be detected by the LSA PSR; intermittent detection of the remainder of the southern array cannot be ruled out. It is however, considered unlikely that LSA ATC (Approach Radar Service Documented Operational Coverage (DOC) of 40 NM) will be controlling aircraft in the airspace above the array areas and therefore impact to operations conducted at the Airport is scoped out as detailed within Table 15.5.

NORWICH AIRPORT

15.4.14 The Norwich Airport PSR is located on a bearing of 320°/51.8 NM from the closest edge of the north array development area boundary. Theoretically the Norwich Airport PSR is likely to detect wind turbines of a maximum blade tip height of 400 m amsl (approximately 398.42 m MWHS) placed within the north array area, (a small area to the north of the array will theoretically be highly likely to be detectable by the Norwich Airport PSR). The south array area will theoretically be unlikely to be detectable by the Norwich Airport PSR although intermittent detection cannot be ruled out from a small area to the northeast of the array. It is considered unlikely that Norwich ATC will be controlling aircraft in the airspace above the array areas and therefore impact to operations conducted at the Airport is scoped out as detailed within Table 15.5.

LONDON STANSTED AIRPORT

15.4.15 The results of theoretical radar detectability of wind turbines of a maximum blade tip height of 400 m amsl (approximately 398.42 m MWHS) indicate that the north array area will not be detectable by the London Stansted Airport PSR; however, analysis cannot rule out occasional detection by the PSR over the majority of the south array area.

15.4.16 The London Stansted Airport PSR is located on a bearing of 273°/68 NM from the closest development boundary of the south array development area. The airport operates an ASR-10 radar system which has an operating range of 60 NM; VE array areas are outside of the range of the Stansted ATC Approach Radar DOC of 40 NM for the PSR and therefore the Stansted PSR is scoped out as detailed within Table 15.5.

MOD ATC PSR SYSTEMS

15.4.17 The MOD operates ATC PSR at a number of Royal Air Force (RAF) airbases in Norfolk and Suffolk which generally operate out to a 40 NM radius of the radar location. The ATC PSR located at RAF Marham, RAF Lakenheath, RAF Wattisham and RAF Honington are located in excess of 40 NM from VE and therefore ais scoped out as detailed within Table 15.5.

15.4.18 Military air traffic controllers located at the Swanwick Area Control Centre (ACC) utilise NATS radar for the provision of ATS to aircraft flying outside of and crossing CAS above FL 100 above and surrounding the array areas, within radar and radio coverage. They may, (subject to controller workload and radio and radar coverage), provide a service to pilots flying outside of CAS in the region of the offshore array area. Consideration of potential impact to NATS *en route* PSRs are considered at paragraph 15.4.19 *et seq*.

AIR TRAFFIC SERVICE INSIDE CAS

NATS EN ROUTE RADAR SYSTEMS

15.4.19 Within CAS, NATS En-route Limited (NERL) (which is a subsidiary of NATS) are the main ATS provider utilising several long-range PSR, and Secondary Surveillance Radar[72] (SSR) systems positioned to provide maximum coverage of UK airspace. NATS utilise the Cromer PSR radar data for the control of aircraft overhead the VE array areas. Additionally, NATS has a licence obligation to provide radar data to other remote aviation stakeholders to a high quality and performance standard for the benefit of UK aviation as a whole. Any effect that VE might have on NERL radar systems must be considered both in terms of effect on the civilian en-route services and in the context of its remote users such as the MOD and airports. There are no SSR systems located within the CAA suggested radius where impact will be expected to be created to SSR; therefore, SSR systems are scoped out from further analysis and included within Table 15.5. Radar LOS analysis has been completed for the Cromer PSR; results indicate that theoretically the northern edge of the north array area will highly likely to be detected, intermittent detection of the remainder of the north array cannot be ruled out. The majority of the south array will not be theoretically detectable by the Cromer PSR however, occasional detection cannot be ruled out on the northern edge of the south array.

MOD AIR DEFENCE RADAR

15.4.20 The MOD through the Air Surveillance and Control System (ASACS) Force is responsible for compiling a Recognised Air Picture (RAP) to monitor the airspace in and around the UK in order to launch a response to any potential airborne threat. This is achieved through the utilisation of a network of long-range Air Defence Radar (ADR) systems, some of which are located along the east coast of the UK. Any identified effect of wind turbines on the ASACS radar systems that serve the airspace above the VE arrays will potentially reduce the capability of the ASACS Force. The nearest ADR to VE is the TPS77 type ADR located at RAF Trimingham, North Norfolk which is located on a bearing of 332°/60.4 NM from the closest boundary of the north array area and 339°/68.8 NM from the south Array Area. Theoretically the ADR is highly likely to detect wind turbines of a maximum blade tip height of 400 m amsl (approximately 398.42 m MWHS) across the northern edge of the north array development area; intermittent detection of the rest of the north array cannot be ruled out. The majority of the south array area is unlikely to be detectable by the ADR although intermittent detection of operational wind turbines at a blade tip height of 400 m amsl (approximately 398.42 m MWHS) cannot be ruled out in the northern edge of the north array.

[72] SSR differs from PSR systems in that it transmits an interrogation requesting a dedicated response. CAA guidance (CAP 764, 2016) states that SSR systems are typically affected when wind turbines are located less than 10 km from the radar position.

RADAR LOS SUMMARY

15.4.21 Table 15.3 provides the results of the radar LOS analysis between those radar systems which are predicted to be affected by the operation of VE.

Table 15.3 – Radar LOS results

RADAR SYSTEM	NORTH ARRAY DETECTABILITY	SOUTH ARRAY DETECABILITY	SCOPED IN/OUT
Southend Airport PSR	Likely (western half) Unlikely (eastern half)	Highly Likely (western half) Likely (eastern half)	Out. It is considered unlikely that LSA ATC will be routinely controlling aircraft in the airspace above the array areas.
Norwich Airport PSR	Likely (majority of the array area) Highly Likely (small area to the north of the array area)	Unlikely across the majority of the array area Likely (small area to the north east of the array).	Out. It is considered unlikely that Norwich Airport ATC will be routinely controlling aircraft in the airspace above the array areas.
London Stansted Airport PSR	No	Likely across the majority of the array area Unlikely (on the eastern edge only)	Out. VE array areas are outside of the range of the Stansted PSR.
NATS Cromer PSR	Highly likely to the northern edge of the array area Likely to the remainder of the array area	Unlikely to the northern edge of the array area No to the remainder of the array area	In.
RAF Trimingham ADR	Highly Likely to the northern edge of the array area Likely to the remainder of the array area	Likely to the north western edge of the array area Unlikely to the remainder of the array area	In.

15.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

15.5.1 The EIA will be supported by further desk based studies that will identify and examine in greater detail civil and military aviation receptors. Studies will be undertaken in parallel with consultation, engagement and meetings with specific stakeholders in order to provide a detailed understanding of potential impacts.

15.5.2 The aviation industry and the provision of Air Navigation Services (ANS) (including radar services) are regulated through extensive legislation and guidance; however, the main mechanism for regulating the relationship between aviation and offshore wind is through the consenting system. The document list provided in Table 15.1, as a minimum, has been and will continue to be considered during the EIA process.

POTENTIAL PROJECT IMPACTS

15.5.3 Aviation receptors were identified in accordance with CAP 764 (CAA, 2016). This assessment considers all radar systems within operational range of VE, as well as military aviation areas of operation. For each identified receptor, the potential physical obstruction and/ or radar effect, and subsequently the operational impacts were considered together with any other potential impacts during the construction, operation and maintenance, and decommissioning phases of VE.

15.5.4 A range of potential impacts on military and civil aviation have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 15.4, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) to enable an assessment of the impact.

15.5.5 Based on the baseline environment information currently available and the project description (outlined in Chapter 3) a number of effects are proposed to be scoped out of the EIA for military and civil aviation. These impacts are outlined in Table 15.5, together with a justification for scoping them out.

Table 15.4 - Impacts proposed to be scoped into the assessment for military and civil aviation

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
15.1	In the construction phase, the presence of wind turbines and movement of certain construction vessels (e.g. tall cranes) may present an increased tall obstruction risk to low flying military aircraft and helicopter flight operations in support of SAR operations.	Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure with the VE array areas.	Under aviation flight rules, a Minimum Safe Altitude (MSA) is established to provide the altitude below which it is unsafe to fly in Instrument Meteorological Conditions (IMC) owing to presence of terrain or obstacles within a specified area. On design freeze, analysis will be required to ensure the MSA established in the array area provides the required separation in the presence of construction vessels and / or partially completed WTGs. An IFP is a published procedure used by aircraft flying in accordance with the IFR which is designed to achieve and maintain an acceptable level of safety in operations. An analysis of aerodrome IFPs may be required in due course. Consultation with the MOD will be completed to establish any impact to military low flying operations completed in the vicinity of the offshore array areas. SAR helicopter operators will be consulted with regard to the potential of VE to create an obstruction to aviation activities conducted in

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			the vicinity of the construction vessels and cranes and wind turbines (partially constructed or completed).
OPERATION			
15.2	**Effects on Aviation Radar Systems**: Radar LOS analysis conclusions indicates that the following PSRs have the potential to be detrimentally affected by the development of VE caused by the detection of operational wind turbines within the array area (assuming a tip height of 400 m amsl) and potentially create wind turbine induced radar clutter to be presented onto ATC radar data displays. > NATS Cromer PSR; and > RAF Trimingham ADR.	Wind turbine derived radar clutter appearing on radar displays can confuse the air traffic controller in being unable to differentiate between aircraft and those radar returns provided by the detection of wind turbines. Furthermore, the appearance of multiple false targets in close proximity can generate false aircraft tracks and seduce those returns from real aircraft away from the true aircraft position.	If required, further radar LOS analysis will be completed at design freeze to ensure any mitigation solution agreed ahead of operation is fit for purpose. Consultation with radar stakeholders will continue to reach agreement of a technical primary radar mitigation scheme (if required) which will remove all impact created by operational wind turbines.
15.3	**Creation of an Obstruction**: Consistent with the construction phase aviation stakeholders may have concerns with the potential physical presence of the array area wind turbines.	Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure with the VE array areas.	A range of specific and embedded mitigation measures (notification, lighting and marking) to minimise environmental effects will apply to the development of VE. These will comply with current guidelines and be agreed with the appropriate stakeholders and are outlined in Section 15.5.7.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
DECOMMISSIONING			
15.4	**Effects on Aviation Radar Systems**: Wind turbines within radar LOS to current aviation radar infrastructure have the potential to impact on the system.	Wind turbine derived radar clutter appearing on radar displays can confuse the air traffic controller in being unable to differentiate between aircraft and those radar returns provided by the detection of wind turbines. Furthermore, the appearance of multiple false targets in close proximity can generate false aircraft tracks and seduce those returns from real aircraft away from the true aircraft position. There will be no specific impact on aviation radar as a result of decommissioning activities over and above that identified at operation.	During the gradual decommissioning of above sea level infrastructure, the impact on PSR will be incrementally reduced. Firstly, as wind turbines are decommissioned and the blades cease rotation, before being removed from the site. Any agreed mitigation will be maintained until the last wind turbine is non-operational and unable to rotate in the decommissioning phase.
15.5	**Creation of an obstruction**: The infrastructure required in the process of wind turbine decommissioning, in particular large crane structures, may present a physical obstruction and effect operations of low flying aircraft and airborne SAR operations.	Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure with the VE array areas. The impact will decrease as above sea level infrastructure is removed.	A range of specific and embedded mitigation measures (notification, lighting and marking) to minimise environmental effects will apply to the development of VE. These notification procedures and mitigation measures will be applicable and in place until all above sea level infrastructure is removed. Any impacts from the operation of the proposed project will be incrementally reduced to zero with the decommissioning of VE.

Table 15.5 – Impacts proposed to be scoped out of assessment for military and civil aviation

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
15.6	Impact to PEXA.	There are no aviation PEXA within or surrounding the airspace of the VE arrays.
15.7	Presence of marine cabling	As offshore cables will be below sea-level, there is no potential source/ receptor pathway for an impact to arise on aviation interests and therefore is scoped out.
15.8	Presence of onshore cabling	As all of the onshore cables will be buried below ground level, there is no potential source/ receptor pathway for an impact to arise on aviation interests and therefore is scoped out.
15.9	Presence of the onshore substation (OnSS)	Whilst the OnSS will have infrastructure up to 18 m (approximately 60 ft), this is considered comparable to other buildings and structures within the AoS. Therefore, no impacts are anticipated to arise on aviation interests and therefore is scoped out.
15.10	Impact to SSR systems.	The CAA state that impact to SSR systems may be prevalent if wind turbines are located within 10 km of the radar source; there are no such systems within the stated distance of the array and on this basis the impact is scoped out.
15.11	Impact to London Southend Airport PSR.	Theoretically the LSA PSR is likely to detect wind turbines at the assessed blade tip height in the western half of the north array area; although occasional detection cannot be ruled out from other areas to the east. The western half of the majority of the south array area at a blade tip height of 400 m amsl is theoretically highly likely to be detected by the LSA PSR; intermittent detection of the remainder of the southern array cannot be ruled out. It is considered that that the airspace in the vicinity of the array is not of operational significance to London Southend Airport and therefore the operational impact will be limited and is scoped out.
15.12	Impact to Norwich Airport PSR.	Theoretically the Norwich Airport PSR is likely to detect wind turbines of a maximum blade tip height of 400 m amsl placed within the north array area, (a small area to the north of the array will theoretically be highly likely to be detectable by the Norwich Airport PSR). The south array area will theoretically be unlikely to be detectable by the Norwich Airport PSR although intermittent detection cannot be ruled out from a small area to the northeast of the array. It is considered that that the airspace in the vicinity of the array is not of operational significance to Norwich Airport and therefore operational impact will be limited and is scoped out.

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
15.13	Impact to London Stansted Airport PSR.	The results of theoretical radar detectability of wind turbines of a maximum blade tip height of 400 m amsl indicate that the north array area will not be detectable by the Stansted Airport PSR; however, analysis cannot rule out occasional detection by the PSR over the majority of the south array area . It is considered that that the airspace in the vicinity of the array is not of operational significance to Stansted Airport and therefore operational impact will be limited and is scoped out
15.14	Impact to RAF Marham PSR.	The array area locations are outside of the operational range of the radar.
15.15	Impact to RAF Lakenheath PSR.	The array area locations are outside of the operational range of the radar.
15.16	Impact to RAF Wattisham PSR.	The array area locations are outside of the operational range of the radar.
15.16	Impact to RAF Honington PSR.	The array area locations are outside of the operational range of the radar.
15.17	Impact to Kent International Airport	At the time of writing this Scoping Report no decision has been made on the reopening of the airport.
15.18	Impact to aviation radar systems during the construction phase	There will be no specific impact on aviation radar as a result of construction activities over and above that identified at operation, therefore potential impacts arising from the presence of wind turbines are considered in more detail under operational impacts.
15.19	Impact to aviation radar systems during the decommissioning phase	There will be no specific impact on aviation radar as a result of decommissioning activities over and above that identified at operation, therefore potential impacts arising from the presence of wind turbines are considered in more detail under operational impacts.

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
15.20	Use of helicopters during all phases of VE	The use of helicopters in the construction and O&M phases of the development will increase the numbers of users operating in the airspace between the airfield of departure and arrival and the transit to and from VE. The airspace in which the helicopters will be operating is uncontrolled, therefore aircraft operate on ‘see and be seen’ basis with flight likely to be conducted under Visual Meteorological Conditions (VMC). If conducting the flight under Instrument Flight Rules (IFR) aircraft are likely to be receiving an Air Traffic Control Service (ATCS) and utilising onboard radar systems for the separation from other aircraft operating in the airspace. It is expected that the continued safe operation of uncontrolled airspace between the shore and VE will not be affected by the addition of helicopter flights in support of VE.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

15.5.7 As part of the design process for VE a number of designed-in measures are proposed to reduce the potential for impacts on civil and military aviation receptors. These are presented below and will evolve over the development process as the EIA progresses and in response to consultation.

15.5.8 A range of embedded mitigation measures exist to minimise physical obstruction effects which will be created by the placement of the wind turbines. These mitigation measures will comply with current guidelines and be agreed with the appropriate stakeholders, as follows:

- CAP 393 Article 223 (CAA, 2019) sets out the mandatory requirements for lighting of offshore wind turbines;
- Legislation requires the fitting of obstacle lighting on offshore wind turbines with a height of 60 m or more above the level of the sea at Highest Astronomical Tide (HAT);
- Where four or more wind turbines are located together in the same group, with the permission of the CAA, only those on the periphery of the group need to be fitted with at least one medium intensity steady red light positioned as close as reasonably practicable to the top of the fixed structure; and
- The obstruction light or lights must be fitted to show when displayed in all directions without interruption. The requirements of the angle of the plane beam and peak intensity levels are defined within CAP 393 (CAA, 2019).

15.5.9 CAP 437 (CAA, 2021) sets out a procedure, which will be followed, to indicate to a helicopter operator that the wind turbine blades and nacelle are safely secured in position prior to helicopter hoist operations commencing:

- CAP 437 states that this is best achieved through the provision of a helihoist status light located on the nacelle of the wind turbine within the pilot's field of view, which is capable of being operated remotely, from the platform itself or from within the nacelle;
- A steady green light is displayed to indicate to the pilot that the wind turbine blades, and nacelle are secure, and it is safe to operate. A flashing green light is displayed to indicate that the wind turbine is in a state of preparation to accept hoist operations or, when displayed during hoist operations, that parameters are moving out of limits. When the light is extinguished, this indicates to the operator that it is not safe to conduct helicopter hoist operations;
- Obstruction lighting in the vicinity of the winching area that has a potential to cause glare or dazzle to the pilot or to a helicopter hoist operations crew member should be switched off prior to, and during, helicopter hoist operations; and
- Cap 437 (CAA, 2021) also provides general advice and best practice for ground operations and dangerous goods procedures right across the offshore helicopter operators, that allows them to discharge the responsibilities imposed by Air Operations Regulation 965/2012[73].

[73] https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=10004

15.5.10 It is good practice to notify aviation stakeholders of the location and dimension of any wind energy development and the associated construction activities. Information regarding construction will be passed to the Defence Geographic Centre (DGC) and the General Aviation Awareness Council (GAAC) at least ten weeks in advance of the erection of the first wind turbine and to follow up on the day with a confirmation that the activity has taken place. The data will include:

- Location height (of all structures over 150 ft, date of erection, date of removal and lighting type (none, infra-red or lighting brightness); and
- Local aerodromes identified during consultation should be notified, particularly any police helicopter or air ambulance units.

15.5.11 In addition to these embedded mitigation measures, an Emergency Response Co-operation Plan (ERCoP) will be in place for the construction, operation and decommissioning phases of VE. The ERCoP is completed initially in discussion between the developer and the Maritime Coastguard Agency (MCA), SAR and Navigation Safety Branches. Detailed completion of the plan will then be in cooperation with the Maritime Rescue Coordination Centre (MRCC), responsible for maritime emergency response. The ERCoP must then be submitted to and approved by the MCA. The ERCoP will detail specific marking and lighting of the wind turbines. The SAR helicopter bases will be supplied with an accurate chart of the VE wind turbines. Furthermore, the arrangements of liaison between the wind farm developer and HM Coastguard in the event of an emergency response will be detailed together with an explanation of procedures and processes carried out.

15.5.12 Information will be circulated to relevant aviation stakeholders including NATS and the MOD. Information on potential aviation obstructions will be promulgated within the UK IAIP (NATS, 2021) and notified to regulatory authorities including the CAA and the MOD for marking on aeronautical related charts and documentation . It is therefore considered that these measures are inherently part of the design of VE and will be secured through the requirements of the DCO. The requirement and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

POTENTIAL CUMULATIVE IMPACTS

15.5.13 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the cumulative impact assessment (CIA). Specifically, the VE civil and military aviation study area covers:

- Civil and military aerodromes that could be potentially impacted by the offshore array areas;
- Aviation radar systems that potentially detect 400 m amsl high (blade tip) wind turbines within the array areas;
- Airborne SAR flight operations (including helicopter flights);
- Military low flying and aviation Practice and Exercise Area (PEXA) that intersect or are adjacent to the VE array areas.

15.5.14 Potential cumulative impacts with other projects and activities will be considered for:

- Introduction of a remote obstacle environment; and
- The effect of wind turbine detection by aviation PSR systems.

POTENTIAL TRANSBOUNDARY IMPACTS

15.5.15 A description of how potential transboundary effects will be assessed is outlined in Chapter 4: Environmental Impact Assessment approach and methodology. As presented in Chapter 4, the limits of the Dutch, Belgian and French Exclusive Economic Zones are located approximately 16 km (south east), 25 km (south) and 18 km (north east) of the VE array areas respectively.

15.5.16 As the array areas are completely within UK airspace and due to the localised nature of any potential impacts, transboundary impacts are unlikely to occur and therefore this impact will be scoped out from further consideration within the EIA.

15.6 SUMMARY OF NEXT STEPS

15.6.1 To inform the EIA process, consultation will be required with aviation stakeholders. Consultation has commenced and it is proposed that consultation will be an iterative process, allowing for any concerns that are raised to be considered in the wind turbine layout and optimisation process of wind farm design.

15.6.2 Standard offshore wind farm enquiries to relevant aviation stakeholders (including but not limited to SAR helicopter operators, civil and military airports, NATS and the MOD) will allow for a standardised approach to provision of data and assessment by the regulators and statutory consultees. A pre-planning assessment has been completed by NATS in which no impact is expected to NATS infrastructure however this has yet to be confirmed. The MOD have stated that they may have concerns due to the detectability of VE wind turbines by one of more MOD radars and to military low flying. Discussion with NATS and the MOD to establish, where required, appropriate technical mitigation for the effect of the proposed project on aviation radar systems is in progress.

15.7 FURTHER CONSIDERATION FOR CONSULTEES

- Do you agree that the data sources identified are sufficient to inform the offshore civil and military aviation baseline for the VE Preliminary Environmental Information Report (PEIR) and EIA?
- Do you agree that all the receptors within the study area have been identified?
- Have all potential impacts resulting from VE been identified for civil and military aviation receptors?
- Are you content that the lighting (and charting) requirements pertaining for the fitment of aviation lighting of a wind turbine of up 400 m amsl are sufficient to provide situational awareness to aircrews?
- For those impacts scoped in within Table 15.4, do you agree that the methods described are sufficient to inform a robust impact assessment?
- Do you agree that the impacts described in Table 15.5 can be scoped out?

16. SEASCAPE, LANDSCAPE AND VISUAL IMPACT ASSESSMENT

16.1 INTRODUCTION

16.1.1 This section of the Scoping Report identifies the seascape, landscape and visual receptors of relevance to the VE array areas and offshore AoS. It describes the potential effects from the construction, operation and maintenance, and decommissioning of VE on seascape, landscape and visual receptors and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

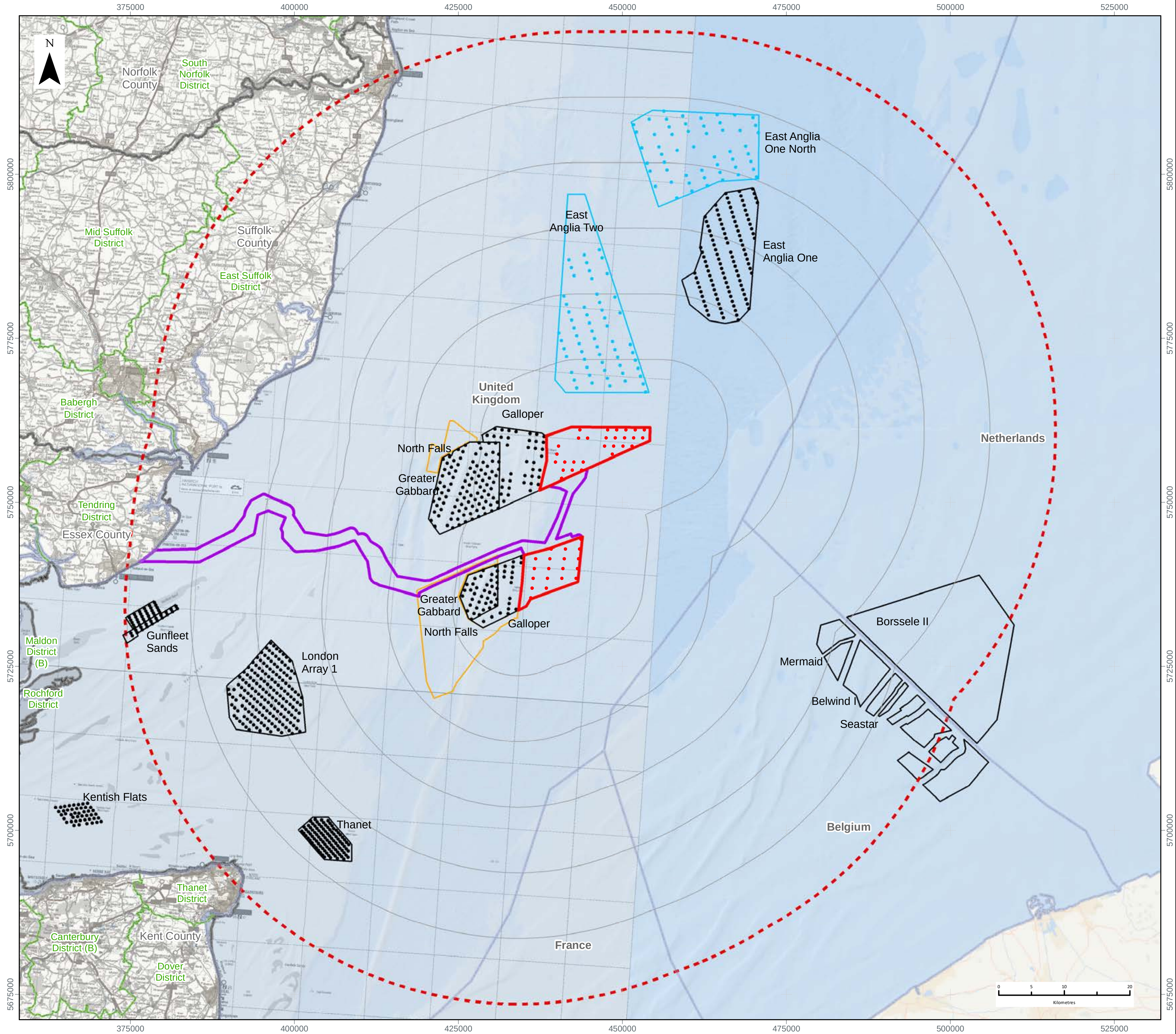
16.1.2 This chapter should be read alongside the following chapters of this Scoping Report:

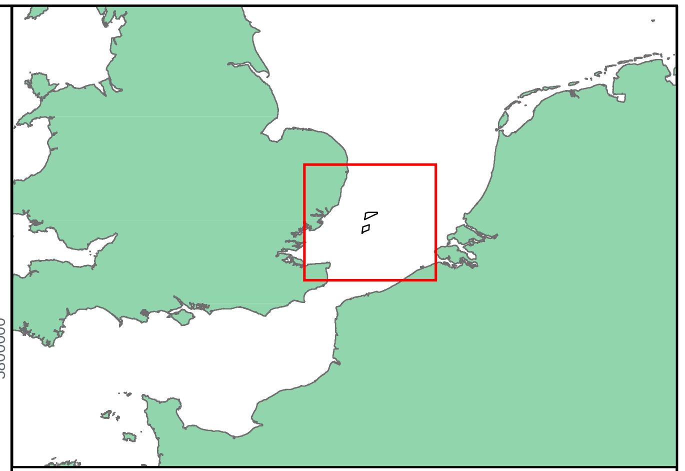
> Chapter 26: Landscape and visual impact (onshore), for interactions with onshore landscape features; and

> Chapter 20: Archaeology and cultural heritage for potential effect to features of historical importance.

16.2 STUDY AREA

16.2.1 The seascape, landscape and visual assessment (SLVIA) study area VE covers a radius of 60 km from VE array areas, as illustrated in Figure 16.1. Broadly, the SLVIA study area is defined by a large area of the seascape including parts of the outer Thames Estuary and the Suffolk, Essex and Kent coasts.





LEGEND

- Five Estuaries WTG
- Array Areas
- Offshore Area of Search
- 10km Radii
- 60km Study Area
- County Boundary
- District Boundary
- Maritime Boundary

Wind Farm Development Status:

- Operational Turbine
- Application
- Scoping

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

SLVIA Study Area

VER	DATE	REMARKS	Drawn	Checked
1	29/07/2021	For Issue	SH	SM
2	10/09/2021	For Issue	SH	SM
3	24/09/2021	For Issue	SH	SM

DRAWING NUMBER:

16.1

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:600,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

P:\2020\201463_FiveEst\GIS\201463_FEWF\SCOPING\201463_FEWF_SCOP_Fig17-1_StudyArea.mxd

16.2.2 The SLVIA study area is defined as the outer limit of the area where significant effects could occur, using professional judgement.

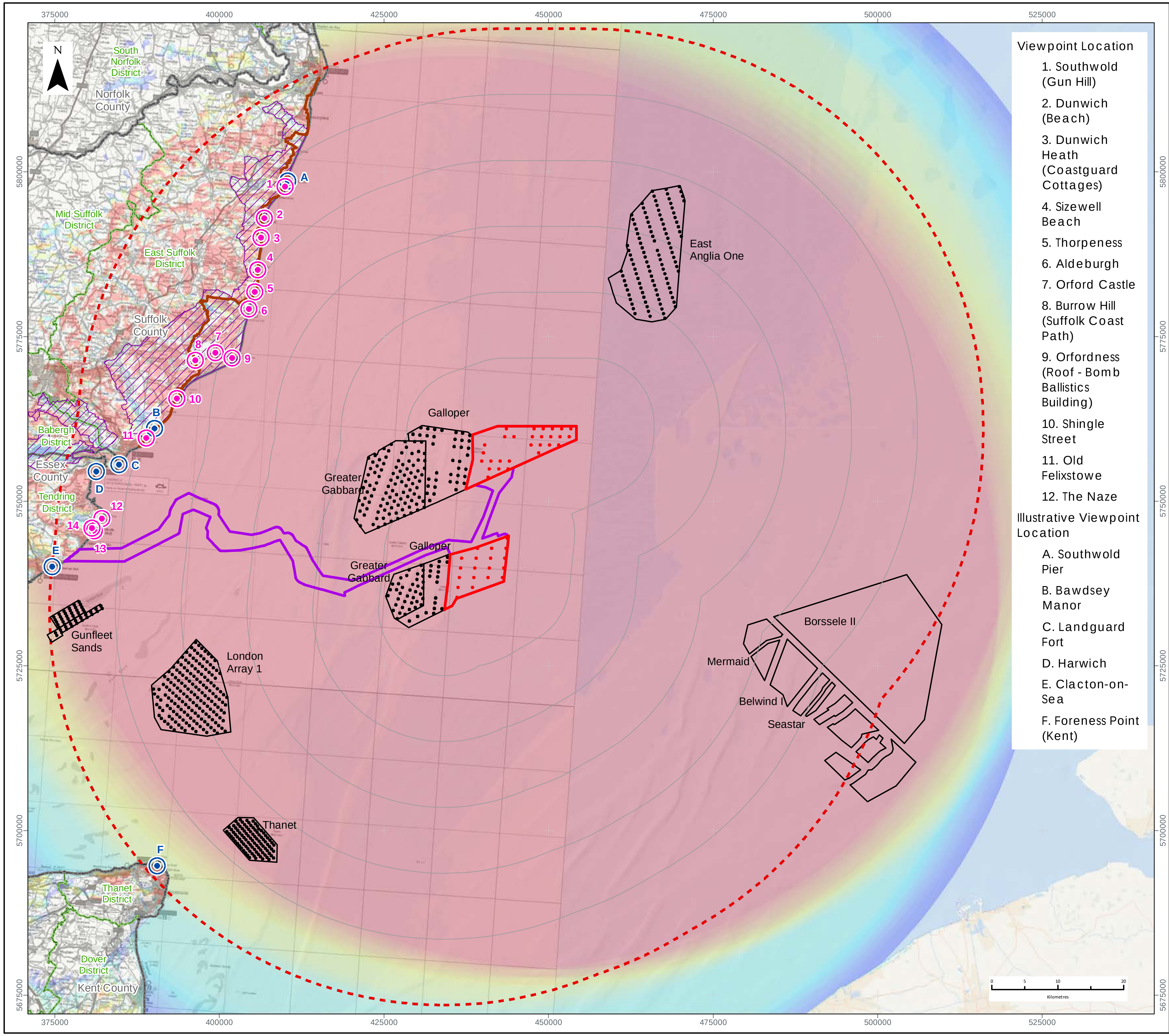
16.2.3 Institute of Environmental Management and Assessment Guidance (IEMA, 2015 and 2017) recommends a proportionate ES focused on the significant effects and a proportionate ES aspect chapter. An overly large SLVIA study area may be considered disproportionate if it makes the understanding of the key impacts of the VE array areas more difficult.

16.2.4 This is supported by Landscape and Visual Impact Assessment (LVIA) Guidance produced by the Landscape Institute (GLVIA3) (Landscape Institute, 2013) (para 3.16). This guidance recommends that *'The level of detail provided should be that which is reasonably required to assess the likely significant effects'*. Para 5.2 and p70 also states that *'The study area should include the site itself and the full extent of the wider landscape around it which the proposed development may influence in a significant manner'*.

16.2.5 Other wind farm specific guidance, such as NatureScot's Visual Representation of Wind Farms Guidance (NatureScot, 2017) recommends that Zone of Theoretical Visibility (ZTV) distances are used for defining study area based on WTG height. This guidance recommends a 45km radius for WTG greater than 150m to blade tip (para 48, p12), however it doesn't go beyond turbines above 150m in height. The height of current offshore WTG models has now exceeded the heights covered in this guidance. The NatureScot guidance recognises that greater distances may need to be considered for larger WTGs used offshore, as is the case for the SLVIA study area for VE array areas.

16.2.6 Other projects in the study area, such as East Anglia ONE North and East Anglia TWO (up to 300 m blade tip height), defined a 50 km radius study area for the purposes of their SLVIA. A precautionary approach is taken in defining a 60 km radius study area for the VE array areas due to the larger WTGs of up to 398 m blade tip height (above LAT) proposed.

16.2.7 Beyond the Scoping Boundary, the SLVIA will generally focus on locations from where it may be possible to see the VE array areas, as defined by the Blade Tip ZTV (Figure 16.2 and Figure 16.3).



LEGEND

- Five Estuaries WTG
- Array Areas
- Offshore Area of Search
- 10km Radii
- 60km Study Area
- County Boundary
- District Boundary
- Suffolk Coast & Heaths AONB
- Suffolk Coast Path

Wind Farm Development Status:

- Operational Turbine
- Viewpoint Location
- Illustrative Viewpoint Location

Blade Tip ZTV (398m)

- Higher Theoretical Visibility
- Lower Theoretical Visibility

ZTV Parameters
Blade Tip: 398m
DTM: OS T5
DTM Resolution: 10m
Observer Height: 2m
Surface Features: Excluded
Earth Curvature: Included

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Blade Tip ZTV

VER	DATE	REMARKS	Drawn	Checked
1	29/07/2021	For Issue	SH	SM
2	10/09/2021	For Issue	SH	SM
3	24/09/2021	For Issue	SH	SM

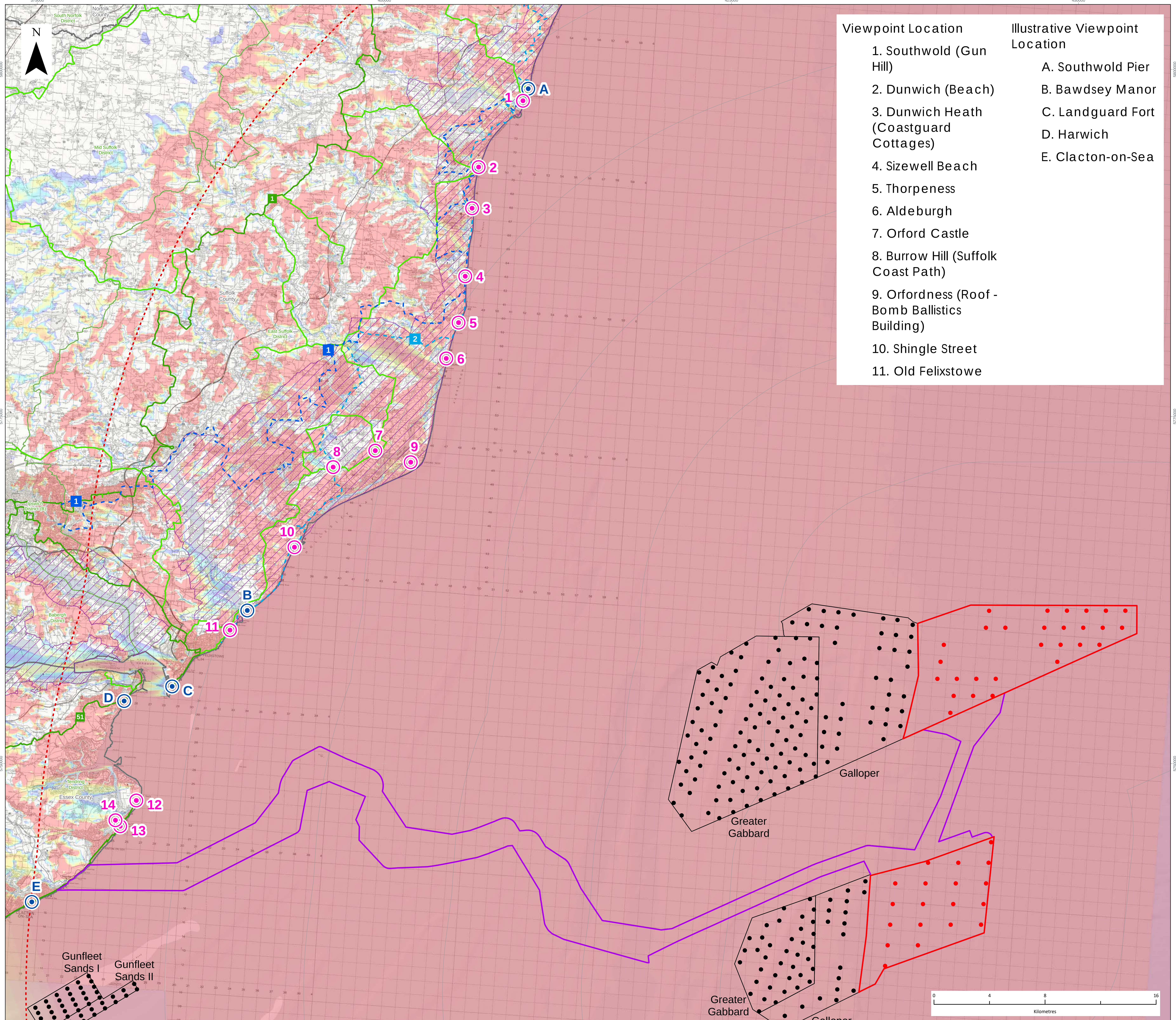
DRAWING NUMBER:

16.2

SCALE: 1:590,000 | PLOT SIZE: A3 | DATUM: WGS84 | PROJECTION: UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

P:\2020\201463_FiveEst\GIS\201463_FEWF\SCOPING\201463_FEWF_SCOP_Fig17-2a_BT_ZTV.mxd



LEGEND

- Five Estuaries WTG
- Array Areas
- Offshore Area of Search
- 10km Radii
- 60km Study Area
- County Boundary
- District Boundary
- Suffolk Coast & Heaths AONB
- 1. Suffolk Coast Path
- 2. Sandlings Walk
- Regional Cycle Route
- National Cycle Route

Wind Farm Development Status:

- Operational Turbine
- Viewpoint Location
- Illustrative Viewpoint Location

Blade Tip ZTV (398m)
Higher Theoretical Visibility
Lower Theoretical Visibility

ZTV Parameters
Blade Tip: 398m
DTM: OS T5
DTM Resolution: 10m
Observer Height: 2m
Surface Features: Excluded
Earth Curvature: Included

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Blade Tip ZTV

VER	DATE	REMARKS	Drawn	Checked
1	29/07/2021	For Issue	SH	SM
2	10/09/2021	For Issue	SH	SM
3	24/09/2021	For Issue	SH	SM

DRAWING NUMBER:

16.3

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:135,000	A1	WGS84	UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

P:\2020\201463_FiveEst\GIS\201463_FEWF\SCOPING\201463_FEWF_SCOP_Fig17-2b_BT_ZTV_A1.mxd

16.2.8 Consideration of the blade tip ZTV (Figure 16.2 and Figure 16.3) indicates that theoretical visibility of VE array areas mainly occurs within 60 km and that beyond this distance, the geographic extent of visibility will become very restricted. At distances over 60km, the lateral (or horizontal) spread of VE array areas will also occupy a small portion of available views and the apparent height (or 'vertical angle') of the WTGs will also appear very small, therefore significant visual effects are unlikely to arise at greater than this distance, even if the WTGs are visible.

16.2.9 The influence of earth curvature begins to limit the apparent height and visual influence of the WTGs visible at long distances (such as over 60km), as the lower parts of the turbines will be partially hidden behind the apparent horizon, leaving only the upper parts visible above the skyline.

16.2.10 The variation of weather conditions influencing visibility off the English coast has also informed the SLVIA study area. Based on initial review of Met Office visibility data, visibility beyond 60 km is considered to be very infrequent. This is supported by the visibility analysis in the Offshore Energy Strategic Environmental Assessment (White Consultants, March 2020), which considered Met Office visibility data for eight coastal stations. Averaging all coastal stations, the visual range recorded was just under 24km around 50% of the time, just under 30 km 33% of the time, around 34km for 20% of the time, and 40 km 10% of the time.

16.2.11 In considering the SLVIA study area, the sensitivity of the receiving seascape, landscape and visual receptors has also been reviewed, taking particular account of the landscape designations shown in Figure 16.5, and other visual receptors. It is clear that the principal issues for the SLVIA are the location of VE array areas off the Sussex and Essex coasts and therefore its exposure to and visibility from these coasts, including from the Suffolk Coast and Heaths AONB and the Suffolk Heritage Coast, which are primarily within 60 km of VE array areas. Within the SLVIA study area, the assessment will focus primarily on the assessment of seascape, landscape and visual effects of the VE array areas within East Suffolk and Tendring District in Essex and their adjacent seascapes.

16.2.12 Potential cumulative effect interactions with other offshore wind farms have also influenced the definition of the SLVIA study area. Other offshore windfarms within the SLVIA study area are shown in Figure 16.1.

16.2.13 Seascape, landscape and visual effects as a result of the VE array areas are proposed to be scoped out beyond 60 km. The study area will be reviewed and amended in response to such matters as refinement of the VE array areas, the identification of additional impact pathways and in response, where appropriate, to feedback from consultation. Feedback from consultees is requested specifically on the SLVIA study area.

16.3 BASELINE DATA

16.3.1 This section provides an overview of the existing data that is available for the SLVIA from desk-based review. Data sources used to collate the information for the SLVIA are set out in Table 16.1.

Table 16.1 - Key sources of information for seascape, landscape and visual

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Galloper Wind Farm Environmental Statement.	Characterisation for the existing operational Galloper OWF site (including seascape, landscape character and viewpoints).	Partial coverage of SLVIA study area.
Campaign to Protect Rural England (CPRE) (2016)	Interactive maps of the UK's light pollution and dark skies as part of a national mapping project (LUC/CPRE, 2016). Open Source data used to understand and illustrate baseline lighting levels. (available online: https://www.nightblight.cpre.org.uk/)	Full coverage of SLVIA study area.
English Heritage (2020)	Any specific visitor attractions / tourist destinations (available online: https://www.english-heritage.org.uk/visit/places	Full coverage of SLVIA study area.
Essex County Council	Essex Landscape Character Assessment (2003).	Essex
Essex County Council	Landscape Character Assessment of the Essex Coast (2005).	Essex
Google Earth Pro (2020)	Aerial photography.	Full coverage of SLVIA study area.
Historic England (2020)	Registered Parks and Gardens and UNESCO World Heritage Sites (available online: https://historicengland.org.uk/listing/the-list/)	Full coverage of SLVIA study area.
Kent County Council (2004)	Landscape Character Areas (LCAs) (Kent). Landscape Assessment of Kent (available online: https://www.kent.gov.uk/about-the-council/strategies-and-policies/environment-waste-and-planning-policies/countryside-policies-and-reports/kents-landscape-assessment)	Kent
Long Distance Walkers Association (2020)	Overview map for Long Distance Paths and Walks (available online: https://www.ldwa.org.uk/ldp/public/ldp_overview_map.php)	Full coverage of SLVIA study area.
Met Office (2010-2020)	Visibility Data. Visibility bands every 1km up to 30km, then every 5km up to 50km, then every 10km up to 70km, and >70km.	Weather stations at Weybourne and Shoeburyness.

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
MMO (2012)	Seascape character area assessment East Inshore and East Offshore Marine Plan Areas (2012). Available online: https://www.gov.uk/government/publications/east-marine-plan-areas-seascape-character-assessment Seascape character area assessment South East Inshore Marine Plan Area (2018). Available online: https://www.gov.uk/government/publications/seascape-assessment-for-the-south-marine-plan-areas-mmo-1037	East Inshore, East Offshore and South-East Inshore Marine Plan Area
National Trust (2020)	Any specific visitor attractions / tourist destinations (available online: https://www.nationaltrust.org.uk/days-out)	Full coverage of SLVIA study area.
Natural England (2014)	National Character Area profiles (available online: https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles)	Full coverage of SLVIA study area.
Natural England (2019)	GIS datasets for: National Parks (https://data.gov.uk/dataset/334e1b27-e193-4ef5-b14e-696b58bb7e95/national-parks-england). Areas of Outstanding Natural Beauty (AONB) (https://data.gov.uk/dataset/8e3ae3b9-a827-47f1-b025-f08527a4e84e/areas-of-outstanding-natural-beauty-england) County Parks (https://data.gov.uk/dataset/e729abb9-aa6c-42c5-baec-b6673e2b3a62/country-parks-england). Open Access Land (https://data.gov.uk/dataset/05fa192a-06ba-4b2b-b98c-5b6bec5ff638/crow-act-2000-access-layer). Heritage Coasts (https://data.gov.uk/dataset/79b3515f-b00e-419a-9c7e-1d3163555886/heritage-coasts)	Full coverage of SLVIA study area.
Oceanwise	Marine and coastal mapping data, ferry routes.	Full coverage of SLVIA study area.
OPEN internal dataset (2020)	Public Rights of Way.	Full coverage of SLVIA study area.
Ordnance Survey (2019)	1:50,000 scale mapping.	Full coverage of SLVIA study area.

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Ordnance Survey (2019)	1:25,000 scale mapping.	Full coverage of SLVIA study area.
Ordnance Survey Open Data (2019)	OS County Region, Local Unitary Authority, Railways, Road and Settlements.	Full coverage of SLVIA study area.
Ordnance Survey (2019)	OS Terrain 50 Digital Terrain Model (DTM).	Full coverage of SLVIA study area.
Royal Yachting Association (RYA) (2013)	Cruising routes for recreational yachting.	Full coverage of SLVIA study area.
Suffolk Coast and Heaths AONB	Touching the Tide Landscape Character Assessment (2012).	Suffolk Coast and Heaths AONB
Suffolk Coast and Heaths AONB	Suffolk Coast & Heaths AONB Management Plan 2018 – 2023	Suffolk Coast and Heaths AONB
Suffolk Coast and Heaths AONB	Suffolk Coast & Heaths AONB Natural Beauty and Special Qualities Indicators (2016).	Suffolk Coast and Heaths AONB
Suffolk Coastal District Council	Suffolk Coastal Landscape Character Assessment (2018).	East Suffolk
Suffolk Coastal District Council	Suffolk Coastal Local Plan (2020) and Waveney Local Plan (2019).	East Suffolk
Suffolk County Council	Suffolk, South Norfolk and North Essex Seascape Character Assessment (2018).	Suffolk, South Norfolk and North Essex
Suffolk County Council	Suffolk Seascape Sensitivity to Offshore Wind Farms (2020).	Suffolk
Suffolk County Council	Suffolk Landscape Assessment (2011/updated 2018).	Suffolk

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Sustrans (2020)	National Cycle Network (GIS dataset) (available online: https://www.sustrans.org.uk/)	Full coverage of SLVIA study area.

16.4 BASELINE ENVIRONMENT

SEASCAPE BASELINE

16.4.1 In England, Seascape Character principally applies to coastal and marine areas seaward of the low water mark. Seascape, like landscape is about the relationship between people and place and the part it plays in forming the setting to our everyday lives. Seascape results from the way that the different components of the environment – both natural and cultural - interact and are understood and experienced by people. Seascape is defined by Natural England in its position statement on All Landscapes Matter (2010) as: *"An area of sea, coastline and land, as perceived by people, whose character results from the actions and interactions of land with sea, by natural and/or human factors"*. A summary of what constitutes seascape is presented in 'An Approach to Seascape Character Assessment' (Natural England, 2012).

16.4.2 A definition of seascape is also set out in NPS EN3 (2.6.203):

"Where necessary, assessment of the seascape should include an assessment of three principal considerations on the likely effect of offshore wind farms on the coast:

- *Limit of visual perception from the coast;*
- *Individual characteristics of the coast which affect its capacity to absorb a development; and*
- *How people perceive and interact with the seascape".*

16.4.3 The SLVIA takes into account these definitions of seascape and also the definition within the UK Marine Policy Statement (UK Government, 2011), which states that *'…references to seascape should be taken as meaning landscapes with views of the coast or seas, and coasts and the adjacent marine environment with cultural, historical and archaeological links with each other'.*

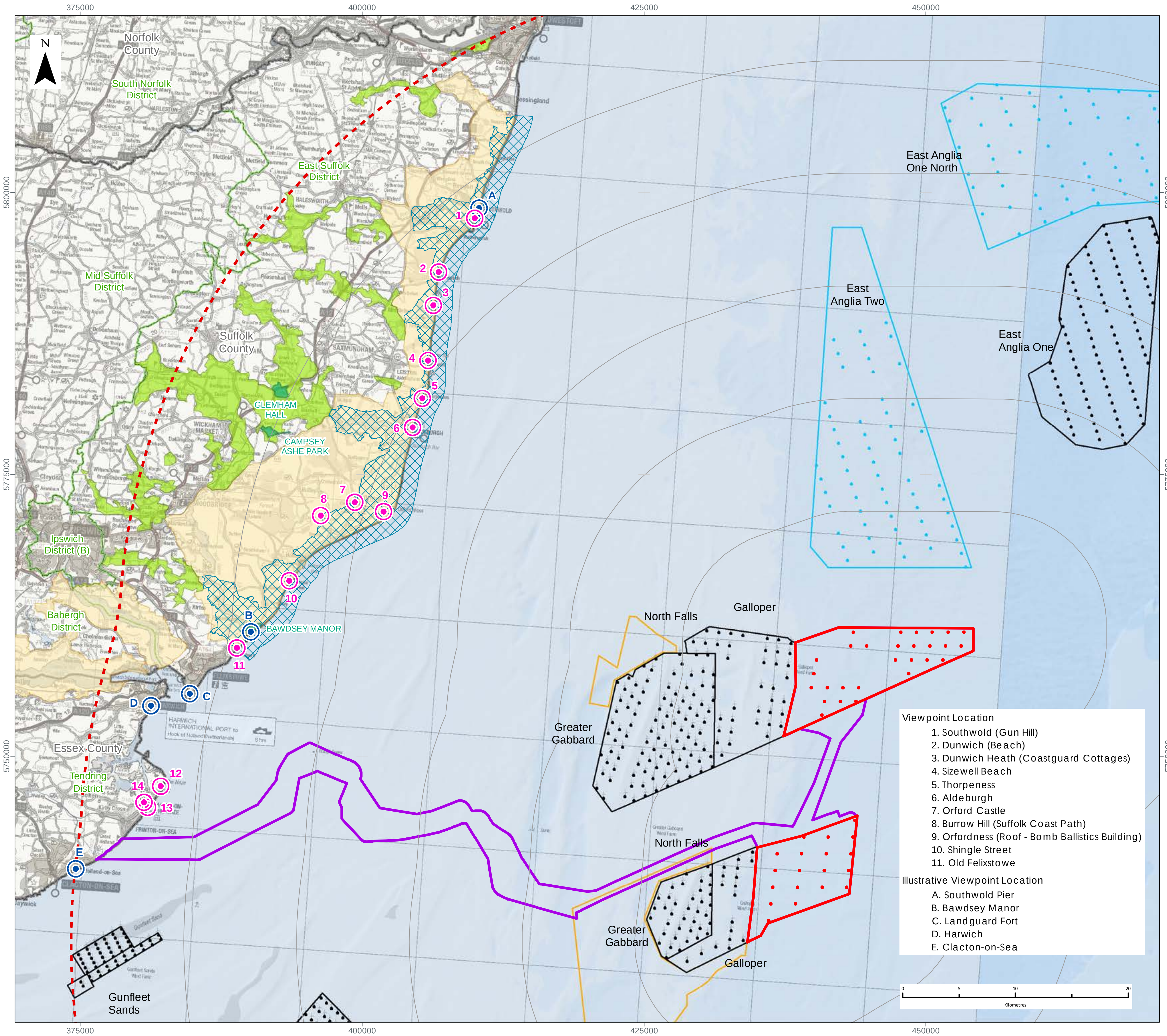
16.4.4 Although seascape character therefore *'principally applies to coastal and marine areas seaward of the low-water mark'* and landscape character *'principally applies to terrestrial areas lying to the landward side of the high-water mark'* (Natural England, 2012, p7, Box 1), there is in fact a subtler transition between seascape and landscape and the importance of the interaction of sea, coastline and land as perceived by people is highlighted in definitions of seascape in the Natural England guidance (Natural England, 2012) and Marine Policy Statement (UK Government, 2011).

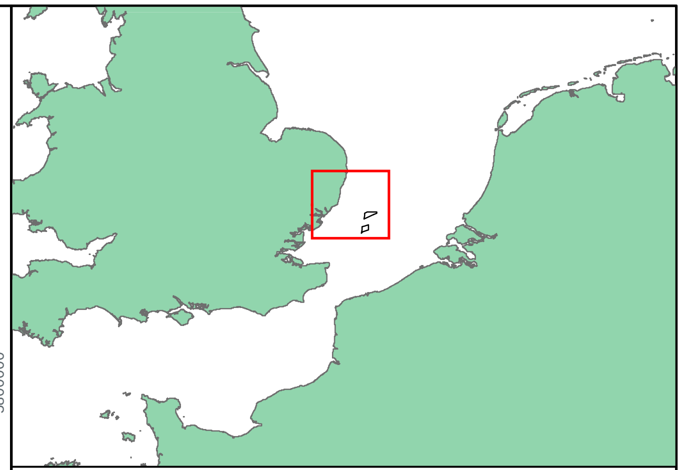
16.4.5 The seascape impact assessment in this SLVIA therefore focuses particularly on areas of onshore landscape with views of the coast or seas and marine environment, as perceived by people, on the premise that the most important effect of offshore windfarms is on the perception of seascape character from the coast.

16.4.6 In order to avoid under-valuing the inter-tidal area between the mean low and high-water mark, the SLVIA will assess 'offshore' seascape effects on Seascape Character Types (SCTs) where they are seaward of the mean high water mark (MWHS); and the effect on terrestrial landscape character will be assessed on landscape character areas (LCAs)/landscape character types (LCTs) lying to the landward side of the mean low-water mark (MLWS). This approach means that the 'foreshore', which includes beaches, inter-tidal areas and coastlines between MWHS and MLWS, will be considered in both the landscape and seascape character assessments. This ensures adequate consideration has been given to assessing the relationship between terrestrial and marine areas and interactions across the land/sea interface.

16.4.7 The seascape character of the SLVIA study area is defined at a national scale in the seascape assessments published by the MMO for the East Inshore and East Offshore marine plan area (MMO, 2012) and for the South East Inshore marine plan area (MMO, 2018). The Marine Character Areas (MCAs) identified within this MMO seascape assessment (Figure 16.4) will form the baseline for the southern portion of the SLVIA study area, within the Outer Thames Estuary and off the north Kent (Thanet) coast.

16.4.8 The seascape character of the SLVIA study area is also defined at the regional level within the Suffolk, South Norfolk and North Essex seascape character assessment (Suffolk County Council, 2018). The SCTs identified within this Suffolk, South Norfolk and North Essex seascape assessment (Figure 16.4) will provide the baseline seascape characterisation and mapping for the SLVIA, against which the seascape effects of VE array areas will be assessed.





LEGEND

- Five Estuaries WTG
- Array Areas
- Offshore Area of Search
- 10km Radii
- 60km Study Area
- County Boundary
- District Boundary
- Suffolk Coast & Heaths AONB
- Suffolk Heritage Coast
- Registered Park and Garden
- Special Landscape Area

Wind Farm Development Status:

- Operational Turbine
- Application
- Scoping
- Viewpoint Location
- Illustrative Viewpoint Location

ZTV Parameters
Blade Tip: 344m
DTM: OS T5
DTM Resolution: 10m
Observer Height: 2m
Surface Features: Excluded
Earth Curvature: Included

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Landscape Planning Designations

VER	DATE	REMARKS	Drawn	Checked
1	29/07/2021	For Issue	SH	SM
2	10/09/2021	For Issue	SH	SM
3	24/09/2021	For Issue	SH	SM

DRAWING NUMBER:

16.4

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

FIVE ESTUARIES
OFFSHORE WIND FARM

P:\2020\201463_FiveEstuGIS\201463_FEWF\SCOPING\201463_FEWF_SCOP_Fig17-3_Designations.mxd

16.4.9 The seascape within which the VE array areas is located is defined by the Offshore Waters SCT (06) (Figure 17.3). Situated at a distance of approximately 18km from the coastline and extending to the seaward extents of the SLVIA study area, the Offshore Waters SCT is formed by an open expanse of sea with consistently deep waters, generally in excess of 30 m. The seascape is visually unified, with an expansive open character, but the character is influenced by the presence of commercial vessels crossing these busy shipping waters, to and from major coastal ports, which are often visible from the shore. The existing Greater Gabbard and Galloper offshore windfarms, together with the recently constructed East Anglia ONE offshore windfarm, form a key characteristic in the baseline character of the southern and central parts of the SCT.

16.4.10 The seascapes of Suffolk, south Norfolk and north Essex within the SLVIA study area, are varied and interesting seascapes, which are valued natural and cultural assets. They contain important habitats, contribute to the setting of designated landscapes (notably the Suffolk Coast and Heaths AONB); are important from an economic perspective, with major ports, seaside resorts and commercial activities at sea and along the coast; and contribute to the culture and identity of local communities.

16.4.11 Changes to the baseline conditions which have occurred since publication of the Suffolk, South Norfolk and North Essex seascape character assessment (Suffolk County Council, 2014) will be considered and reported in the SLVIA. In particular, the installation and commissioning of East Anglia ONE offshore windfarm has recently introduced a further large-scale operational wind farm influence to the baseline seascape.

16.4.12 The southern and eastern parts of the SLVIA study area includes portions of France, Belgium and Netherlands territorial waters, however the closest part of the coastline of France is located 78.9 km from the VE array areas, Belgium is 80km and Netherlands 90.7km.

LANDSCAPE BASELINE

LANDSCAPE CHARACTER

16.4.13 There is a hierarchy of published Landscape Character Assessments that describe the baseline landscape character of the landscape in the SLVIA study area, at the National, County and District level.

16.4.14 The English Landscape is classified at the national level by National Character Areas (NCAs). The 159 NCAs, which cover the country, were originally identified by the Countryside Agency. This mapping and the associated descriptions have been revised and developed by Natural England into National Character Area profiles, which provide a recognised, national, spatial framework. The NCAs will be used in providing a high-level description of the landscape and its context.

16.4.15 At the National level, the SLVIA study area is characterised by a number of NCAs, including: Greater Thames Estuary (81); Suffolk Coast and Heaths (NCA 82); South Norfolk and High Suffolk Claylands NCA (NCA 83); Northern Thames Basin (111) and North Kent Plain (113).

16.4.16 The Suffolk Coast and Heaths NCA (82) covers the largest part of the Suffolk section of the SLVIA study area and is located approximately 37.3 km from the VE array areas, at its closest point. The Suffolk Coast and Heaths NCA lies on the North Sea coast between Great Yarmouth in the north and Harwich in the south, forming a long, narrow band that extends between 10-20 km inland. The distinctive landscape character is a product of its underlying geology, shaped by the effects of the sea and the interactions of people. It is mainly flat or gently rolling. Near the coast, wildlife habitats and landscape features lie in an intimate mosaic, providing diversity. Farming utilises much of the total land area, however the remaining land consists of coast and lowland heaths (known locally as the Sandlings) and form distinctive features, although traditional heath is now much fragmented. The coast is interrupted by five estuaries (Stour, Orwell, Deben, Alde/Ore and Blyth) with extensive intertidal areas of mudflat and salt marsh. The shoreline consists of predominantly shingle beaches, often extensive in nature, including shingle structures, such as Orford Ness.

16.4.17 The Greater Thames Estuary NCA (81) covers the Essex coastline within the SLVIA study area between Harwich and Clacton-on-Sea but extends south to encompass the coastlines of South Essex and North Kent, along with a narrow strip of land following the path of the Thames into East London. It is predominantly a remote and tranquil landscape of shallow creeks, drowned estuaries, low lying islands, mudflats and broad tracts of tidal salt marsh and reclaimed grazing marsh that lies between the North Sea and the rising ground inland, including areas around Hamford Water and Horney Island, providing a stark contrast to the nearby busy urban and industrial areas where population density is high.

16.4.18 The landscape of the onshore parts of the study area will be informed by these NCAs, however it will be described and assessed in relation to the published County Council Landscape Character Assessments that describe the associated coastal landscapes within the SLVIA study area shown in Figure 17.3, as follows:

- Essex Landscape Character Assessment (2003);
- Landscape Assessment of Kent (2004); and
- Suffolk Landscape Assessment (2011/updated 2018).

16.4.19 These provide a county-wide, consistent character framework as a background for more detailed assessments (such as at the district level). They are considered to be of an appropriate scale to allow assessment of the effects of VE array areas over the relatively wide SLVIA study area, at a sufficient level of detail. More detailed district or specific coastal LCAs/LCTs will be utilised to support additional description of character or qualities where required, including:

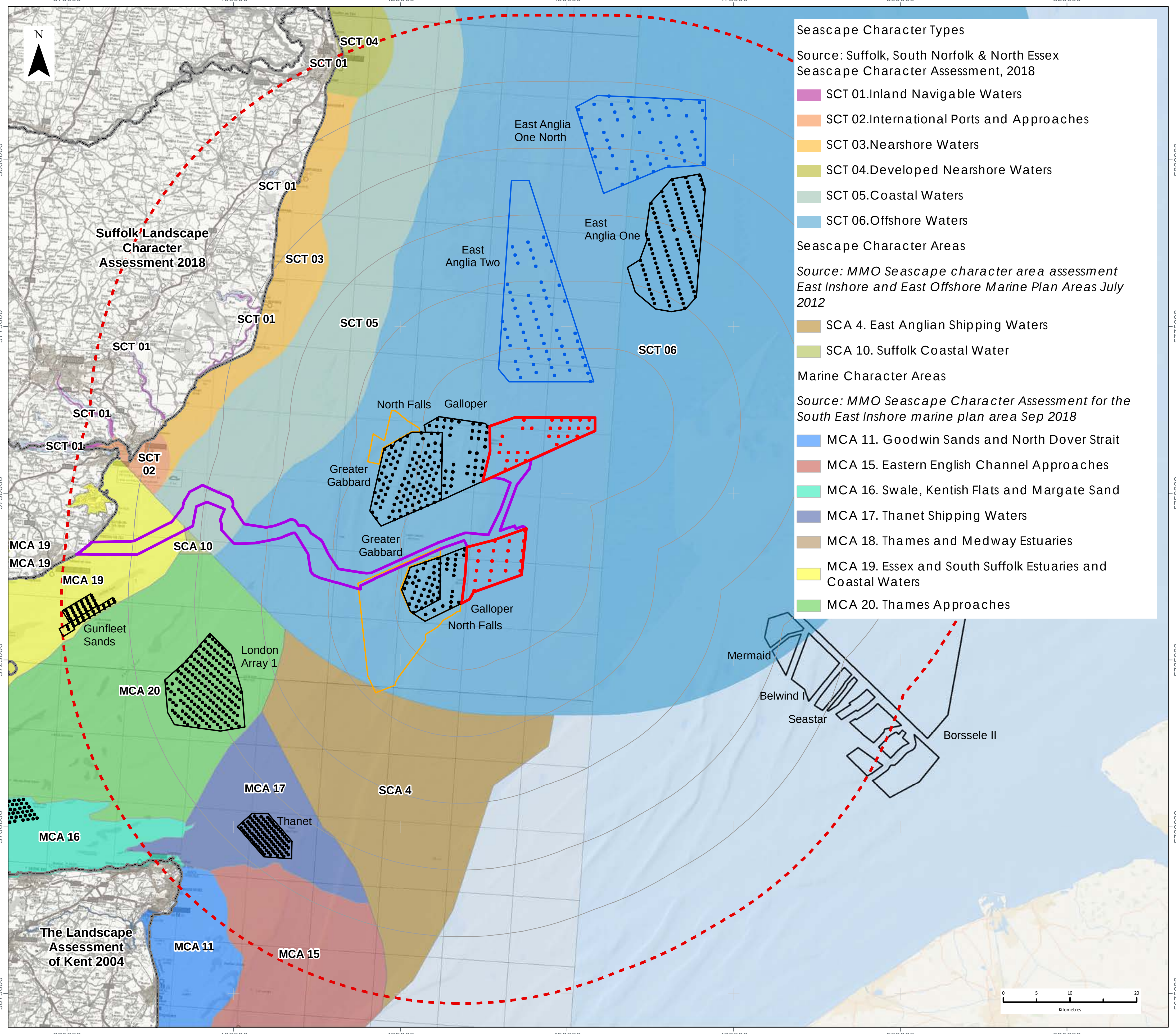
- Landscape Character Assessment of the Essex Coast (2005);
- Shotley Peninsula and Hinterland Landscape Character Assessment (Stour and Orwell Society 2013);
- Suffolk Coastal Landscape Character Assessment (2018);
- Tendring District Landscape Character Assessment (2001); and
- Touching the Tide Landscape Character Assessment (2012).

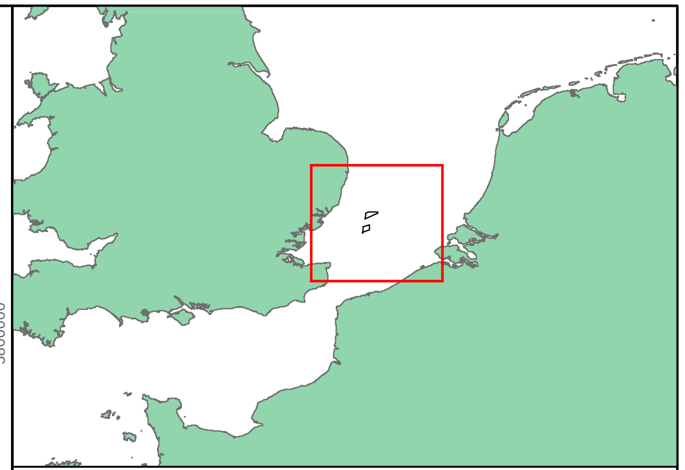
16.4.20 Broadly the coastline of East Suffolk to the north of Felixstowe/River Deben is within the Suffolk Coast and Heaths AONB and consists of gently rolling landform of shingle ridges or coastal dunes at the coast, flat marshlands of coastal levels and fens, beside estuaries, slightly interrupted by a series of low cliffs of Estate Sandlands along the coast, backed by Sandlings Forests and Heaths. To the south, the coastline of southern Suffolk and north Essex is extensively urbanised in places particularly around Felixstowe, Harwich and Walton-on-the-Naze, except for the large inter-tidal estuarine inlet of Hamford Water and its complex pattern of saltmarsh, creeks, mud and reed fringed islands.

16.4.21 VE array areas is likely to influence the visual aspects of perceived character experienced in sea views from several landscape types forming a narrow strip of the immediate coastal LCTs forming the closest parts of the East Suffolk and North Essex coastlines. These are relatively long stretches of coastline which are varied in character, with geographic extents likely to be concentrated on the narrow strip of immediate coastal landscape, including stretches of the Coastal Dunes/Single Ridges (05) and Estate Sandlands (07) LCTs of Suffolk and the Coastal Landscapes (F) LCT of Essex, primarily the Brightlingsea-Clacton-Frinton Coast (F7) and Hamford Water (F8) LCAs.

LANDSCAPE DESIGNATIONS AND DEFINED AREAS

16.4.22 The offshore areas of the Scoping Boundary are located beyond the boundaries of any areas subject to international, national or regional landscape designation intended to protect landscape quality, as shown in Figure 16.5.





LEGEND

- Five Estuaries WTG
- Array Areas
- Offshore Area of Search
- 10km Radii
- 60km Study Area
- County Boundary

Wind Farm Development Status:

- Operational Turbine
- Application
- Scoping

Data Source:
Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors
Contains Ordnance Survey data © Crown copyright and database right 2021.
Contains public sector information licensed under the Open Government Licence v3.0

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Seascape/Landscape Character

VER	DATE	REMARKS	Drawn	Checked
1	29/07/2021	For Issue	SH	SM
2	10/09/2021	For Issue	SH	SM
3	24/09/2021	For Issue	SH	SM

DRAWING NUMBER:

16.5

SCALE: 1:600,000 | PLOT SIZE: A3 | DATUM: WGS84 | PROJECTION: UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

P:\2020\201463_FiveEst\GIS\201463_FEWF\SCOPING\201463_FEWF_SCOP_Fig17-4_LCA_Seascape.mxd

16.4.23 Certain nationally designated landscapes or defined areas found within the study area have been designated or defined due to their scenic qualities or historic landscape qualities and are of relevance to the SLVIA as shown on Figure 16.5 and set out in Table 16.2.

Table 16.2 – Landscape designations with relevance to SLVIA and VE

SITE	CLOSEST DISTANCE TO VE ARRAY AREAS	FEATURE OR DESCRIPTION
NATIONAL		
Suffolk Coast and Heaths AONB (SCHAONB)	37.3km	The SCHAONB covers approximately 403km^2 stretching from Kessingland in the north to the River Stour in the south. It is a mainly flat or gently rolling landscape, often open but with few commanding viewpoints and near the coast, habitats and landscape features lie in an intimate mosaic, providing great diversity in a small area. Where it joins the sea, the AONB consists of predominantly shingle beaches, often extensive in nature, and backed in places by sandy cliffs. The coastline is interrupted by five river estuaries (Blyth, Alde/Ore, Deben, Orwell and Stour) with extensive wildlife-rich intertidal areas of mudflat and saltmarsh. In some places, old estuary mouths have become blocked, creating large areas of marshland. The area includes both distinctive features of the coast and lowland heath which give the AONB its name. The area's heathland, known locally as the Sandlings and now much fragmented, is situated just inland from the coast. Elsewhere, the SCHAONB comprises mainly farmland. Other main components of the landscape are forestry plantations, low-lying freshwater marshes, intertidal estuaries, heathland, the coast, small villages and iconic coastal market towns. The SCHAONB remains a lightly populated, undeveloped area, popular for outdoor recreation and tourism. The area is valued for its tranquillity, the quality of the environment and culture and for its wildlife. The scenic qualities and interest are particularly defined by the coast and views out to sea; shingle features of the coast, some vegetated, notably Orford Ness; prominence of short sections of crumbling soft cliffs, such as at Dunwich and Covehithe; bodies of water (broads/saline lagoons) Shingle Street, Benacre and Easton Broads; and seascape setting of the coastal areas of the AONB. There are pockets of

SITE	CLOSEST DISTANCE TO VE ARRAY AREAS	FEATURE OR DESCRIPTION
		relative wildness associated with coast, in this largely farmed and settled landscape. A number of coastal locations within the AONB provide opportunities to experience attributes of relative wildness, including Orford Ness, Minsmere, Dunwich Heath and the marshlands/estuaries, where the character of the landscape and views afforded out to sea and along the coast are highly valued. The seascape setting of the coastal areas of the AONB contributes to the perception of wildness attributes and relative tranquillity. The 'special qualities' of the SCHAONB are set out in the SCHAONB Natural Beauty and Special Qualities Indicators report (LDA Design, 2016), with the purpose of establishing what constitutes the natural beauty and special qualities of the AONB.
Suffolk Heritage Coast	35.8km	The Suffolk Heritage Coast is largely contained within the SCHAONB (Figure 16.5). It runs from Kessingland to Felixstowe and incorporates the Blyth, Alde/Ore and lower Deben estuaries. The purpose of Heritage Coast designation is similar to that of an AONB. As its geographic area is largely within the AONB and its protection policies are now incorporated into the SCHAONB Management Plan 2018 - 2023, the effects of the VE array areas on the Suffolk Heritage Coast will be considered as integral to the assessment of the SCHAONB.
Bawdsey Manor Registered Park and Garden (RPG)	47.5km	Bawdsey Manor is a grade II listed park and garden, located on the East Suffolk coast and is the closest RPG to the VE array areas. Bawdsey Manor occupies c 57ha on an exposed coastal location beside the North Sea, in an isolated position c 3km south-west of the village of Bawdsey, close to the mouth of the River Deben, with a grade II* listed country mansion and a series of gardens laid out and containing an extensive artificial Pulhamite cliff at the coast built in the 1890s, which are also grade II listed.

SITE	CLOSEST DISTANCE TO VE ARRAY AREAS	FEATURE OR DESCRIPTION
LOCAL		
Special Landscape Areas (SLA)	41.8km (to the closest SLA)	Special Landscape Areas are identified in District Council Planning Policy and have been designated locally because of their landscape sensitivity and scenic quality. They are areas identified as having special landscape attributes, which are particularly vulnerable to change. They include some river valleys which still possess traditional grazing meadows and marshes, with their hedgerows, dykes and associated flora and fauna and Historic Parklands. Such areas include the valleys of the River Alde, Blyth, Deben, Fynn, Hundred, Mill, Minsmere, Ore and Yox, together with their tributaries. By their nature these areas tend to be lower lying and lie inland from the coast separated from it by intervening vegetation on rolling farmland.

VISUAL BASELINE

INTRODUCTION

16.4.24 An initial understanding of the baseline visual resource is provided in the Suffolk, South Norfolk and North Essex Seascape Character Assessment (Suffolk County Council, 2020) *'The MMO online marine planning mapping tool…. indicates that visibility extends to a maximum of approximately 20km (11nm) from the coast within the study area. However, this is only a tool, and the degree of inter-visibility between the coast and sea and along the coast is dependent on several factors including atmospheric conditions and weather. In clear conditions views can be extensive. However, sea fogs and coastal mists can significantly restrict views. Views to sea and along the coastline from the shore can make a significant contribution to sense of place and experiential qualities that are unique to coastal areas. The nature of views varies dependent on the viewing location, orientation and objects in the view. Views directly offshore can be to a vast and uninterrupted horizon, although in some location's views to wind turbines and shipping are possible, subject to conditions'.*

16.4.25 Views from the inshore waters nearest the terrestrial coastline are described as being *'Expansive views offshore'* and *'encompass largely undeveloped seascape'*, although *'offshore shipping and wind farms are visible in adjacent seascape character types, subject to weather conditions'*. The seascape is described as having a *'strong visual relationship with the predominantly rural coastline'*; and with *'occasional coastal towns and large-scale developments including energy and military infrastructure evident in some views'.*

16.4.26 Views from the inland navigable waters along the coast are described as being *'Long distance and relatively expansive views inland, especially across adjacent low-lying marshes'* and there are *'views to adjacent towns, major ports and infrastructure (including river crossings)'* which *'have localised urbanising effect from the inland waters'*.

16.4.27 The visual context of the seascape of the SLVIA study area includes a number of key elements and components, which include:

- Extensive shingle beaches and shallow bays, which provide opportunities for long distance and panoramic views including out to sea, along the SCHAONB and Heritage Coast, and over low-lying coastal marshes, estuaries and beaches;
- Large open vistas across heaths and along the coast, out to sea and from sea to the coastline, often with memorable or unusual views and eye-catching features or landmarks;
- Large scale but relatively flat coastal landforms and simple relationship of shingle beach, sea and big skies, including extensive shingle beaches and the substantial spit formed by Orfordness which extends along much of the Suffolk coast;
- A dense concentration of shipping activity, extensive offshore commercial activities such as fishing and dredging, windfarm developments and gas fields, although otherwise visually unified and expansive open water character with few surface features;
- The southern portion of the seascape setting of the AONB is currently influenced by the existing Greater Gabbard (140 x 170m) and Galloper (56 x 180.5m) OWFs, and the more distance and the more distant London Array, which create a cluttered horizon;
- Sizewell A and B Nuclear Power Station, which form incongruous elements including the large-scale, 'brutalist' concrete mass of Sizewell A adjacent to the simple dome of Sizewell B in views along the coastline;
- Orford Ness Transmitting Towers, at 11 in number and 106.7m in height, are seen widely in views across Orford Ness and Sudbourne Marshes;
- The Port of Felixstowe, which is the UK's busiest container port and includes major port infrastructure and busy shipping waters containing numerous large vessels visible from the coast;
- The general built form within the extensive, coastal, urban environment in the southern parts of the study area which predominates between Felixstowe, Harwich, Frinton-on-Sea and Clacton-on-Sea; and
- Some areas provide opportunities to experience relatively dark skies, however aviation lighting on existing offshore wind farms, lighting of vessels and urban areas to the south influence   s seaward and coastal views at night.

ZONE OF THEORETICAL VISIBILITY

16.4.28 The visual baseline is largely defined by the ZTV shown in Figure 16.2 and in more detail in Figure 16.3. The ZTV shows the main area in which the VE array areas will theoretically be visible, highlighting the different groups of people who may experience views of wind turbines located within the array area and assisting in the identification of viewpoints where they may be affected. The ZTVs shown in Figure 17.2a-b are based on WTGs of 398 m to tip (above LAT) and represents the Maximum Development Scenario (MDS) for the SLVIA considered in the scoping assessment. The ZTV illustrates where there will be no visibility of these WTGs, as well as areas where there will be lower or higher numbers of WTGs theoretically visible.

16.4.29 The ZTV illustrates the 'bare ground' situation based on an Ordnance Survey (OS) terrain model and does not take into account the screening effects of vegetation, buildings, or other local features that may prevent or reduce visibility. By using a bare ground elevation model, the results will be an over-representation of maximum visibility, as many could, in reality, be blocked by surface features not included in the model.

16.4.30 The Blade Tip ZTV (Figure 16.2 and Figure 16.3) shows the main areas of theoretical visibility of the VE array areas will be along the East Suffolk coastline and immediate hinterland, between Southwold in the north and Felixstowe in the south; and from the North Essex coastline of Tendring District between Harwich, the Naze and Clacton-on-Sea in the south. The closest areas of theoretical visibility of the VE array areas will be at Orford Ness at approximately 37.3 km from the array area.

16.4.31 The area of theoretical visibility of the VE array areas become more fragmented from the hinterland and inland areas of the SLVIA study area, where views of the sea become increasingly screened within the main river valleys, either by adjacent rising land or coastal landforms (such as Orford Ness). Actual visibility from these hinterland and inland areas also becomes increasingly screened by vegetation, such as woodland and hedgerows, and/or built development and settlement. There are relatively few elevated areas affording wider views of the sea from inland areas of the SLVIA study area. Visibility from streets, open spaces and low storey buildings within coastal, urban areas will typically be contained within the urban environment by surrounding built form, with most visibility of VE array areas likely at the coastal edge and sea-front.

VISUAL RECEPTORS

16.4.32 The principal visual receptors in the study area are likely to be found along the closest sections of the East Suffolk and North Essex coastlines. These include people within settlements, driving on roads, visitors to tourist facilities or historic environment assets, and people engaged in recreational activity such as those using walking and cycle routes. A detailed assessment will be undertaken in the SLVIA for those visual receptors that are most susceptible to changes, which may experience significant visual effects as a result of the VE array areas and will focus on visual receptors where the sea is a strong influence in the baseline view, along the Suffolk coastline and immediate hinterland, including:

- **Coastal settlements** - including Kessingland, Southwold, Walberswick, Dunwich, Thorpeness, Aldeburgh, Orford, Bawdsey and Felixstowe in Suffolk; and Harwich, Walton-on-the-Naze, Frinton-on-Sea and Clacton-on-Sea in Essex;
- **Recreational routes** - including the Suffolk Coast Path, England Coast Path, Sandlings Walk, Regional Cycle Routes 30 and 31;
- **Main road routes** - such as a short section of the A12 and the various roads that lead off it to the coast such as the A1094, A1095, B1083, B1084, B1122, B1125 and the B1387;
- **Visitors to tourist facilities** - such as the sea fronts/beaches of the main coastal towns/resorts, holiday villages and nature reserves/visitor centres; and
- **Visitors to historic environment assets** - such as Dunwich Heath, Orford Ness, Orford Castle, Landguard Fort and the series of Martello Towers along the Suffolk coast.

VIEWPOINTS

16.4.33 Viewpoints have been compiled in Table 16.3 based on the ZTV for VE array areas (Figure 16.2 and Figure 16.3), the landscape and visual receptors described above and informed by other projects including the viewpoints selected for Galloper, Greater Gabbard and East Anglia TWO projects.

16.4.34 Consultation on the viewpoint locations proposed in Table 16.3 has been undertaken with stakeholders to agree these viewpoints, including Natural England, Historic England, Suffolk County Council, East Suffolk District Council, Essex County Council, Tendring District Council and Suffolk Coast and Heaths AONB Partnership.

16.4.35 VE OWFL are aiming to complete viewpoint photography in late Summer 2021 and have engaged with stakeholders in advance of scoping to agree viewpoint locations. If optimal conditions are not available in later Summer 2021 contingency periods have been identified in early Autumn 2021 and spring/early Summer 2022 subject to appropriate weather conditions.

16.4.36 Representative and illustrative viewpoints proposed for the visual assessment are identified in Table 16.3 and mapped in Figure 16.2 and Figure 16.3.

- **Representative viewpoints** – are selected to represent the experience of different types of visual receptor within an area where larger numbers of viewpoints cannot all be included. A combination of baseline panorama, cumulative wireline and full photomontage visualisations will be produced. Detailed assessment of the visual effects from these viewpoints will be undertaken in the SLVIA that have the potential to experience significant visual effects, while others may be scoped out during the simple assessment, if no potential for significant effects is identified.
- **Illustrative viewpoints** – are chosen specifically to demonstrate a particular effect or specific issue (including restricted visibility). A baseline panorama and wireline visualisation (90 degrees field of view) will be produced, but a written assessment of the visual effects from these viewpoints will not be included in the SLVIA.

16.4.37 Wireline visualisations showing VE array areas from each of the viewpoints listed in Table 16.3 are presented in Appendix A in Figures 17.5a-r.

Table 16.3 – Proposed viewpoints included in SLVIA

ID	NAME	GRID REF	CLOEST DISTANCE (KM) TO VE ARRAY AREAS	LANDSCAPE DESIGNATION	VISUAL RECEPTORS
REPRESENTATIVE VIEWPOINTS					
1	Southwold (Gun Hill)	E650817 N275764	47.1	SCHAONB / Suffolk Heritage Coast	Residents (Southwold); Beach users/visitors to sea front; Walkers (Suffolk Coast Path); Recreational boating (Southwold Harbour).
2	Dunwich (Beach)	E647961 N270778	45.5	SCHAONB / Suffolk Heritage Coast	Residents of the edges of Dunwich village; Beach users (Dunwich Beach); Visitors to Dingle Marshes RSPB reserve.
3	Dunwich Heath (Coastguard Cottages)	E647696 N267787	43.8	SCHAONB / Suffolk Heritage Coast	Visitors to Dunwich Heath and Beach (including National Trust Coastguard Cottages); Walkers (Suffolk Coast Path).
4	Sizewell Beach	E647542 N262862	41.0	SCHAONB / Suffolk Heritage Coast	Residents (Sizewell); Beach users (Sizewell Beach); Walkers Suffolk Coast Path): Workers (Sizewell Nuclear Power Station).
5	Thorpeness	E647287 N259492	39.4	SCHAONB / Suffolk Heritage Coast	Residents (Thorpeness); Beach users (Thorpeness beach); Tourist visitors to Thorpeness; Walkers (Suffolk Coast Path).
6	Aldeburgh	E646586 N256852	38.8	SCHAONB / Suffolk Heritage Coast	Residents (Aldeburgh); Beach users/visitors to seafront (Aldeburgh Beach); Recreational boating (Aldeburgh Yacht Club).

ID	NAME	GRID REF	CLOEST DISTANCE (KM) TO VE ARRAY AREAS	LANDSCAPE DESIGNATION	VISUAL RECEPTORS
7	Orford Castle	E641941 N249876	40.9	SCHAONB / Suffolk Heritage Coast	Visitors to the roof of Orford Castle; Residents of Orford.
8	Burrow Hill (Suffolk Coast Path)	E638992 N248481	43.5	SCHAONB / Suffolk Heritage Coast	Walkers (Suffolk Coast Path).
9	Orfordness (Bomb Ballistics Building)	E644543 N249215	38.2	SCHAONB / Suffolk Heritage Coast	Visitors to Orford Ness.
10	Shingle Street	E636604 N242531	45.1	SCHAONB / Suffolk Heritage Coast	Residents (Shingle Street); Walkers (Suffolk Coast Path); Visitors/beach users.
11	Old Felixstowe	E632379 N236250	49.0	SCHAONB / Suffolk Heritage Coast	Residents (Old Felixstowe); Beach users/visitors to seafront; Walkers (Suffolk Coast Path).
12	The Naze	E626489 N223535	53.1	No landscape designation	Residents (Walton-on-the-Naze); Visitors to Naze Tower/car park; Beach users/visitors to seafront.
13	Walton Pier (Walton-on-the-Naze)	E625460 N221599	53.6	No landscape designation	Residents (Walton-on-the-Naze); Visitors to Walton sea front.
14	Martello Tower, Walton	E625091 N222009	54.0	No landscape designation	Residents (Walton-on-the-Naze); Visitors to Martello Tower.

ID	NAME	GRID REF	CLOEST DISTANCE (KM) TO VE ARRAY AREAS	LANDSCAPE DESIGNATION	VISUAL RECEPTORS
ILLUSTRATIVE VIEWPOINTS					
A	Southwold Pier	E651138 N276658	47.6	SCHAONB / Suffolk Heritage Coast	Visitors to sea front and pier.
B	Bawdsey Manor	E633529 N237748	48.0	SCHAONB / Suffolk Heritage Coast	Walkers (path along coastal edge)
C	Landguard Fort	E628501 N231912	52.0	No landscape designation	Visitors to Landguard Fort and Nature Reserve.
D	Harwich	E625125 N230625	55.1	No landscape designation	Residents (Harwich); Beach users/visitors to sea front.
E	Clacton-on-Sea	E619474 N215730	59.8	No landscape designation	Residents (Clacton-on-Sea); Beach users/visitors to sea front.
F	Foreness Point	E638476 N171504	58.4	No landscape designation	Walkers (Thanet Coastal Path); residents (Cliftonville/Kingsgate areas); Beach users/visitors to sea front (Botany Bay, Palm Bay, Kingsgate Bay).
night-time viewpoints (locations as per day-time viewpoints above)					
N3	Dunwich Heath (Coastguard Cottages)	E647696 N267787	43.8	SCHAONB / Suffolk Heritage Coast	Visitors to Dunwich Heath and Beach (including National Trust Coastguard Cottages); Walkers (Suffolk Coast Path).

ID	NAME	GRID REF	CLOEST DISTANCE (KM) TO VE ARRAY AREAS	LANDSCAPE DESIGNATION	VISUAL RECEPTORS
N6	Aldeburgh	E646586 N256852	38.8	SCHAONB / Suffolk Heritage Coast	Residents (Aldeburgh); Beach users/visitors to seafront (Aldeburgh Beach); Recreational boating (Aldeburgh Yacht Club).
N11	Old Felixstowe	E632379 N236250	49.0	SCHAONB / Suffolk Heritage Coast	Residents (Old Felixstowe); Beach users/visitors to seafront; Walkers (Suffolk Coast Path).
N12	The Naze	E626489 N223535	53.1	No landscape designation	Residents (Walton-on-the-Naze); Visitors to Naze Tower/car park; Beach users/visitors to seafront.

16.4.38 The detailed assessment of visual effects from representative viewpoints will focus on those viewpoints where the combination of their sensitivity and potential magnitude of change resulting from the offshore elements of VE array areas may give rise to significant effects.

16.4.39 In preparing photomontages for the SLVIA, the photographs for all viewpoints will, where possible, be taken in good visibility conditions during summer, seeking to represent a maximum visibility scenario when the offshore elements of VE array areas may be most visible. Further photomontages will also be produced from up to five key viewpoints to be agreed with stakeholders, showing the existing night-time view alongside a representation of the appearance of visible aviation and marine navigation lighting.

16.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

16.5.1 The project-wide approach to the assessment methodology is set out in Chapter 4: EIA Approach and Methodology. Whilst this has informed the approach that will be used in the SLVIA, it is necessary to set out how this methodology will be applied, and adapted as appropriate, to address the specific needs of the SLVIA.

16.5.2 The SLVIA is an objective evaluation that is informed by experienced professional judgement based on the application of a methodology. The key guidance and an overview of the SLVIA approach are summarised as follows.

TECHNICAL GUIDANCE

16.5.3 The assessment will be undertaken in accordance with the methods outlined in the following best practice guidance documents.

- The Landscape Institute with the Institute of Environmental Management and Assessment (2013). Guidelines for Landscape and Visual Impact Assessment. Third Edition;
- Natural England and the Department for Environment, Food and Rural Affairs (2014). Landscape and Seascape Character Assessments.
- Planning Inspectorate (2018) Advice Note Nine: Rochdale Envelope https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/05/Advice-note-9.-Rochdale-envelope-web.pdf;
- Natural England (2012). An Approach to Seascape Character Assessment.
- Natural England (2014). An Approach to Landscape Character Assessment.
- Scottish Natural Heritage (2012). Assessing the Cumulative Impact of Onshore Wind Energy Developments;
- Scottish Natural Heritage (2017). Visual Representation of Windfarms: Version 2.2; and
- Landscape Institute (2017). Visual Representation of Development Proposals.

OVERVIEW OF APPROACH

16.5.4 The objective of the assessment of the VE array areas will be to predict the significant effects on the seascape, landscape and visual resource. In accordance with the EIA Regulations 2017, the SLVIA effects will be assessed to be either significant or not significant. The methodology to undertake the SLVIA will reflect the ‘Guidelines for Landscape and Visual Impact Assessment: Third Edition’ (Landscape Institute, 2013).

16.5.5 The SLVIA will assess the effects of changes resulting from VE array areas on seascape / landscape as a resource, the views available to people and their visual amenity. The SLVIA is undertaken using the following steps:

- The features of VE array areas that may result in seascape, landscape and visual effects are described. The overall scope of the assessment will be defined, including the study area and range of possible seascape, landscape and visual effects;
- The seascape / landscape baseline will be established using seascape /landscape character assessment and the ZTV of VE array areas, to identify seascape and landscape receptors that may be affected and their key characteristics and value;
- The visual baseline will be established by identifying the extent of possible visibility (ZTV), identifying the people who may be affected and identifying visual receptors and selecting viewpoints;
- A preliminary assessment will be undertaken of landscape and visual receptors using ZTV analysis, to identify which landscape and visual receptors are unlikely to be significantly affected and those that are more likely to be significantly affected by VE array areas, which require to be assessed in full;
- Interactions are identified between VE array areas and seascape, landscape and visual receptors, to predict likely significant effects arising and measures are proposed to mitigate effects;
- An assessment of the susceptibility of seascape, landscape and visual receptors to specific change and the value attached to landscape receptors and views will be undertaken, combining these judgements to assess the sensitivity of the landscape and visual receptors to VE array areas;
- An assessment of the size / scale of seascape/landscape impact, the degree to which seascape/landscape elements are altered and the extent to which the impacts change the key characteristics of the landscape will be undertaken, combining these judgements to assess the magnitude of change on each seascape / landscape receptor;
- An assessment of the size / scale of visual impact, the extent to which the change will affect views, whether this is unique or representative of a wider area, and the position of VE array areas in relation to the principal orientation of the view and activity of the receptor. These judgements are combined to assess the magnitude of change on the visual receptor; and
- The assessments of sensitivity to change and magnitude of change will be combined to assess the significance of seascape, landscape and visual effects.

16.5.6 The significance of effects will be assessed through a combination of two considerations – the sensitivity of the landscape or visual receptor/view and the magnitude of change that will result from the VE array areas. In accordance with the Landscape Institute’s GLVIA3, the SLVIA methodology requires the application of professional judgement, but generally, the higher the sensitivity and the higher the magnitude of change the more likely that a significant effect will arise.

16.5.7 The objective of the cumulative SLVIA is to describe, visually represent and assess the ways in which the VE array areas will have additional effects when considered together with other existing, consented or application stage developments and to identify related significant cumulative effects arising. The guiding principle in preparing the cumulative SLVIA will be to focus on the likely significant effects and in particular those which are likely to influence the outcome of the consenting process.

POTENTIAL PROJECT IMPACTS

16.5.8 A range of potential impacts on seascape, landscape and visual receptors have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE SLVIA are outlined in Table 16.4, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) to enable an assessment of the impact.

16.5.9 Based on the baseline environment information currently available and the project description (outlined in Chapter 3: Project Description) a number of impacts are proposed to be scoped out of the SLVIA. These impacts are outlined in Table 16.5, together with a justification for scoping them out.

Table 16.4 - Impacts proposed to be scoped in to the SLVIA

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
16.1	Impact (daytime) of the construction of the offshore elements of VE array areas on seascape character.	Potential for short-term, temporary impacts on perceived seascape character, arising as a result of the construction activities and structures located within the VE array areas, which may alter the seascape character of the area within the Scoping Boundary itself and the perceived character of the wider seascape through visibility of these changes.	**Scoped in:** Suffolk, South Norfolk & North Essex SCTs: SCT03: Nearshore Waters SCT05: Coastal Waters SCT06: Offshore Waters MMO SCAs/MCAs: MCA19: Essex and South Suffolk Estuaries and Coastal Waters MCA20: Thames Approaches SCA4: East Anglia Shipping Waters **Scoped out:** Suffolk, South Norfolk & North Essex SCTs: SCT01: Inland Navigable Waters SCT02: International Ports and Approaches SCT04: Developed Nearshore Waters MMO SCAs/MCAs: MCA11: Goodwin Sands and North Dover Strait MCA15: Eastern English Channel Approaches MCA16: Swale, Kentish Flats and Margate Sand

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			MCA17: Thanet Shipping Waters A simple assessment of the potential effects of VE array areas on SCTs will be undertaken initially using desk-based information and ZTV analysis, with a detailed assessment focusing on those that are identified as requiring further assessment. Detailed assessment to include desk-based seascape character assessment publications and primary baseline data collection (for example through site surveys), quantitative and qualitative assessment methodologies to determine likely significance, and modelling such as ZTV analysis and wireline/photomontage visualisations.
16.2	Impact (daytime) of the construction of the offshore elements of VE array areas on perceived landscape character.	Potential for short-term, temporary impacts on perceived landscape character, arising as a result of the construction activities and structures located within the VE array areas, which may be visible from the coast (during good to excellent visibility conditions) and may therefore affect the perceived character of the landscape.	**Scoped in (Suffolk):** 5. Coastal Dunes and Shingle Ridges 6. Coastal Levels 7. Estate Sandlands 8. Open Coastal Fens 29. Wooded Fens **Scoped in (Essex):** F7. Brightlingsea-Clacton-Frinton Coast F8. Hamford Water F9. Stour Estuary Slopes F10. Stour Estuary **Scoped out:**

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			All other LCTs identified in Suffolk Landscape Character Assessment (SCC, 2008) and all other LCAs identified in the Essex Landscape Character Assessment (ECC, 2003). All LCTs within Kent Landscape Character Assessment (KCC, 2004). A simple assessment of the potential effects of VE array areas on the perceived character of LCTs/LCAs will be undertaken initially using desk-based information and ZTV analysis, with a detailed assessment focusing on those that are identified as requiring further assessment. Detailed assessment to include desk-based landscape character assessment publications and primary baseline data collection (for example through site surveys), quantitative and qualitative assessment methodologies to determine likely significance, and modelling such as ZTV analysis and wireline/photomontage visualisations.
16.3	Impact (daytime) of the construction of the offshore elements of VE array areas on perceived landscape character / special qualities of designated landscapes.	Potential for short-term, temporary impacts on perceived landscape character and special qualities of designated landscapes, arising as a result of the construction activities and structures within the VE array area, which may be visible from the coast (during good to	**Scoped in:** Suffolk Coast and Heaths AONB (including Suffolk Heritage Coast) Bawdsey Manor RPG **Scoped out:** Kent Downs AONB Campsey Ashe RPG

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		excellent visibility conditions) and may therefore affect the perceived character and qualities of the landscape.	Glenham Hall RPG Special Landscape Areas (Suffolk) A simple assessment of the potential effects of VE array areas on the perceived character and qualities of designated landscape will be undertaken initially using desk-based information and ZTV analysis, with a detailed assessment focusing on those that are identified as requiring further assessment. Detailed assessment to include desk-based assessment to define special qualities that may be affected by VE array areas, using published documents and primary baseline data collection (for example through site surveys), quantitative and qualitative assessment methodologies to determine likely significance, and modelling such as ZTV analysis and wireline/photomontage visualisations. Relevant special qualities for detailed assessment will be agreed with stakeholders as part of the evidence plan process.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
16.4	Impact (daytime) of the construction of the offshore elements of VE array areas on visual receptors / views.	Potential for short-term, temporary impacts on views and visual amenity experienced by people from principal visual receptors and representative viewpoints, arising as a result of the construction activities and structures, which may be visible from the coast (during good to excellent visibility conditions) and may therefore affect views and visual amenity.	**Scoped in:** Principal visual receptors at coastal settlements, recreational routes (including Suffolk Coast Path), main road/rail routes, visitors to tourist/visitor facilities and visitors to historic environment assets within ZTV. Receptors at representative viewpoints in Table 16.3. **Scoped out:** Visual receptors outside ZTV. Illustrative viewpoints in Table 16.3. A simple assessment of the potential effects of VE array areas on the views and visual receptors will be undertaken initially using desk-based information and ZTV analysis, with a detailed assessment focusing on those that are identified as requiring further assessment. Detailed assessment to include desk-based publications and primary baseline data collection (for example through site surveys), quantitative and qualitative assessment methodologies to determine likely significance, and modelling such as ZTV analysis and wireline/photomontage visualisations.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
OPERATION			
16.5	Impact (daytime) of the operation and maintenance of the offshore elements of VE array areas on seascape character.	Potential for long-term, reversible impacts on perceived seascape character (SCTs), arising as a result of the operational WTGs, substations and maintenance activities located within the VE array areas, which may alter the seascape character of the array area itself and the perceived character of the wider seascape.	**Scoped in:** <u>Suffolk, South Norfolk & North Essex SCTs:</u> SCT03: Nearshore Waters SCT05: Coastal Waters SCT06: Offshore Waters <u>MMO SCAs/MCAs:</u> MCA19: Essex and South Suffolk Estuaries and Coastal Waters MCA20: Thames Approaches SCA4: East Anglia Shipping Waters **Scoped out:** <u>Suffolk, South Norfolk & North Essex SCTs:</u> SCT01: Inland Navigable Waters SCT02: International Ports and Approaches SCT04: Developed Nearshore Waters <u>MMO SCAs/MCAs:</u> MCA11: Goodwin Sands and North Dover Strait MCA15: Eastern English Channel Approaches MCA16: Swale, Kentish Flats and Margate Sand MCA17: Thanet Shipping Waters

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			A simple assessment of the potential effects of VE array areas on SCTs will be undertaken initially using desk-based information and ZTV analysis, with a detailed assessment focusing on those that are identified as requiring further assessment. Detailed assessment to include desk-based seascape character assessment publications and primary baseline data collection (for example through site surveys), quantitative and qualitative assessment methodologies to determine likely significance, and modelling such as ZTV analysis and wireline/photomontage visualisations.
16.6	Impact (daytime) of the operation and maintenance of the offshore elements of VE array areas on perceived landscape character.	Potential for long-term, reversible impacts on perceived landscape character of LCAs/LCTs and qualities of designated landscapes, arising as a result of the operational WTGs, substations and maintenance activities, which may be visible from the coast (during good to excellent visibility conditions) and may therefore affect the perceived character and qualities of the landscape.	**Scoped in (Suffolk):** 5. Coastal Dunes and Shingle Ridges 6. Coastal Levels 7. Estate Sandlands 8. Open Coastal Fens 29. Wooded Fens **Scoped in (Essex):** F7. Brightlingsea-Clacton-Frinton Coast F8. Hamford Water F9. Stour Estuary Slopes F10. Stour Estuary **Scoped out:**

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			All other LCTs identified in Suffolk Landscape Character Assessment (SCC, 2008) and all other LCAs identified in the Essex Landscape Character Assessment (ECC, 2003). All LCTs within Kent Landscape Character Assessment (KCC, 2004). A simple assessment of the potential effects of VE array areas on the perceived character of LCTs/LCAs will be undertaken initially using desk-based information and ZTV analysis, with a detailed assessment focusing on those that are identified as requiring further assessment. Detailed assessment to include desk-based landscape character assessment publications and primary baseline data collection (for example through site surveys), quantitative and qualitative assessment methodologies to determine likely significance, and modelling such as ZTV analysis and wireline/photomontage visualisations.
16.7	Impact (daytime) of the operation and maintenance of the offshore elements of VE array areas on perceived landscape character / special qualities of designated landscapes.	Potential for long-term, reversible impacts on perceived landscape character and special qualities of designated landscapes, arising as a result of the operational WTGs, substations and maintenance activities, which may be visible from the coast (during good to	**Scoped in:** Suffolk Coast and Heaths AONB (including Suffolk Heritage Coast) Bawdsey Manor RPG **Scoped out:** Kent Downs AONB Campsey Ashe RPG

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		excellent visibility conditions) and may therefore affect the perceived character and qualities of the landscape.	Glenham Hall RPG Special Landscape Areas (Suffolk) A simple assessment of the potential effects of VE array areas on the perceived character and qualities of designated landscape will be undertaken initially using desk-based information and ZTV analysis, with a detailed assessment focusing on those that are identified as requiring further assessment. Detailed assessment to include desk-based assessment to define special qualities that may be affected by VE array areas, using published documents and primary baseline data collection (for example through site surveys), quantitative and qualitative assessment methodologies to determine likely significance, and modelling such as ZTV analysis and wireline/photomontage visualisations. Relevant special qualities for detailed assessment will be agreed with stakeholders as part of the evidence plan process.
16.8	Impact (daytime) of the operation and maintenance of the offshore elements of VE array areas on visual receptors / views.	Potential for long-term, reversible impacts on views and visual amenity experienced by people as principal visual receptors and representative viewpoints, arising as a result of the operational WTGs,	**Scoped in:** Principal visual receptors at coastal settlements, recreational routes (including Suffolk Coast Path), main road/rail routes, visitors to tourist/visitor facilities and visitors to

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		substations and maintenance activities when visible from the coast during very good to excellent visibility conditions. WTGs will often be seen behind the operational wind farms, however their taller height and horizontal spread of the WTGs may result in effects on views.	historic environment assets within ZTV. Receptors at representative viewpoints in Table 16.3. **Scoped out:** Visual receptors outside ZTV. Illustrative viewpoints in Table 16.3. A simple assessment of the potential effects of VE array areas on the views and visual receptors will be undertaken initially using desk-based information and ZTV analysis, with a detailed assessment focusing on those that are identified as requiring further assessment. Detailed assessment to include desk-based publications and primary baseline data collection (for example through site surveys), quantitative and qualitative assessment methodologies to determine likely significance, and modelling such as ZTV analysis and wireline/photomontage visualisations.
16.9	Impact (night-time) of the operation and maintenance of VE array areas lighting on visual receptors / views	Potential for long-term, reversible impacts on views and visual amenity experienced by people from principal visual receptors and representative viewpoints, including from within the SCHAONB, arising as a result of the marine navigation and aviation lights. Potential for impacts on perception of dark night skies quality of the	**Scoped in:** Receptors at representative night-time viewpoints identified in Table 16.3. Receptors within the SCHAONB where opportunities to experience areas with relatively dark skies. **Scoped out:**

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		SCHAONB arising from lighting of VE array areas in views from the coast of the seascape outside the SCHAONB.	Visual receptors outside aviation lighting (hub height) ZTV. Visual receptors at main coastal urban areas and conurbations of the SLVIA study area, where there are high levels of baseline night-time lighting at the coast. A ZTV showing the geographic extent of visible aviation and marine navigation lighting will be used to inform the assessment of effects resulting from WTG lighting. Night-time photographs and visualisations will be prepared from proposed night-time viewpoints (Table 16.3) to illustrate the effects of the lighting from key viewpoints, to be agreed with stakeholders.
DECOMMISSIONING			
16.10	Impact (daytime) of the decommissioning of the offshore elements of VE array areas on seascape character.	Potential for short-term, temporary impacts on perceived seascape character, arising as a result of the decommissioning activities and structures located within the VE array areas, which may alter the seascape character of the area within the Scoping Boundary itself and the perceived character of the wider seascape through visibility of these changes.	The residual effects on seascape character arising as a result of the decommissioning of the VE array areas are likely to be assessed as being the same magnitude and significance as those arising from construction, with the residual effects being short-term and temporary occurring during the length of the decommissioning phase.
16.11	Impact (daytime) of the decommissioning of the	Potential for short-term, temporary impacts on perceived landscape	The residual effects on perceived landscape character arising as a result of the

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
	offshore elements of VE array areas on perceived landscape character and special qualities of designated landscapes.	character, arising as a result of the decommissioning activities and structures within the VE array areas, which may be visible from the coast (during good to excellent visibility conditions) and may therefore affect the perceived character and qualities of designated landscapes.	decommissioning of the VE array areas are likely to be assessed as being the same magnitude and significance as those arising from construction, with the residual effects being short-term and temporary occurring during the length of the decommissioning phase.
16.12	Impact (daytime) of the decommissioning of the offshore elements of VE array areas on visual receptors / views.	Potential for short-term, temporary impacts on views and visual amenity experienced by people from principal visual receptors and representative viewpoints, arising as a result of the decommissioning activities and structures within the VE array areas, which may be visible from the coast (during good to excellent visibility conditions).	The residual effects on visual receptors / views arising as a result of the decommissioning of the VE array areas are likely to be assessed as being the same magnitude and significance as those arising from construction, with the residual effects being short-term and temporary occurring during the length of the decommissioning phase.

Table 16.5 – Impacts proposed to be scoped out of the SLVIA

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
CONSTRUCTION		
16.13	Construction phase seascape, landscape and visual impacts of the offshore elements of VE array areas outside the 60km radius SLVIA study area (Figure 17.1).	The 60km radius SLVIA study area is defined to an outer limit within which significant effects could occur. Significant effects will not occur beyond 60km due to the limited changes to views arising from the VE array areas at distances of over 60 km, particularly since the array area is located largely behind the operational Galloper and Greater Gabbard offshore wind farms.
16.14	Impacts of the construction of the VE array areas on physical aspects of landscape character.	Due to the location of VE array areas at considerable distance offshore it will only impact on the perception of character and qualities – which is considered as an indirect effect in LVIA. No physical attributes that define landscape character or special qualities of designated landscapes will be changed as a result of the VE array areas.
16.15	The seascape, landscape and visual impacts of the offshore cable route construction.	Limited influence on seascape, landscape and visual receptors due to sporadic, temporary nature of above sea construction processes. The activities mainly occur from vessels, which are already an apparent component of the baseline seascape and views.
16.16	Impact of the array area lighting on seascape and landscape character at night during construction.	Navigational lights associated with construction buoyage and construction vessels will not be visible from the coast. Aviation marking lights may be required on top of cranes associated with heavy lift vessels or jack up vessels, however, these will be temporary in nature and will largely be behind existing wind farms.

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
OPERATION AND MAINTENANCE		
16.17	Operation and maintenance phase seascape, landscape and visual impacts of the offshore elements of VE array areas outside the 60km radius SLVIA study area (Figure 17.1).	The 60km radius SLVIA study area is defined to an outer limit within which significant effects could occur. Significant effects will not occur beyond 60km due to the limited changes to views arising from the VE array areas at distances of over 60 km, particularly since the array area is located largely behind the operational Galloper and Greater Gabbard offshore wind farms.
16.18	The seascape, landscape and visual effects of the operation of the offshore cable route.	Cable is located below the sea surface so will not be visible as part of the seascape or views once operational and will therefore have no operational effect on seascape, landscape and visual receptors.
16.19	Impact of the array area lighting on seascape and landscape character at night during operation and maintenance.	The matter of visible aviation lighting assessment will be assessed as wholly a visual matter as it is considered that the proposed aviation lighting will not have significant effects on the perception of landscape or seascape character, which is not readily perceived at night in darkness. No attributes of seascape or landscape character will be changed as a result of the lighting of the VE array areas.
16.20	Impact of the operation and maintenance of the VE array areas on the views experienced by offshore visual receptors.	The VE array areas are located in the immediate vicinity of other operational wind farms in the open sea at a considerable distance from the coast. Whilst there may be some increase in the density and spread of WTGs within this area and in views from vessels, offshore receptors are not of high sensitivity and therefore this increase is unlikely to give rise to a significant visual effect.

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
DECOMMISSIONING		
16.21	Decommissioning phase seascape, landscape and visual impacts of the offshore elements of VE array areas outside the 60km radius SLVIA study area (Figure 17.1).	The 60km radius SLVIA study area is defined to an outer limit within which significant effects could occur. Significant effects will not occur beyond 60km due to the limited changes to views arising from the VE array areas at distances of over 60 km, particularly since the array area is located largely behind the operational Galloper and Greater Gabbard offshore wind farms.
16.22	Impacts of the decommissioning of the VE array areas on physical aspects of landscape character.	Due to the location of VE array areas at considerable distance offshore it will only impact on the perception of character and qualities – which is considered as an indirect effect in LVIA. No physical attributes that define landscape character or special qualities of designated landscapes will be changed as a result of the VE array areas.
16.23	Impact of the array area lighting on seascape and landscape character at night during decommissioning.	Navigational lights associated with construction buoyage and construction vessels will not be visible from the coast. Aviation marking lights may be required on top of cranes associated with heavy lift vessels or jack up vessels, however, these will be temporary in nature and will largely be behind existing wind farms.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

16.5.10 As part of the design process for VE a number of designed-in measures are proposed to reduce the potential for impacts on seascape, landscape and visual receptors. These are presented below. These will evolve over the development process as the EIA progresses and in response to consultation.

16.5.11 VE are committed to implement these measures, and also various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/out presented in Table 16.4 and Table 16.5.

16.5.12 Measures adopted as part of the project will include:

- The number of WTGs installed will not exceed 80 WTGs.
- WTGs will have a maximum blade tip height of 398 m above LAT and the rotor diameter will not exceed 376 m.
- VE will agree a lighting scheme for the aviation lighting of structures (turbines and offshore support platforms) above 60m in height with the relevant authorities. Aviation warning lights will have reduced intensity at and below the horizontal and allow a further reduction in lighting intensity when the visibility in all directions from every wind turbine is more than 5km.

16.5.13 The requirement and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

POTENTIAL CUMULATIVE IMPACTS

16.5.14 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For seascape, landscape and visual receptors, cumulative interactions may occur with other planned projects and developments in the study area. Potential cumulative impacts with other projects and activities will be considered for each of the impacts considered in Table 16.6.

16.5.15 . It is proposed that cumulative impacts detailed in Table 16.7 will be scoped out of further assessment within the EIA.

16.5.16 The impacts from the offshore elements of VE array areas have the potential to act cumulatively with impacts from other developments to contribute to cumulative effects. Such impacts from the offshore elements of VE array areas that have the potential to contribute to cumulative seascape, landscape and visual effects include during operation effects on seascape, landscape and visual amenity due to inter-visibility of other planned projects with VE array areas. Cumulative effects during construction are considered less likely to be significant, due to the temporary nature of the activity.

16.5.17 The focus of the cumulative seascape, landscape and visual assessment will be on the additional effect of the VE array areas in conjunction with other developments of the same type i.e. other offshore wind farms. In accordance with guidance (NatureScot, 2012), the SLVIA will assess the effect arising from the addition of the VE array areas to the cumulative situation, and not the overall effect of multiple wind farms.

16.5.18 The cumulative SLVIA will consider operational, consented and application stage offshore wind farms within the SLVIA study area, as well as proposals subject to scoping requests, as shown on Figure 16.1.

16.5.19 The SLVIA study area includes the following OWFs that will be scoped into the cumulative impact assessment:

> Operational OWFs - Galloper, Greater Gabbard, London Array 1, Thanet and East Anglia ONE within the United Kingdom (UK) territorial waters, which will be considered as part of the baseline environment;

> Application stage OWFs – East Anglia Two and East Anglia One North in UK territorial waters; and

> Scoping stage OWFs – North Falls.

16.5.20 Cumulative impacts proposed to be scoped out of the cumulative assessment are identified in Table 16.7.

Table 16.6 – Cumulative impacts proposed to be scoped in to the SLVIA

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
16.24	Cumulative effect (daytime) of the construction, operation and maintenance, and decommissioning of VE array areas on seascape character, landscape character and views / visual receptors.	Potential for cumulative short-term and long-term, reversible impacts on perceived seascape character (SCTs), landscape character of LCAs/LCTs and qualities of designated landscapes, and views / visual amenity experienced by people arising as a result of visibility of the operational WTGs, substations and maintenance activities located within the array area cumulatively with other projects located within the study area.	**Scoped in:** Seascape, landscape and visual receptors identified above as scoped in for impacts 17.1 – 17.7. Operational, consented, application and scoping OWFs within the SLVIA study area as shown in Figure 17.1, consisting the operational Greater Gabbard, Galloper, East Anglia ONE, London Array, Gunfleet Sands and Thanet which will be considered as part of the baseline; and the application stage East Anglia ONE North and East Anglia TWO, which will be assessed as part of an ‘application stage’ scenario; and the scoping stage North Falls which will be considered as part of a cumulative assessment of VE array areas and North Falls. The potential effects of the VE array areas with the application stage Sizewell C project will also be scoped into the assessment. **Scoped out:** Seascape, landscape and visual receptors identified above as scoped out for impacts 17.1 – 17.8. OWFs within French, Belgian and Dutch territorial waters (Figure 17.1). A simple assessment of the potential cumulative effects of VE array areas on seascape, landscape and visual receptors will be undertaken initially using desk-based information and ZTV analysis, with a detailed cumulative assessment focusing on those that are identified as requiring further assessment. Detailed

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			cumulative assessment to include desk-based publications and primary baseline data collection (for example through site surveys), quantitative and qualitative assessment methodologies to determine likely significance, and modelling such as cumulative ZTV analysis and cumulative wireline/photomontage visualisations.

Table 16.7 – Cumulative impacts proposed to be scoped out of the SLVIA

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
16.25	Construction, operation and maintenance, and decommissioning phase cumulative impacts with offshore wind farms located in French, Belgian and Dutch waters (Borssele II, Mermaid, Belwind and Seastar) (Figure 17.1).	Due to the long distance of the VE array areas from the coastline of France, Belgium and Netherlands (approximately 80km at its closest point); the long distance of the Borssele II, Mermaid, Belwind and Seastar OWF from the UK coastline (approximately 87km at its closest point) and limited effect interactions on receptors along these coastlines.

POTENTIAL TRANSBOUNDARY IMPACTS

16.5.21 A description of how potential transboundary effects will be assessed is outlined in Chapter 4: Environmental Impact Assessment approach and methodology. As presented in Chapter 4, the limits of the Dutch, Belgian and French Exclusive Economic Zones are located approximately 16 km (south east), 25 km (south) and 18 km (north east) of the VE array areas respectively.

16.5.22 Parts of the study area is located within the EEZs of Belgium, France and the Netherlands as shown on Figure 16.1. There are, however, no areas of land within these countries located within or close to the SLVIA study area. Due to the concentrated nature of any potential impacts on the seascape, landscape and visual resource to the UK coastline within the SLVIA study area, transboundary impacts are unlikely to occur on sensitive seascape, landscape or visual receptors and therefore it is suggested that transboundary impacts will be scoped out from further consideration within the SLVIA.

16.6 SUMMARY OF NEXT STEPS

PROPOSED APPROACH TO PEIR AND ES

SLVIA CONTENTS

16.6.1 The SLVIA chapter of the PEIR and ES will provide a summary of the significance of changes resulting from the construction, operation and maintenance, and decommissioning of the offshore elements of VE to seascape, landscape and visual receptors. Full technical assessments of the seascape, landscape and visual impacts will be contained within technical appendices. The SLVIA will be supported by plan figures and visual representations (photomontages).

DESK-BASED AND SITE SURVEY WORK

16.6.2 The SLVIA undertaken as part of the PEIR and ES will be informed by desk-based studies and field survey work undertaken within the SLVIA study area. The landscape, seascape and visual baseline will be informed by desk-based review of landscape and seascape character assessments, and the ZTV, to identify receptors that may be affected by the offshore elements of VE and produce written descriptions of their key characteristics and value.

16.6.3 A preliminary desk-based assessment will be undertaken of seascape, landscape and visual receptors using ZTV analysis, to identify which landscape and visual receptors are unlikely to be significantly affected, which will be subject to a simple assessment, and those that are more likely to be significantly affected by the offshore elements of VE, which require a detailed assessment.

16.6.4 Interactions will be identified between the offshore elements of VE and seascape, landscape and visual receptors, to predict potentially significant effects arising and measures may be proposed to mitigate effects.

16.6.5 For those receptors where a detailed assessment is required, primary data acquisition will be undertaken through a series of surveys. These surveys will include field survey verification of the ZTV from terrestrial LCAs/LCTs, micro-siting of viewpoint locations, panoramic baseline photography and visual assessment survey from all representative viewpoints (as listed in Table 16.3). These viewpoint photography and visual assessment surveys are planned to be undertaken during late Summer 2021 subject to appropriate weather conditions. If optimal weather conditions are not available later summer 2021, photography may be undertaken in early Autumn 2021 or Spring/early Summer 2022.

16.6.6 There is some risk of delay in being able to take viewpoint photographs due to the ongoing Covid-19 public health situation, however it is anticipated that site visits to the study area will be possible to undertake in late summer/early Autumn 2021 and Spring/early Summer 2022. Further visual assessment surveys are then likely to be undertaken prior to the PEIR submission, using the photomontage visualisations to undertake field survey assessment of visual effects from each representative viewpoint. Sea-based offshore surveys are not proposed to be undertaken as part of the SLVIA. Illustrative wirelines (without baseline photography) will be prepared for offshore viewpoints if required.

16.6.7 Detailed assessment methods will be based on quantifying impacts through modelling to enable prediction of seascape, landscape and visual effects. Assessment of the sensitivity of seascape, landscape and visual receptors will be undertaken, together with an assessment of the magnitude of change arising as a result of the offshore elements of VE. Judgements on sensitivity and magnitude will be combined to arrive at an overall assessment as to whether the offshore elements of VE will have an effect that is significant or not significant on each seascape, landscape and visual receptor.

16.6.8 The SLVIA undertaken as part of the PEIR and ES will prepare the necessary information to assess the night-time visual effects of the proposed lighting of the offshore elements of VE.

STUDY AREA REFINEMENTS FOR PEIR / ES

16.6.9 The 60km radius SLVIA study area (Figure 17.1) may be further refined for the PEIR or ES if the WTG layout within the VE array areas changes from that shown in the Scoping Report. The ZTV (Figure 16.2 and Figure 16.3) of the VE array areas may also be further refined to address any ongoing design changes, or changes in the design envelope, for example in response to embedded environmental measures that may influence the MDS for the SLVIA.

STAKEHOLDER ENGAGEMENT

16.6.10 Consultation will be a key feature of the SLVIA process for VE, from the pre-application to examination stage with relevant statutory and non-statutory organisations, the public and Interested Parties (IPs).

16.6.11 VE is seeking early engagement with consultees to gain input and local knowledge on the key seascape, landscape and visual constraints / sensitivities and discuss potential future environmental measures, as appropriate. VE considers it important to engage early to ensure all seascape, landscape and visual aspect matters are considered appropriately and proportionately with the relevant statutory consultees.

16.6.12 Formal pre-application consultations with regards to SLVIA will be undertaken primarily through specialist consultation via an Expert Topic Group (ETG) as part of the EPP, along with wider consultation through this Scoping Report and the PEIR. Numerous ETG meetings and site visits will be organised with representatives from Natural England, Suffolk County Council, East Suffolk Council, Suffolk Coast and Heaths AONB Partnership, Essex County Council and Tendring District Council.

16.6.13 Feedback received through this consultation process will be considered in preparing the PEIR and ES where appropriate to be submitted with the DCO Application.

16.6.14 In line with the consultation strategy, public consultation with be conducted primarily through a series of Public Information Days (PIDs) and public meetings. Details of the proposed consultation phases are set out in Chapter 6 of this Scoping Report.

16.6.15 All consultation feedback pertaining to the SLVIA will be presented in a Consultation Report, to be provided as part of the DCO Application, and will be summarised in the SLVIA chapter together with information on how feedback has been addressed in the PEIR and ES.

16.7 FURTHER CONSIDERATION FOR CONSULTEES

16.7.1 The following specific questions are provided for to help frame the consultees scoping opinion for the seascape, landscape and visual:

> Do you agree that the data sources identified in Table 16.1 are sufficient to inform the baseline for the VE PEIR and ES?

> Do you agree that all the designated areas within the ZTV have been identified?

> Do you agree with the proposed viewpoint list in Table 16.3 or have any proposed additions or alternatives?

> Have all potential impacts resulting from VE been identified for seascape, landscape and visual receptors?

> Do you agree that the impacts described in Table 16.5 can be scoped out?

> For those impacts scoped in (Table 16.4), do you agree that the methods described are sufficient to inform a robust impact assessment?

> Do you have any specific requirements for the SLVIA methodology and/or visual representations (photomontages/ZTVs) to be included in the SLVIA?

17. MARINE ARCHAEOLOGY AND CULTURAL HERITAGE

17.1 INTRODUCTION

17.1.1 This chapter of the Scoping Report identifies the marine archaeological and cultural heritage receptors of relevance to the VE array areas and offshore AoS. It describes the potential effects from the construction, operation and maintenance, and decommissioning of the offshore and intertidal components (up to MHWS) of VE on archaeological and cultural heritage receptors and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

17.1.2 Effects of the onshore components of VE on cultural heritage assets are described separately in Chapter 20: Archaeology and cultural heritage.

17.1.3 This chapter and the associated appendices (Appendix B and C) should be read alongside the following chapters of this Scoping Report:

- Chapter 7: Physical Processes;
- Chapter 16: Seascape, Landscape and Visual Impact Assessment; and
- Chapter 20: Archaeology and cultural heritage (onshore).

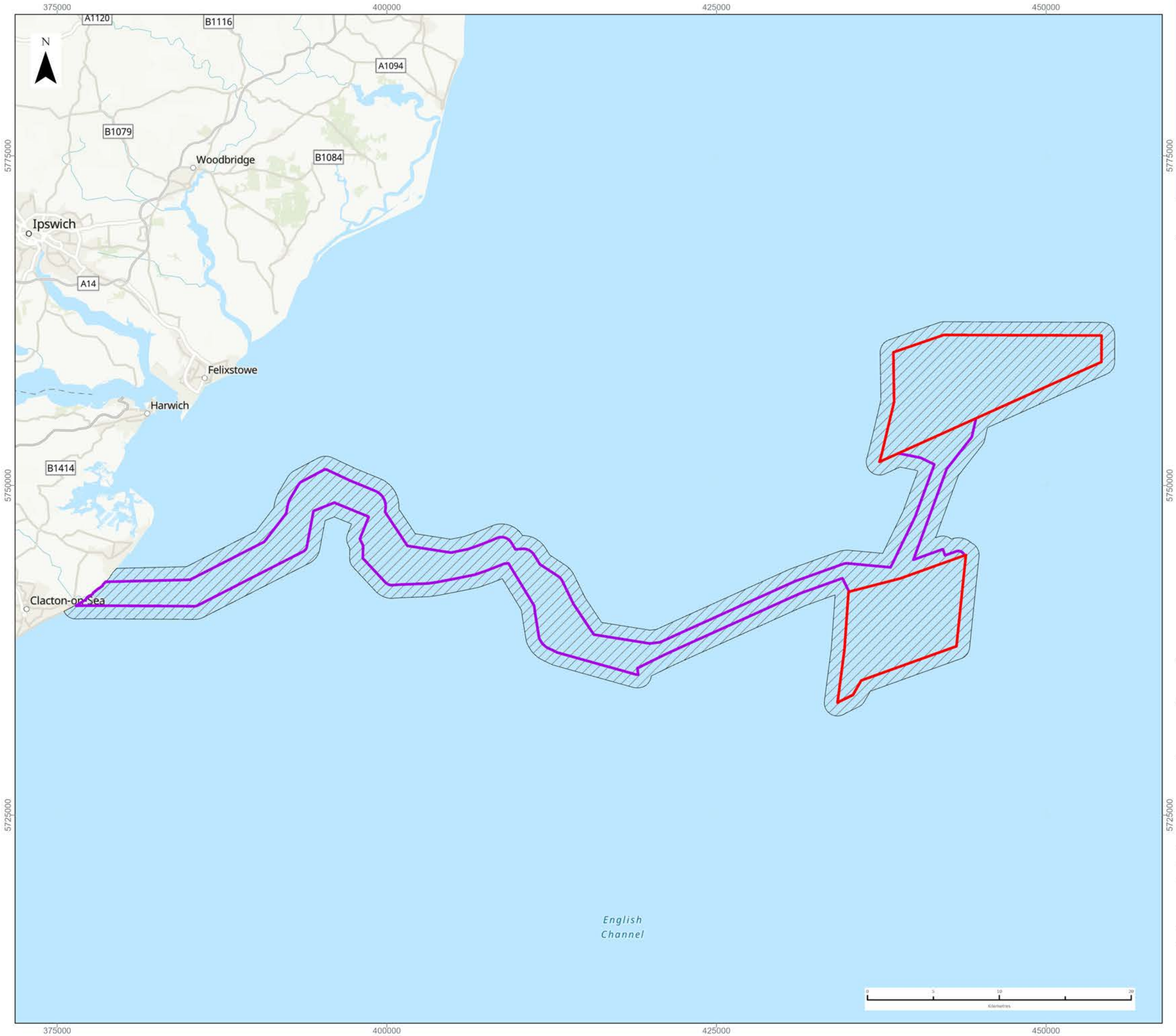
17.2 STUDY AREA

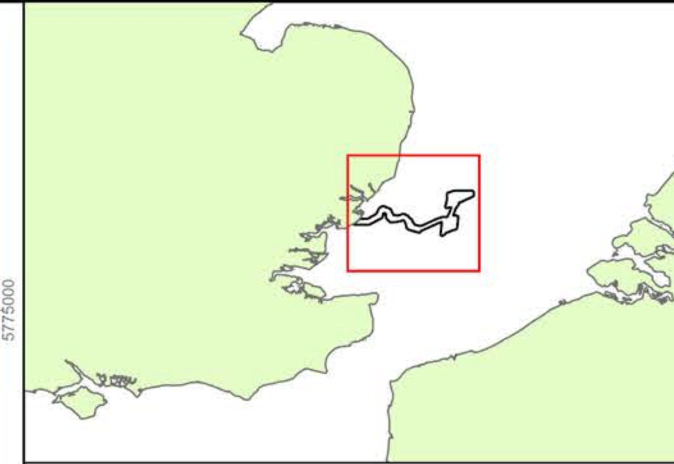
17.2.1 A marine archaeology study area has been established for the purposes of collating and characterising baseline data as part of this desk-based review. The marine archaeology study area encompasses the offshore AoS and the array areas, plus a 1 km buffer up to MHWS (Figure 17.1). The Zone of Influence for direct impacts on archaeology receptors is defined as the offshore AoS and the array areas.

17.2.2 The extended marine archaeology study area is industry standard and allows for the consideration of direct and indirect effects on marine archaeological and cultural heritage receptors and is designed to accommodate the potential imprecision of historic marine positioning.

17.2.3 It is important to note that the marine archaeology study area will be reviewed and amended for future stages (PEIR and subsequently ES) in response to such matters as refinement of the offshore AoS and array areas, feedback from consultees, and/ or the identification of additional constraints (environmental and/ or engineering).

17.2.4 There is an intertidal overlap between the onshore and offshore archaeology study areas up to MHWS to ensure that there is total coverage of the offshore AoS between the two chapters.





LEGEND

- Array Areas
- Offshore Area of Search
- Marine archaeology study area

Data Source:
Basemap: World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, METI/NASA, USGS

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Marine archaeology study area

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	HA	CH

DRAWING NUMBER:

17.1

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:300,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

17.3 BASELINE DATA

17.3.1 The data sources detailed in Table 17.1 were consulted for this scoping chapter and are expected to inform the PEIR and ES assessments of the known archaeological and cultural heritage assets and likely significant impacts.

Table 17.1 – Key sources of information for marine archaeology and cultural heritage

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
United Kingdom Hydrographic Office (UKHO) wrecks and obstructions	Records of known wrecks and obstructions held by the United Kingdom Hydrographic Office (UKHO) and available via emapsite.com.	Partial coverage of the marine archaeology study area up to MLWS.
UKHO Admiralty Charts	Admiralty charts and historic mapping relevant to the defined marine archaeology study area.	Full coverage of the marine archaeology study area.
National Record of the Historic Environment (NRHE)	Point and polygon data in relation to wrecks and palaeoenvironmental evidence via Archaeology Data Service (ADS) ArchSearch.	Full coverage of the marine archaeology study area.
Essex Historic Environment Record (HER)	Point data derived from Historic Environment Record held by Essex HER Office.	Partial coverage of the marine archaeology study area to MLWS.
North Sea Palaeolandscape Project (NSPP)	Palaeolithic and Mesolithic landscape mapping of the North Sea.	No coverage of the marine archaeology study area, though the detailed study provides useful characterisation of the directly adjacent subzone.
Lost Frontiers Project (LFP)	A continuation of the NSPP. Building on the mapping of Palaeolithic and Mesolithic landscapes of the North Sea, using paleoenvironmental data and ancient DNA. Potential submerged Neolithic landscapes will also be explored.	Data is not yet published for this project but will be considered when this data becomes available.

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Technical Report for Strategic Environmental Assessment (SEA) Area 3 (*Flemming*, 2002)	Description of palaeolandscape potential of the North Sea basin.	Broadscale data with regional coverage.
Galloper Wind Farm Project-Environmental Statement – Chapter 19: Archaeology and Cultural Heritage and associated technical reports (*Wessex Archaeology*, 2011)	Review of archaeological potential of the subzone.	Partial coverage with some overlap with the marine archaeology study area. The detailed study also provides useful characterisation of the directly adjacent subzone.
England's Historic Seascapes Marine HLC Pilot Study: Southwold to Clacton (*English Heritage*, 2007)	Description of palaeolandscape and marine archaeological potential in the offshore zone from Southwold to Clacton.	Broadscale data with regional coverage.
Greater Gabbard Windfarm – Phase One: Offshore Turbine Area – Archaeological Desk Based Assessment (*Maritime Archaeology Ltd*., 2005)	Review of archaeological potential of the subzone.	No coverage of the marine archaeology study area though the detailed study provides useful characterisation of the directly adjacent subzone.
Greater Gabbard Windfarm – Phase Two: Export Cable Route and Onshore Works – Archaeological Desk Based Assessment (*Maritime Archaeology Ltd*., 2005)	Review of archaeological potential of the subzone.	Partial coverage. Minor overlap with the marine archaeology study area. The detailed study also provides useful characterisation of the directly adjacent subzone.
Coastal and Intertidal Zone Archaeological Network (CITiZAN)	Interactive mapping of intertidal heritage in England.	Partial coverage of the marine archaeology study area, though the detailed study provides useful characterisation of the directly adjacent subzone.
Historic England Peat Database	Database of all intertidal and coastal peats containing location, nature, age and related archaeology.	No data within the marine archaeology study area though pates have been located along the Essex coast.

17.4 BASELINE ENVIRONMENT

17.4.1 Marine archaeological and cultural heritage receptors can be attributed to four main categories of sites or features:

- Submerged prehistoric landscapes resulting from changes to sea-level and eventual stabilisation of sea-level at or near to the present position. Such landscapes may contain highly significant evidence of prehistoric human occupation and/or environmental change;
- Archaeological remains of watercraft deposited when such vessels sank while at sea or became abandoned in an intertidal context which subsequently became inundated;
- Remains of aircraft crash sites, either coherent assemblages or scattered material usually the result of Second World War (WWII) military conflict, but also numerous passenger casualties, particularly during the peak of seaplane activity during the interwar period. Also, includes aircraft, airships and other dirigibles dating to the First World War (WWI) though these rarely survive in the archaeological record; and
- Structural remains other than watercraft, including such elements as fish traps, abandoned quays, hards, defensive structures or sites lost to coastal erosion may be found within the intertidal zone (between MHWS and MLWS). Marine archaeological and cultural heritage receptors located seaward of MHWS have been considered in this section.

SUBMERGED PALAEOLANDSCAPES

17.4.2 The potential for submerged landscapes within the marine archaeology study area is high. Fluctuations in sea-level and temperature in the Palaeolithic resulted in repeated (re)colonisation and abandonment of these landscapes (Cohen *et al*., 2017). To the north of the marine archaeology study area, at Happisburgh and Pakefield, the earliest evidence of hominin occupation of northern Europe (c. 900 ka to 800 ka) comes from sites, features and finds within the coastal and marine zone (Parfitt *et al*., 2005, 2010; Bynoe, 2018).

17.4.3 These periods of (re)colonisation are associated with the retreat of ice-sheets following the last three glacial maximums:

- Devensian: Upper Palaeolithic c. 100 – 22,000 BP (glacial maximum);
- Wolstonian: Lower Palaeolithic c. 250 – 150,000 BP (glacial maximum); and
- Anglian: Lower Palaeolithic c. 350 – 280,000 BP (glacial maximum).

17.4.4 Due to the effects of ice scouring during each successive glacial period, the North Sea Basin has the highest potential for Palaeolithic material from within the last 100,000 years and increases significantly following the last glacial maximum, at the onset of the Holocene (*Flemming*, 2002). This is because these former Pleistocene land surfaces have not been eroded or reworked by younger landscapes (*Cohen* et al., 2017).

17.4.5 There are no *in situ* finds from the region, although the potential for the preservation of such material is well attested in similar contexts based on finds from developments such as aggregate dredging Area 240 approximately 60 km north of the marine archaeology study area, off the coast of Norfolk (*Tizzard* et al., 2014) where an assemblage of Middle Palaeolithic tools has been recovered.

17.4.6 Eight pre-historic and Palaeolithic finds have also been recorded in the marine archaeology study area within the HER and NRHE databases, as summarised in Table 17.3 and Table 17.4 and further detailed in Appendix C.

17.4.7 A Palaeolithic hand axe was found along the beach in Frinton-on-Sea and was recorded by CITiZAN (Table 17.1). The location of the find falls within the marine archaeology study area.

17.4.8 There are no protected areas or statutory designations in relation to submerged landscapes within the marine archaeology study area.

HISTORIC ENGLAND PEAT DATABASE

17.4.9 The Historic England Peat Database (Table 17.1) highlights 45 records of peats throughout Essex. Twelve of those records are located along the Essex coastline (*Hazell*, 2008), of which six have been dated but only four dates are included in the peat database (4277 ± 45 BP, 4020 ± 70BP, and 1420 ± 80 BP).

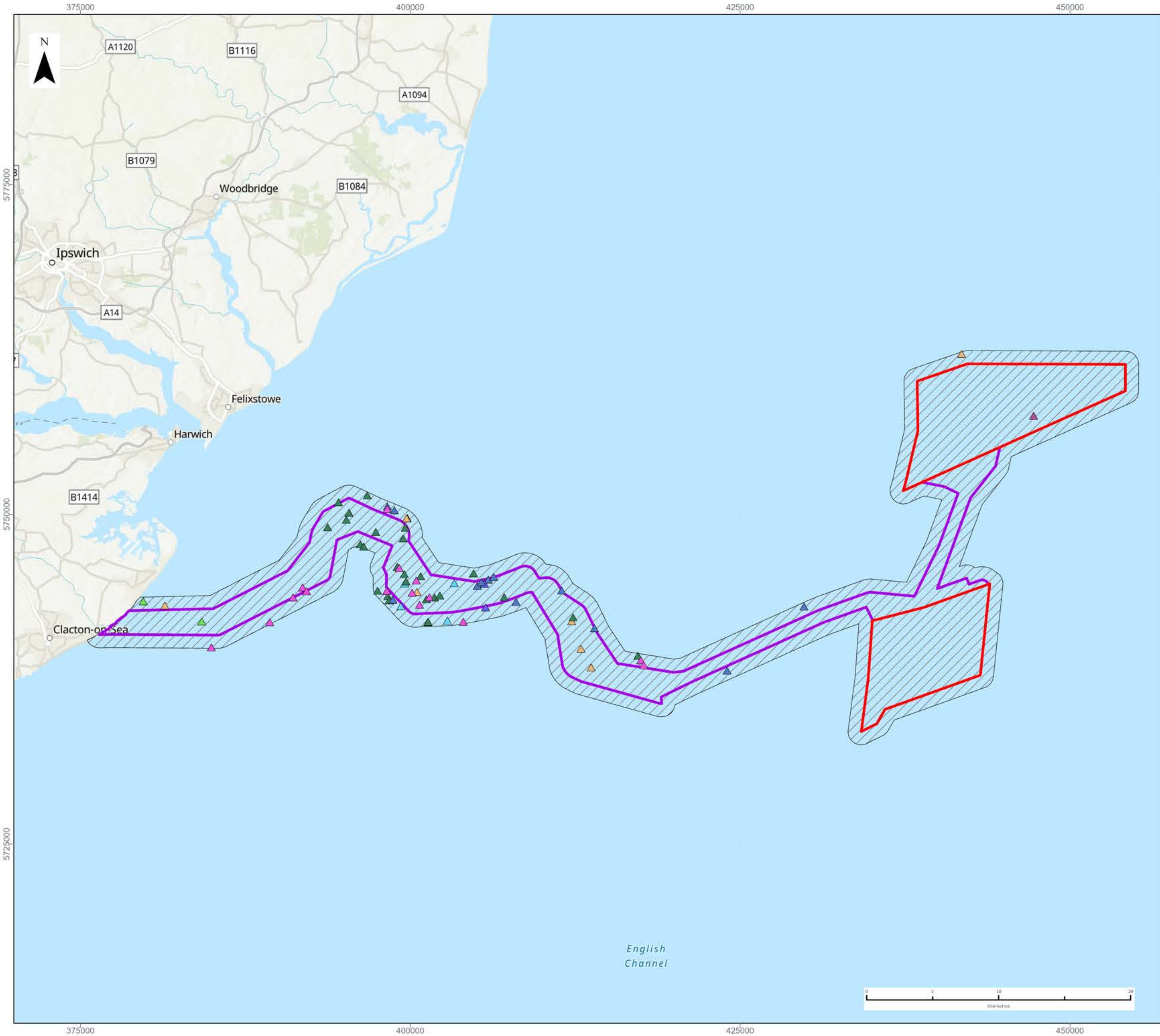
17.4.10 There are no recorded peats near the landfall site but there are three along the coast near Frinton-on-Sea, two to the south located at Jaywick and Clacton-on-Sea, and one to the north at Stone Point (north of Walton-on-the-Naze).

UKHO WRECKS AND OBSTRUCTIONS

17.4.11 There are 97 wrecks, obstructions and fouls recorded by the UKHO within the marine archaeology study area (Figure 17.2, Table 17.2 and Appendix B).

Table 17.2 – UKHO wrecks, fouls and obstructions

PERIOD	NUMBER OF RECORDS	TYPES
Medieval	0	n/a
Post-medieval	0	n/a
20^{th} century (1900-1913/1919-1938)	1	Steam ship
WWI	12	Trawler, steam ship, submarine
WWII	15	Launch, drifter, steam ship, trawler, liner, military vessel, tanker, motor vessel
Post-WWII (1946 – present)	8	Yacht, fishing vessel, cabin cruiser, carrier, steam ship, motor vessel
Aircraft	2	Unknown
Unknown wrecks	37	Wooden vessel, trawler
Obstructions and Foul Ground	22	Cables, nets, chains, mooring, tackle, wires, debris



LEGEND

- Array Areas
- Offshore Area of Search
- Marine archaeology study area

Archaeological Receptors (UKHO)

- 20th Century
- Aircraft
- Foul
- Modern
- Submarine
- Unknown
- Unidentified wreck
- WWI
- WWII

Data Source:
Basemap: World Hillshade: Esri, Ordnance Survey, NASA, NGA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, METI/NASA, USGS

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

UKHO sites within study area

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	HA	CH

DRAWING NUMBER:

17.2

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:300,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

NRHE WRECKS, OBSTRUCTIONS, DOCUMENTED LOSSES AND SITES

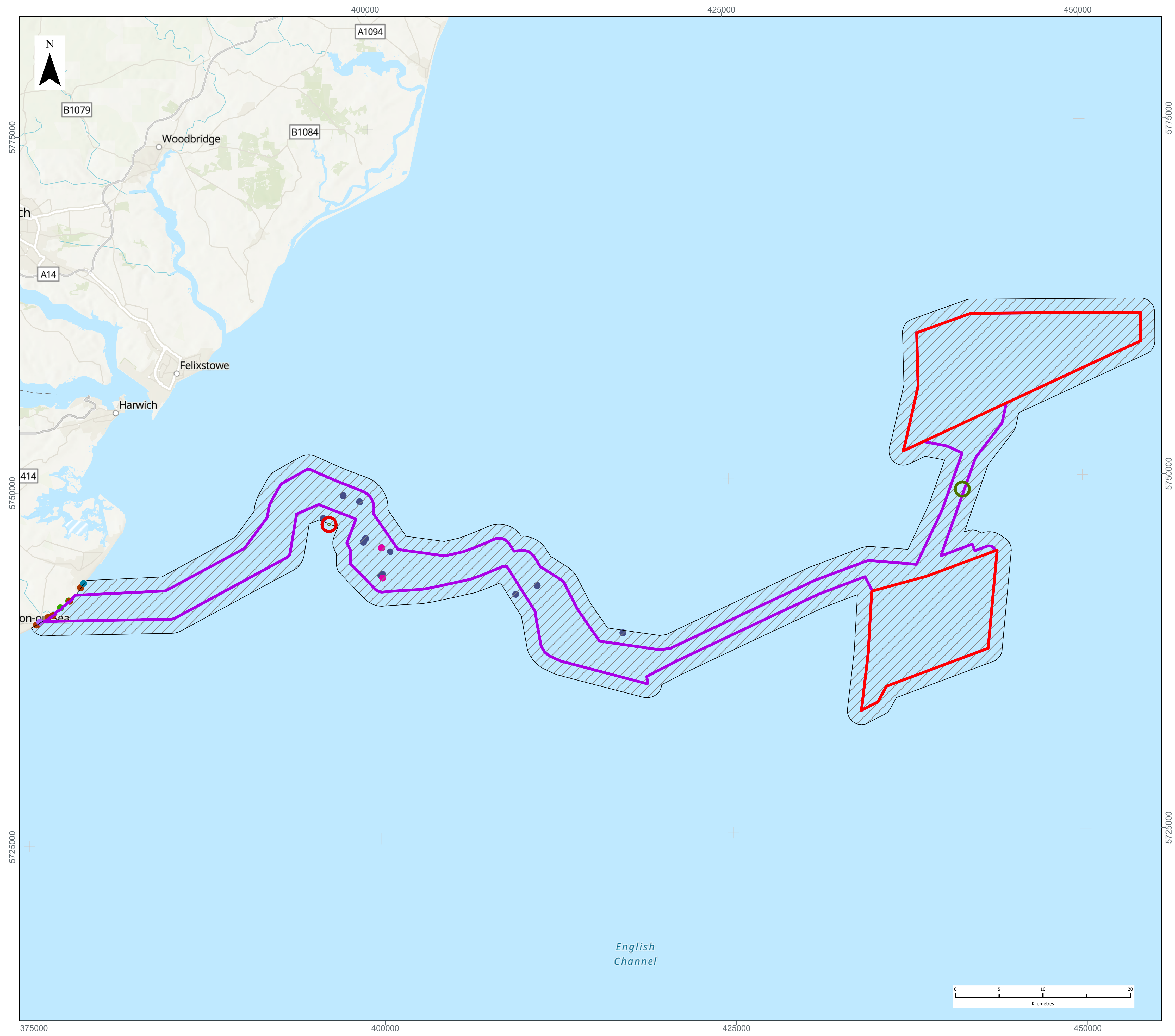
17.4.12 There are 41 records in the NRHE dataset within the marine archaeology study area (Table 17.3, Figure 17.2, Appendix C).

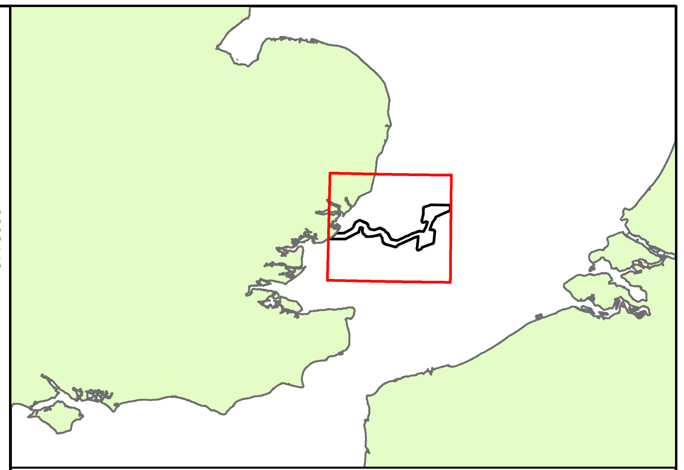
17.4.13 The majority of the finds were dredged from Licence Area 447 (active 2015-2016) which is located approximately 19 km east of Walton-on-the-Naze, and within the offshore AoS.

17.4.14 There is one battle site recorded in the NRHE: the St. James' Day Fight, part of the Second Anglo-Dutch Wars, was a two-day battle which took place on 25-26 July 1666 (Julian calendar), in the centre of the array areas (Figure 17.3, Appendix C).

Table 17.3 – NRHE records

PERIOD	NUMBER RECORD	TYPES
Unknown	14	Wrecks, aircraft component, metal object, animal bone, brass gauge, cutlery
Bronze Age	1	Two Bronze Age beakers
Medieval	1	Remains of a church
Modern	1	Horseshoes
Palaeolithic	3	Mammoth teeth
Post-Medieval	7	Martello towers, battle site, sloop or smack, undefined craft, brig
Roman	1	Romano British pottery
WWII	10	Three wrecks, one aircraft, beach defence structures
20^{th} century	3	Two cutters, one barge





LEGEND

- Array Areas
- Offshore Area of Search
- Marine archaeology study area

NRHE Areas

- 20th Century
- Palaeolthic
- Post-Medieval
- Unknown date
- WWII

NRHE Sites

- Bronze Age
- Medieval
- Modern
- Palaeolithic
- Post-Medieval
- Roman
- Unknown date
- WWII

Data Source:
Basemap: World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, METI/NASA, USGS
World Hillshade: Esri, CGIAR, USGS

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

HRHE sites within study area

VER	DATE	REMARKS	Drawn	Checked
1	21/09/2021	For Issue	HA	CH

DRAWING NUMBER:

17.3

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:450,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

C:\Users\heather.anderson\OneDrive - Maritime Archaeology Trust\Documents - MA Commercial\1887 GoBe RWE Five Estuaries Scoping\GIS\1887_VE_Master\1887_VE_Master.aprx

ESSEX HISTORIC ENVIRONMENT RECORD (HER)

17.4.15 There are 25 sites within the marine archaeology study area included in the HER data (Figure 17.4), as summarised in Table 17.4 and outlined in Appendix C.

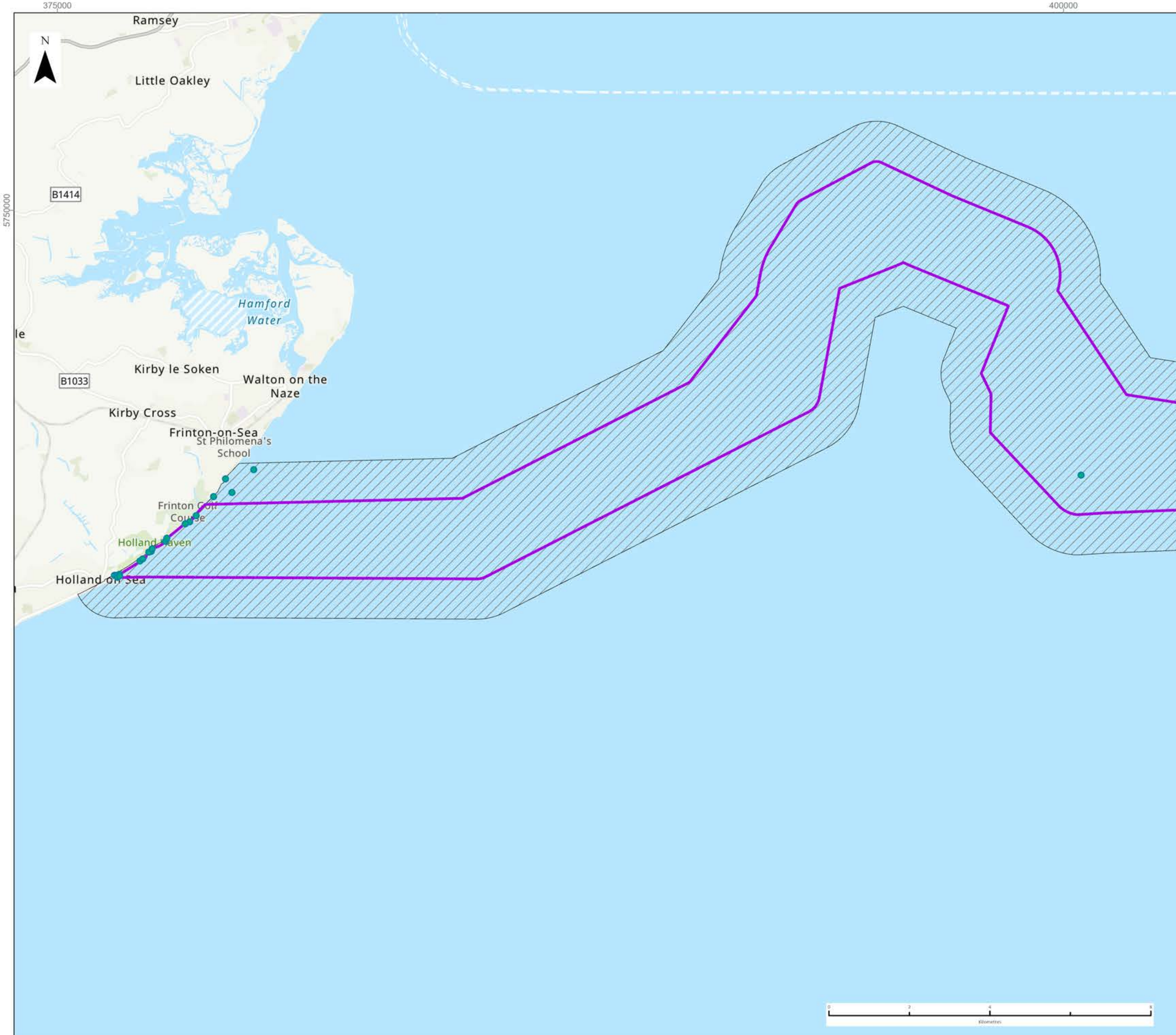
Table 17.4 – Essex Historic Environment Records (HER)

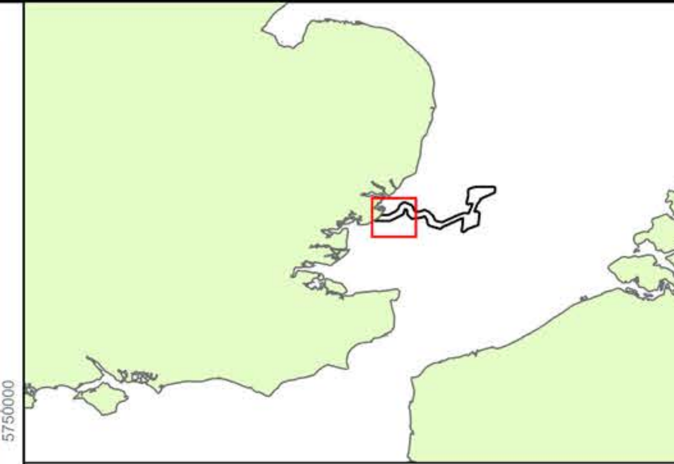
PERIOD (AS RECORDED BY HER)	NUMBER RECORD	TYPES
Palaeolithic	1	Mammoth tooth
Lower Palaeolithic to Late Neolithic	1	Implements found in the cliffs.
Prehistoric	1	One core, one flake
Neolithic	1	Axe or pick
Mesolithic	1	Tranchet axe and one other axe.
Roman	1	Coin
Modern	13	WW2 structures, Martello tower, modern structures
Medieval- Post-medieval	2	Martello tower, site of former estuary
Late Iron Age	1	Roman silver coin
Unknown	3	Earthworks, hill, coin

17.4.16 There are no features or sites within the marine archaeology study area that are currently designated under the Protection of Wrecks Act 1973, or any other site designation or statutory protection.

17.4.17 There are two records of unknown aircraft remains recorded in the UKHO data, both are within the marine archaeology study area and Offshore Area of Search.

17.4.18 One of the aircraft records (UKHO 15199) is reported as mostly lifted, the other one (UKHO 14995) is reported as structure recovered by divers. If further remains of these aircrafts sites are located during the project, they will be designated under the Protection of Military Remains Act 1986.





LEGEND

- Offshore Area of Search
- Marine archaeology study area
- HER sites

Data Source:
Basemap: World Topographic Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

HER sites within nearshore marine archaeology study area

VER	DATE	REMARKS	Drawn	Checked
1	16/09/2021	For Issue	HA	CH

DRAWING NUMBER:

17.4

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:100,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

C:\Users\heather.anderson\OneDrive - Maritime Archaeology Trust\Documents - MA Commercial\1887 GoBe RWE Five Estuaries Scoping\GIS\1887_VE_Master\1887_VE_Master.aprx

17.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

PROPOSED ASSESSMENT METHODOLOGY

17.5.1 The proposed assessment methodology for marine archaeology takes into consideration the following guidance documents for marine archaeological developments:

> Standard and Guidance for Historic Environment Desk-Based Assessment, Chartered Institute for Archaeologists (CIfA) (2014a and 2014b);

> Historic Environment Guidance for Offshore Renewable Energy Sector, Collaborative Offshore Wind Research into the Environment (COWRIE) (2007);

> Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy, COWRIE (2008);

> JNAPC Code of Practice for Seabed Development, Joint Nautical Archaeology Policy Committee (2006);

> Commercial Renewable Energy Development and the Historic Environment, Historic England Advice Note 15 (2021);

> Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects, The Crown Estate (2021); and

> Protocol for Archaeological Discoveries: Offshore Renewables Projects, The Crown Estate (2014).

POTENTIAL PROJECT IMPACTS

17.5.2 A range of potential impacts on marine archaeology and cultural heritage have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 17.5, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) to enable an assessment of the impact.

17.5.3 Based on the marine archaeology and cultural heritage information currently available and the project description, no impacts have been identified at this stage to be scoped out for the assessment of marine archaeology and cultural heritage.

Table 17.5 – Impacts proposed to be scoped into the assessment for marine archaeology and cultural heritage.

<table>
<tr><th>IMPACT NUMBER</th><th>IMPACT</th><th>DESCRIPTION</th><th>PROPOSED APPROACH TO ASSESSMENT</th></tr>
<tr><td colspan="4">CONSTRUCTION</td></tr>
<tr><td>17.1</td><td>Removal of sediment containing undisturbed archaeological contexts during seabed preparation ahead of construction.</td><td>Direct or indirect effects as a result of exposing marine archaeological and cultural heritage receptors to natural, chemical, or biological processes and causing or accelerating total or partial loss of the same.</td><td rowspan="4">Known marine archaeological and cultural heritage receptors will be further identified, detailed and classified by potential and/or significance during the baseline characterisation ahead of PEIR and avoided by establishing appropriate Archaeological Exclusion Zones (AEZs) following the archaeological assessment of geophysical data combined with the results from the baseline assessment.

Unknown marine archaeological and cultural heritage receptors will be identified during the archaeological assessment of geophysical and geotechnical data ahead of PEIR and avoided by establishing Archaeological Exclusion Zones (AEZs) or appropriate buffer areas at project design stage or further investigated where justified.

An Outline Marine WSI document will be produced to accompany the PEIR to outline the Archaeological Exclusion Zones (AEZs)</td></tr>
<tr><td>17.2</td><td>Intrusion of piling foundations disturbing archaeological contexts.</td><td>Direct penetration and compression effects on marine archaeological and cultural heritage receptors leading to a partial or total loss of the receptor.</td></tr>
<tr><td>17.3</td><td>Compression of stratigraphic contexts containing archaeological material from combined weight of Wind Turbine Generators (WTG)</td><td>Direct penetration and compression effects on marine archaeological and cultural heritage receptors leading to a partial or total loss of the receptor.</td></tr>
<tr><td>17.4</td><td>Disturbance of sediment containing potential marine archaeological and cultural heritage receptors (material and contexts) during inter-array and export cable laying operations.</td><td>Direct or indirect effects as a result of exposing marine archaeological and cultural heritage receptors to natural, chemical, or biological processes and causing or accelerating loss of the same and direct penetration and compression effects on marine archaeological and cultural heritage</td></tr>
</table>

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		receptors leading to a partial or total loss of the receptor.	or appropriate buffer areas and detail responsibilities through all project stages. Any additional unknown or unexpected marine archaeological and cultural heritage receptors identified during any of the project stages will be reported utilising the project specific Protocol for Archaeological Discoveries (PAD) which will be produced ahead of PEIR. Appropriate archaeological campaigns following a PAD report will be detailed in the Outline Marine WSI.
17.5	Penetration and compression effects of jack-up barges and anchoring of construction vessels during seabed preparation and seabed installation operations.	Direct or indirect effects as a result of exposing marine archaeological and cultural heritage receptors to natural, chemical, or biological processes and causing or accelerating loss of the same and direct penetration and compression effects on marine archaeological and cultural heritage receptors leading to a partial or total loss of the receptor.	
OPERATION			
17.6	Scour effects caused by: (a) the presence of Wind Turbine Generators, Offshore Substation Platform foundations, and (b) the exposure and replacement of inter-array and export cables or the use of cable protection measures (such as remedial cable burial).	Indirect scour effects impacting marine archaeological and cultural heritage receptors and exposing such material to natural, chemical or biological processes and causing or accelerating total or partial loss of the same.	Known marine archaeological and cultural heritage receptors will be further identified and detailed during the baseline assessment ahead of PEIR and avoided by establishing Archaeological Exclusion Zones (AEZs) or appropriate buffer areas at project design stage. Unknown marine archaeological and cultural heritage receptors will be identified during the archaeological assessment of geophysical and geotechnical data ahead of PEIR and avoided by establishing Archaeological Exclusion Zones (AEZs) or
17.7	Penetration and compression effects of jack-	Direct or indirect effects as a result of exposing marine archaeological and cultural	

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
	up barges and anchoring of construction vessels during operation and maintenance activities.	heritage receptors to natural, chemical, or biological processes and causing or accelerating loss of the same and direct penetration and compression effects on marine archaeological and cultural heritage receptors leading to a partial or total loss of the receptor.	appropriate buffer areas at project design stage or further investigated where justified. An Outline Marine WSI document will be produced to accompany the PEIR to outline the Archaeological Exclusion Zones (AEZs) or appropriate buffer areas and detail responsibilities through all project stages. Any additional unknown or unexpected marine archaeological and cultural heritage receptors identified during any of the project stages will be reported utilising the project specific Protocol for Archaeological Discoveries (PAD) which will be produced ahead of PEIR. Appropriate archaeological campaigns following a PAD report will be detailed in the Outline Marine WSI.
DECOMMISSIONING			
17.8	Draw-down of sediment into voids left by removed Wind Turbine Generators foundations leading to loss of sediment	Direct or indirect effects as a result of draw-down effects directly impacting or exposing marine archaeological and cultural heritage receptors to natural, chemical, or biological processes and causing or accelerating loss of the same and direct penetration and compression effects on marine archaeological and cultural heritage	Known marine archaeological and cultural heritage receptors will be further identified and detailed during the baseline assessment ahead of PEIR and avoided by establishing Archaeological Exclusion Zones (AEZs) or appropriate buffer areas at project design stage.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		receptors leading to a partial or total loss of the receptor.	Unknown marine archaeological and cultural heritage receptors will be identified during the archaeological assessment of geophysical and geotechnical data ahead of PEIR and avoided by establishing Archaeological Exclusion Zones (AEZs) or appropriate buffer areas at project design stage or further investigated where justified. An Outline Marine WSI document will be produced to accompany the PEIR to outline the Archaeological Exclusion Zones (AEZs) or appropriate buffer areas and detail responsibilities through all project stages. Any additional unknown or unexpected marine archaeological and cultural heritage receptors identified during any of the project stages will be reported utilising the project specific Protocol for Archaeological Discoveries (PAD) which will be produced ahead of PEIR. Appropriate archaeological campaigns following a PAD report will be detailed in the Outline Marine WSI.
17.9	Penetration and compression effects of jack-up barges and anchoring of construction vessels during decommissioning activities.	Direct or indirect effects as a result of exposing marine archaeological and cultural heritage receptors to natural, chemical, or biological processes and causing or accelerating loss of the same and direct penetration and compression effects on marine archaeological and cultural heritage receptors leading to a partial or total loss of the receptor.	

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

17.5.4 As part of the design process for VE a number of designed-in measures are proposed to reduce the potential for impacts on marine archaeological and cultural heritage receptors. The designed-in measures will evolve over the development process as the EIA progresses and in response to consultation.

17.5.5 VE OWFL is committed to implement the measures outlined below as well as various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts are scoped in as presented in Table 17.5.

17.5.6 Measures adopted as part of the project will include:

- An Outline Marine Written Scheme of Archaeological Investigation (WSI), followed by a final WSI produced post DCO (if granted) prior to construction, which will detail responsibilities through all project stages and include the implementation of a Protocol for Archaeological Discoveries (PAD);
- Archaeological Exclusion Zones (AEZs) and buffers following the classification of archaeological receptors as outlined in the Outline Marine WSI to protect any known and identified marine archaeological receptors and allow the re-routing and micro-siting of seabed structures and cables; and
- Commitment to undertake full archaeological reviews and assessment of all relevant geophysical and geotechnical data collected.

17.5.7 The mitigation methodology is to be agreed with the statutory advisors and a full scheme of archaeological mitigation will be implemented through the development and implementation of an Outline Marine WSI secured through the deemed Marine License (dML) in order for the statutory advisors to be confident that due consideration and appropriate mitigation has been given throughout the EIA process.

POTENTIAL CUMULATIVE IMPACTS

17.5.8 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For marine archaeology and cultural heritage, cumulative interactions may occur with other planned projects and developments in the study area. Potential cumulative impacts with other projects and activities will be considered for each of the impacts considered in Table 17.5.

17.5.9 In general, the impacts on known and identified marine archaeological and cultural heritage receptors is deemed to be localised. However, cumulative scour and changes to seabed sediment transport over the long term and the effects, both negative and positive, on marine archaeological and cultural heritage receptors will be assessed at PEIR. The assessment will consider the effects upon a single receptor assessed alongside other proposed and foreseeable projects and activities outlined in Table 17.5.

17.5.10 The COWRIE (2008) guidance which recommends establishing a geographical boundary for cumulative impact assessment on a case-by-case basis. Therefore 50 km has been used at scoping stage, however, it is likely that additional projects will be screened in/out during the PEIR stage based on spatial and/or temporal overlap.

17.5.11 The potential cumulative effects on marine archaeology will be assessed by taking offshore wind developments which may act cumulatively into account. For the purpose of this scoping report, all offshore wind developments or other relevant activities within a range of 50 km of the offshore AoS and array areas have been included.

17.5.12 Cumulative effects will be considered for marine archaeological and cultural heritage receptors, including paleoenvironmental features and deposits, maritime and aviation sites and materials. Cumulative impacts will include sediment disturbance alongside other offshore wind farms' export cables and seabed foundations, as well as the effects of jack-up barges and anchoring of construction, operation and maintenance vessels. Cumulative impacts may expose marine archaeological and cultural heritage receptors to natural, chemical or biological processes, causing or accelerating partial or total loss of the same.

17.5.13 The operational OWFs within 50 km of the offshore AoS and array areas to be considered include:

> London Array 1 Wind Farm and Export Cable Route;
> Thanet Wind Farm and Export Cable Route;
> Greater Gabbard and Export Cable Routes;
> Galloper and Export Cable Routes; and
> East Anglia One and Export Cable Route; and
> Borssele (Netherlands).

17.5.14 The projects listed above have followed standard industry practice in consultation with the relevant curators which sought to avoid impacts on all marine archaeological and cultural heritage receptors (sites, finds and deposits) during the construction, operations and maintenance and decommissioning phases. The potential cumulative impact assessment will therefore be based on the findings of the respective Environmental Statement (ES) chapters, where available.

17.5.15 The identified OWFs within 50 km of the offshore AoS and array areas currently in the planning and development stages include:

> North Falls and Export Cable Route;
> East Anglia One North, and Two Arrays and Export Cable Routes; and
> East Anglia Three Export Cable Route.

17.5.16 There is the potential for other activities occurring within the region surrounding the offshore AoS and array areas to create potential cumulative impacts on marine archaeological and cultural heritage receptors. The cumulative impacts of the proposed marine archaeology study area in relation to other activities will utilise the relevant ES documents, where available to ensure that significant impacts on marine archaeological and cultural heritage receptors will be mitigated effectively.

17.5.17 Other activities and infrastructure within 50 km of the offshore AoS and array areas include:

> Longsands Dredging Areas;
> Outer OTE Dredging Area;
> Thames D Dredging Areas;
> North Falls East Dredging Area;

- Shipwash Dredging Areas;
- North Inner Gabbard Dredging Areas;
- Southwold East Dredging Areas;
- Yarmouth Dredging Areas;
- South East Anglia Link cable (in planning);
- Grid Link (in planning);
- Nautilus Interconnector (in planning);
- Neuconnect interconnector (in planning);
- Atlantic Crossing 1 telecommunication cable (active):
- Circe North telecommunication cable (active);
- Concerto North telecommunication cable (active);
- Concerto telecommunication cable (active);
- Farland North telecommunication cable (active);
- Norsea Com 1 Seg 3 telecommunication cable (active);
- Norsea Com 1 Seg 3 telecommunication cable (active);
- Pan European Crossing telecommunication cable (active);
- Pangea South telecommunication cable (active);
- Tangerine telecommunication cable (active);
- Ulysses 2 telecommunication cable (active);
- Mercator telecommunication cable (proposed);
- Hermes North telecommunication cable (disused);
- Hermes South telecommunication cable (disused);
- Rembrandt 2 telecommunication cable (disused);
- Sea-Me-We3 telecommunication cable (disused);
- TAT 14 telecommunication cable (disused);
- Uk-Belgium 5 telecommunication cable (disused);
- UK-Netherlands 12 telecommunication cable (disused);
- Nemo Interconnector power cable; and
- Britned power cable.

POTENTIAL TRANSBOUNDARY IMPACTS

17.5.18 A description of how potential transboundary effects will be assessed is outlined in Chapter 4: Environmental Impact Assessment approach and methodology. As presented in Chapter 4, the limits of the Dutch, Belgian and French Exclusive Economic Zones are located approximately 16 km (south east), 25 km (south) and 18 km (north east) of the VE array areas respectively.

17.5.19 due to the localised nature of any potential impacts on known marine archaeological and cultural heritage receptors, transboundary impacts are unlikely to occur and therefore it is proposed that only projects with spatial and/or temporal overlap will be further considered within the EIA as further detailed in Chapter 4: Environmental Impact Assessment approach and methodology.

17.5.20 However, it should be noted that should wrecks or aircrafts of non-British nationality be impacted by VE further archaeological investigations may be warranted as will be outlined in the forthcoming Outline Marine WSI. Further discussions on protection non-British receptors should include the relevant organisation in the country of relevance. There is also a potential for paleochannels and palaeolandscapes within the North Sea to stretch beyond international boundaries. The impact on submerged landscapes in those cases is expected to be local within VE and will be mitigated and offset by archaeological assessments of available geophysical and geotechnical data.

17.6 SUMMARY OF NEXT STEPS

17.6.1 The next steps to be undertaken ahead of the PEIR chapter submission for the marine archaeology topic are summarised below:

- Consultation with statutory advisors: Regular engagement will be established in order to ensure that the assessment proceeds according to the regulators' requirements;
- Full Baseline Assessment: A full marine archaeological desk-based study will be undertaken ahead of the PEIR which will aim to determine the marine archaeological potential of the offshore AoS and array areas and the significance of marine archaeological and cultural heritage receptors, both known and as yet unknown;
- Baseline Historic Seascapes Assessment: A baseline assessment of the Historic Seascape will be undertaken prior to the submission of the PEIR. The Historic Seascape Characterisation (HSC) assessment will draw on the publication; Historic Seascape Characterisation: Historic Seascape Characterisation (*LUC*, 2017);
- Archaeological assessments of available marine geophysical and geotechnical survey data: The archaeological assessment will aim to identify marine archaeological and cultural heritage receptors (deposits and finds and sites) and will assign a rating of archaeological potential;
- Full impact assessment: The PEIR will include an assessment of significance of effects which will consider all aspects of the design scenario in order to determine the impact on all known and identified marine archaeological and cultural heritage receptors both known and potential. It will also detail the designed-in mitigation measures;
- Production of an Outline Marine WSI document: An Outline Marine WSI will be developed in order to detail all marine archaeology designed-in mitigation measures and will outline specific packages of work required in order to fulfil those commitments. The Outline Marine WSI will describe the roles and responsibilities of the Applicant, Statutory Advisers and archaeological contractors, and set out the requirements for further surveys and monitoring to deliver all mitigation requirements. The Outline WSI document will be appended to the PEIR documents; and

- Project-specific Protocol for Archaeological Discoveries: The PAD will ensure the awareness of all managers and contractors undertaking offshore work, prior to or during construction, and throughout operational and decommissioning phases, should material with archaeological potential be located. The PAD document will be appended to the PEIR documents.

17.7 FURTHER CONSIDERATIONS FOR CONSULTEES

- Do you agree that relevant sources of secondary data have been accessed for scoping or identified for use in the EIA?
- Is there any other baseline information that you feel should be considered?
- Based on the information received to date, do you agree that known marine archaeological and cultural heritage receptors within the marine archaeology study area will be appropriately identified?
- Have all potential impacts resulting from VE been identified for marine archaeological and cultural heritage receptors?

18. INFRASTRUCTURE AND OTHER MARINE USERS

18.1 INTRODUCTION

18.1.1 This chapter of the Scoping Report identifies the existing infrastructure and other marine users which are of relevance to the VE array areas and offshore AoS. It describes the potential impacts from the construction, operation and maintenance, and decommissioning of the offshore components of VE on offshore infrastructure and other marine users and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

18.1.2 There are a number of topics related to offshore infrastructure and other marine users which are covered in other chapters of this scoping report. These chapters are:

- Chapter 14: Commercial Fisheries;
- Chapter 13: Shipping and Navigation;
- Chapter 15: Military and Civil Aviation; and
- Chapter 27 :Socioeconomics and Tourism.

18.1.3 Other marine users considered in this chapter include:

- Offshore renewables;
- Oil and gas;
- Nuclear energy facilities;
- Carbon capture and storage (CCS);
- Cables and pipelines;
- Aggregate sites;
- Marine disposal sites;
- Military areas (note that military aviation is also covered in Chapter 16 Military and Civil Aviation); and
- Marine and coastal recreational activities and watersports[74].

18.2 STUDY AREA

18.2.1 For the purpose of this scoping assessment, the study area is the area within which VE may install offshore infrastructure (i.e. the offshore AoS and array areas) which may directly interact with third party infrastructure and other marine users. This area is coincident with the VE array areas and the offshore AoS (Figure 1.1). Activities in the wider Outer Thames Estuary area have also been reviewed to provide a regional context and for consideration of the potential for indirect impacts on infrastructure and other marine users.

18.3 BASELINE DATA

18.3.1 An initial desk-based review of the data sources was undertaken to identify other marine users and existing and proposed infrastructure that may potentially be directly and indirectly affected within the defined study area. The key data sources identified are provided in Table 18.1.

[74] Note: that recreational boating is also covered in Chapter 15 Shipping and Navigation

Table 18.1 - Data sources for infrastructure and other marine users

TOPIC	DATA SOURCES AND SUMMARY	COVERAGE OF VE
Offshore renewables	> The Crown Estate offshore wind leasing sites - Rounds 1-4 (July 2021).	This is a national dataset providing full coverage of the study area.
Oil and gas	> Oil and Gas Authority interactive map of all offshore oil and gas activity (surface and sub-surface) (January 2021).	This is a national dataset providing full coverage of the study area.
CCS and natural gas storage	> The Crown Estate (May 2021); and > The UKs Storage Appraisal Project strategic study of the potential for UK carbon dioxide (CO_2) storage.	This is a national dataset providing full coverage of the study area.
Offshore cables and pipelines	> Kingfisher Information Service – Cable Awareness (KIS-ORCA) displays used and abandoned cables and pipeline routes (May 2021).	This is a national dataset providing full coverage of the study area.
Disposal sites	> Cefas – GIS Shapefile of Disposal Sites (March 2021).	This is a national dataset providing full coverage of the study area.
Marine aggregate extraction	> The Crown Estate Aggregate Licence Area Charts (January 2021). > BMAPA dredger reports.	This is a national dataset providing full coverage of the study area.
MOD	> Ocean Wise marine themes – PEXA Charts (June 2021).	This is a national dataset providing full coverage of the study area.
Recreational activities	> SeaSearch (July 2019); and > Ocean Wise marine themes (June 2021).	This is a national dataset providing full coverage of the study area.
Marine Management Organisation - Marine Case Management System Public Register	> Public register of marine licence applications in the vicinity of the VE array areas and offshore AoS.	This is a national dataset providing full coverage of the study area.

18.3.2 As part of the EIA process, VE OWFL will undertake consultation with relevant developers, operators and marine users within the study area to ascertain any other planned developments and concerns relating to VE. In addition, it is envisaged that consultation with The Crown Estate as well as other licensing authorities will identify any other future developments within the study area.

18.4 BASELINE ENVIRONMENT

OFFSHORE RENEWABLES

18.4.1 A number of operational OWFs are located within the wider Outer Thames Estuary area (see Figure 18.1). There are no existing or proposed OWF arrays (other than VE's) within the study area. Figure 18.1 presents the spatial interactions between the North Falls OWF scoping boundary for the proposed cable corridor and the VE offshore AoS (see Chapter 1).

Table 18.2 - Operational OWF in the other marine users and infrastructure wider Outer Thames Estuary study area

OFFSHORE WIND FARM	OPERATOR	DISTANCE FROM VE ARRAY AREAS
Galloper	RWE	0
Greater Gabbard	SSE and RWE	3.3
London Array	London Array Ltd	35.3
Gunfleet Sands II	Ørsted	51.9
Gunfleet Sands I	Ørsted	54.5
Gunfleet Sands Demo	Ørsted	58.1

18.4.2 In the north of the wider Outer Thames Estuary, East Anglia One North and East Anglia Two Offshore Wind Farms have submitted DCO applications and are awaiting consent award. In addition, Greater Gabbard Extension known as North Falls OWF is also being progressed as part of the 2017 Crown Estate extensions round.

18.4.3 In addition, the export cables for the following OWFs (either proposed or operational) have been identified in the other marine users and infrastructure study area (Figure 18.1):

- Galloper OWF;
- Greater Gabbard OWF;
- North Falls[75] OWF;

18.4.4 In September 2019, TCE launched the Round 4 seabed bidding round. No bidding areas for the Round 4 OWFs are located in the other marine users and infrastructure study area.

WAVE AND TIDAL

18.4.5 There are no identified wave or tidal energy development sites existing or planned within the other marine users and infrastructure study area. Therefore, no further consideration to wave or tidal developments is proposed in the EIA.

OIL AND GAS INFRASTRUCTURE

18.4.6 There are no oil and gas installations or abandoned exploration wells within 100 km of the other marine users and infrastructure study area. New blocks awarded under the 32nd licensing rounds, are to the north of the study area off the Norfolk coast. There is no overlap with existing or provisional licences blocks, or other wells (live or abandoned). Given the lack of existing activity and the limited historical oil and gas activity in this area, it is assumed that that this part of the North Sea does not have high potential for exploration.

18.4.7 The closest active gas pipeline (PL1339 Bacton to Zeebruge) is located in the northeast of the other marine users and infrastructure study area (UK DEAL, 2019), shown in Figure 18.1. The offshore AoS does not cross any existing oil and gas pipelines and there are no assets within the VE array areas. Therefore, no further consideration to oil and gas developments is proposed in the EIA.

CARBON CAPTURE AND STORAGE (CCS)

18.4.8 As part of the UK's Storage Appraisal Project (UKSAP), a strategic study of the potential for UK CO_2 storage which examined the potential for storage in UK waters, five sites were identified including the depleted Viking gas fields and Bunter Closure fields in the Southern North Sea, a considerable distance (>45 km) from the other marine users and infrastructure study area. To date no development activities or applications for CCS projects have been submitted. Therefore, no further consideration of CCS projects is proposed in the EIA.

NUCLEAR

18.4.9 EDF's Sizewell nuclear facilities (Sizewell A, B and C) are located on the Suffolk coast approximately 36 km from VE at the closest point (Figure 18.1). Both Sizewell A (which is in the process of being decommissioned) and Sizewell B have cooling water outfall and intake infrastructure that extends into the marine environment. EDF Energy have submitted an application for Sizewell C power station located immediately to the north of the existing Sizewell B power station. Development comprises the delivery of a new nuclear power station and onsite associated facilities. Installation of offshore infrastructure for the development will require temporary safety zones to be applied surrounding working construction vessels. However, as these nuclear facilities are beyond the proposed location of offshore infrastructure associated with VE and no direct or indirect interaction with them is anticipated, no further consideration of nuclear projects is proposed in the EIA.

INTERCONNECTOR AND TELECOMMUNICATION CABLES

18.4.10 There are a number of interconnector and telecommunication cables within the other marine users and infrastructure study area and the wider Outer Thames Estuary area (Figure 18.1).

18.4.11 Those operational cables which have the potential for direct interaction with VE are listed below:

- Concerto 1S (crosses through the VE northern array area);
- Concerto 1N (crosses through the VE northern array area); and
- Farland (crosses through the VE northern array area).

18.4.12 Both Atlantic Crossing 1 (AC1) - Seg B1 and UK-Netherlands 12 (see Figure 18.1) are out of service telecommunications cables and are proposed to be scoped out as receptors from the EIA.

18.4.13 The Neuconnect interconnector is a proposed new interconnector cable linking the UK and Germany (Figure 18.1). The currently proposed route passes through the VE northern array area. VE OWFL has objected to this route through the Neuconnect's marine licence application process and is seeking a revised route which skirts the boundary of the VE northern array area to minimise conflict between the two projects.

18.4.14 At the time of writing, VE OWFL is aware that National Grid is working towards submitting an application for the South & East Anglia link (SEAlink) cable. The SEAlink geophysical survey area, available from the MMO's marine licensing public register , is presented in Figure 18.1 in the absence of any specific route options. Of note is that the Notices to Mariners[76] (August and September 2021) do not show a geophysical survey route to Holland Haven.

18.4.15 VE OWFL also note that the proposed Nautilus interconnector (National Grid, 2021) is in the early planning stages and is anticipated to make landfall between Sizewell and Thorpeness. The search area for the proposed route for the Nautilus interconnector encapsulates the VE array areas and approximately half of the offshore AoS (Figure 18.1).

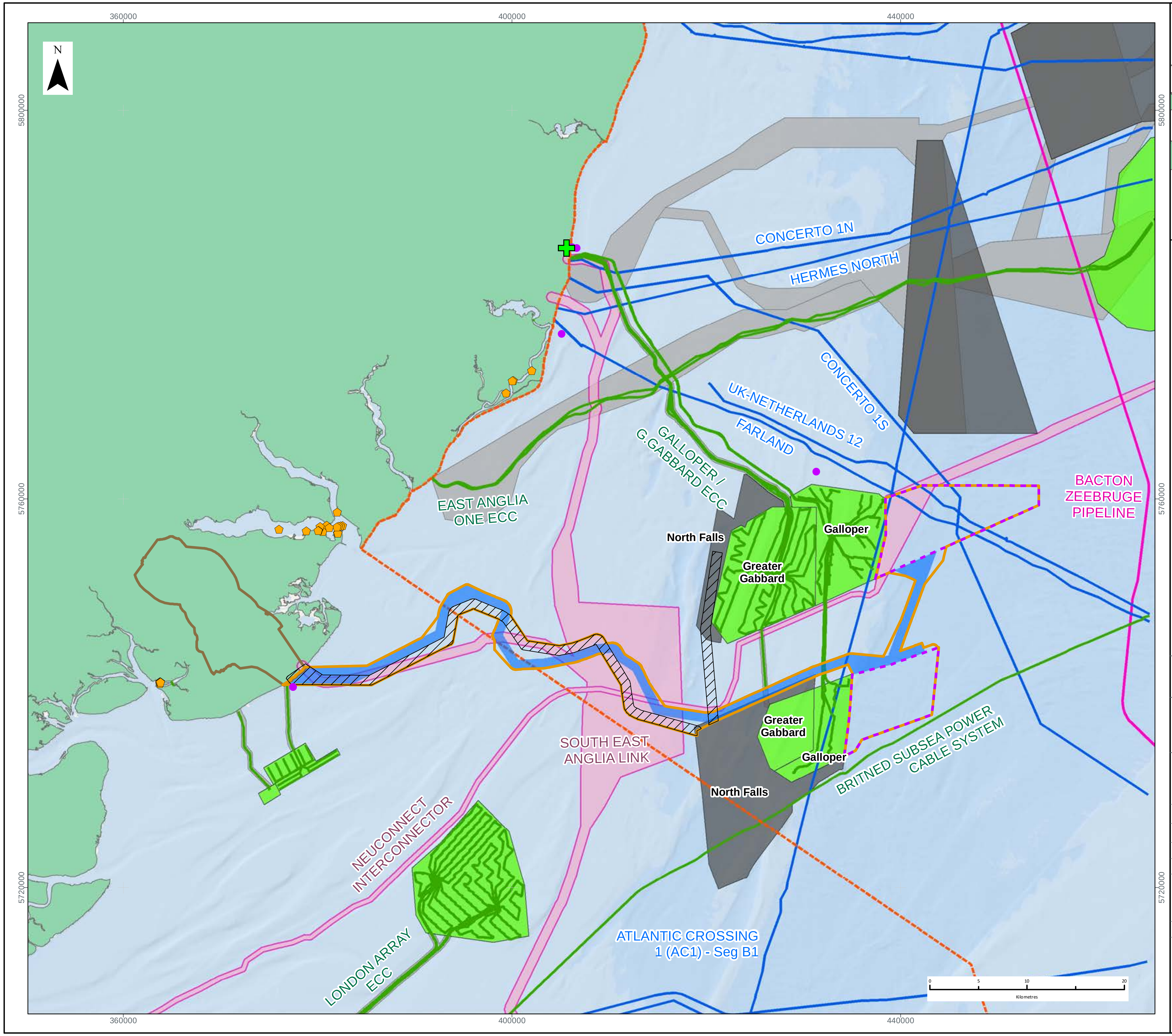
WASTE WATER ASSETS

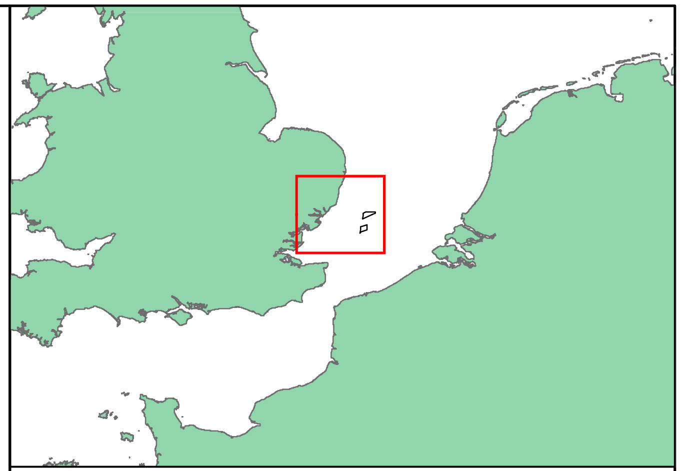
18.4.16 VE OWFL has undertaken a preliminary review of all waste water assets within the other marine users and infrastructure study area and will consult with the asset owners to understand where coastal assets are, how they are operated and any likely interactions with them. Of key relevance is the Clacton Waste Water Treatment works and its two outfalls which are located to the south of the landfall zone.

MARINE DISPOSAL

18.4.17 There are a number of marine disposal sites in the Outer Thames Estuary area (Figure 18.2). However, none directly interact with the other marine users and infrastructure study area. Therefore, no further consideration of marine disposal sites projects is proposed in the EIA. In addition, there are a number of closed or disused disposal areas (Figure 18.2). None directly interact with the VE array areas and offshore AoS and will therefore not be considered in the EIA.

[76] National Grid – South East Anglia Link Offshore and Nearshore Marine Surveys 2021 Rev06 - Issued: 20210906; National Grid – South East Anglia Link Offshore and Nearshore Marine Surveys 2021 Rev06 - Issued: 20210812





LEGEND

- Array Areas
- Onshore Cable Corridor Area of Search
- Preferred Offshore Export Cable Route
- Study area
- Sizewell Power Station (A B C)

Oceanwise MTF Data:

- Diffuser / Wastewater Asset
- Harbour Moorings
- North Falls Scoping export cable corridor
- Nautilus Interconnector Study Area
- Subsea Cables (Energy)
- Subsea Cables (Telecoms)
- Additional Subsea Cables Routes
- Pipelines

Offshore Wind Farm Status:

- Concept/Early Planning
- Consented
- In Planning
- Operational

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Infrastructure in the indirect impacts study area

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	SM	BPHB

DRAWING NUMBER:

18.1

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

FIVE ESTUARIES
OFFSHORE WIND FARM

Z:\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Other Users\VE_OU_Fig18_1_Energy_Infrastructure.mxd

AGGREGATES SITES

18.4.18 There are a number of aggregates areas in the Thames Estuary (Figure 18.2). The Thames Estuary Aggregates region, has seven production licences, operated by a number of companies. During 2017, 1.85 million tonnes of construction aggregate were dredged from a permitted licensed tonnage of 3 million. In addition, 0.55 million tonnes were dredged for reclamation fill. Licensed area 130.49 km^2 and total area available to dredge was 97.59 km^2.

18.4.19 Licensed aggregates areas that are located in the Outer Thames Estuary area (Figure 18.2) are listed below. :

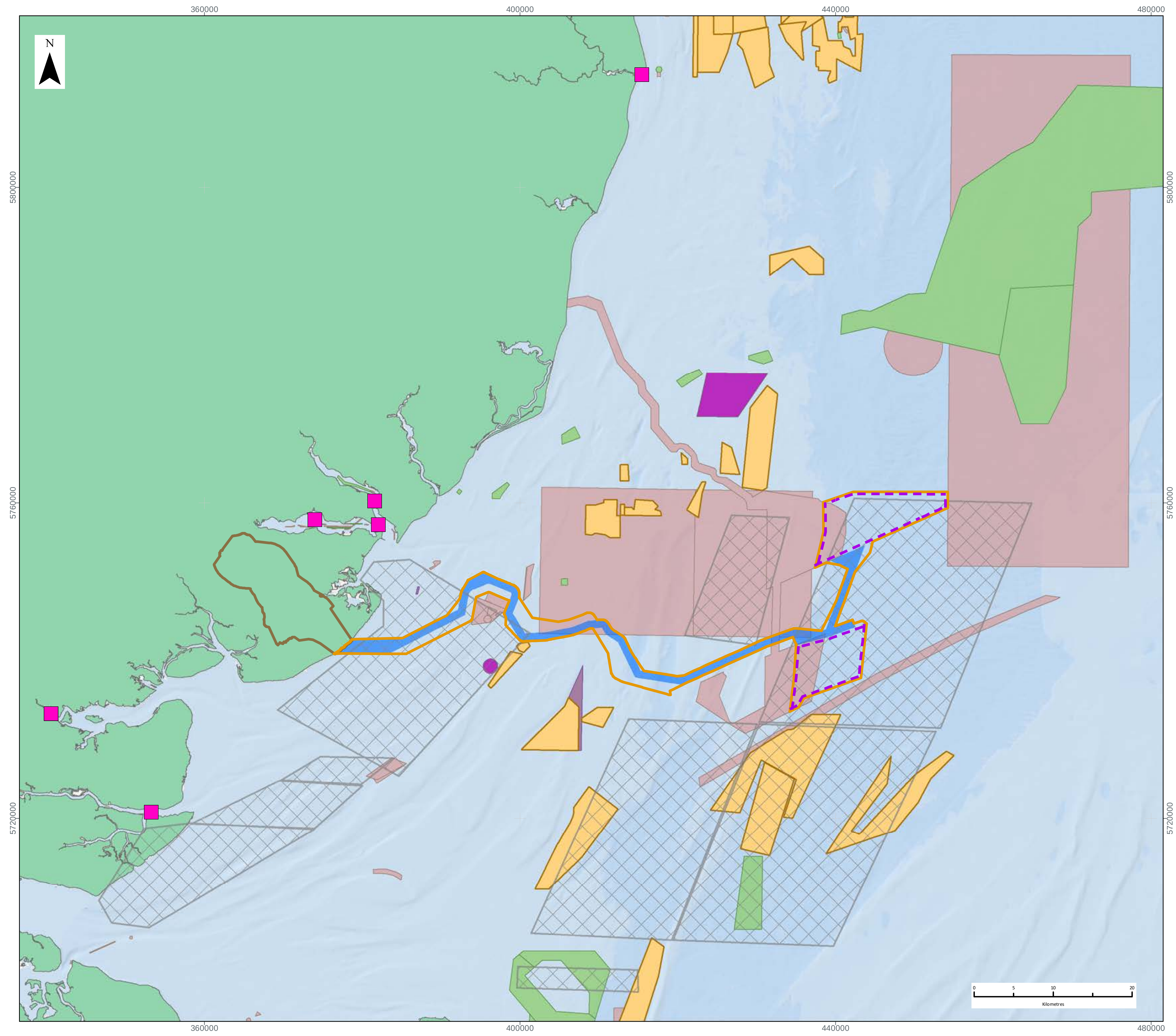
- 1802, operated by Aggregate Industries UK Ltd
- 498 and 508 operated by Britannia Aggregates Ltd;
- 510/2, 507/5, 507/6, 507/2, 507/4, 507/3, 507/1, 430, and 510/1 operated by CEMEX UK Marine Ltd;
- 524 operated by DEME Building Materials Ltd;
- 528/2, operated by Hanson Aggregates Marine Ltd;
- 509/3, 509/1, 509/2 and 430 operated by Tarmac Marine Ltd;
- 498 and 1809 operated by Volker Dredging Ltd; and
- 501 operated by Westminster Gravels Ltd.

18.4.20 None directly interact with the VE array and offshore AoS, VE OWFL have agreed in-principle with Tarmac Marine Ltd. that there are no issues despite the close proximity (adjacent to the offshore AoS) of their licenced aggregate areas to the offshore AoS.

MILITARY AREAS

18.4.21 The Thames Estuary has a long history of military conflict particularly during World War II, there is a small risk that during construction and operation, unexploded ordnance (UXO) may be encountered on the seabed, including items such as sunken sea mines, air delivered bombs and naval ammunition. Confirmed munitions have been encountered as part of construction of the Greater Gabbard and Galloper OWF, therefore it is considered that there is potential for UXO to be present in the VE study area. Two explosive dumping areas have also been identified in the vicinity of the VE offshore AoS. However, as they are not within the offshore AoS or VE array areas, no further consideration is proposed in the EIA.

18.4.22 There are a number of practice and exercise areas (PEXA) in the Outer Thames region, shown in Figure 18.2. All areas are used for practicing mine laying and sweeping and there are no areas designated as submarine exercise or live firing areas within the vicinity of the other marine users and infrastructure study area. VE OWFL have consulted with the MOD and no concerns with the offshore AoS crossing the PEXA were raised.



LEGEND

- Study area
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Cable Corridor Area of Search
- Aggregate Areas
- Military Practice Areas (PEXA)
- Dredging Locations

Disposal Sites

- Open
- Disused
- Closed
- Explosives Dumping Area

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Marine users in the indirect impacts study area

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	SM	BPHB

DRAWING NUMBER:

18.2

SCALE: 1:500,000	PLOT SIZE: A3	DATUM: WGS84	PROJECTION: UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

Z:\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Other Users\VE_OU_Fig18_2_Aggregates_and_Disposal.mxd

SAILING AND CRUISING

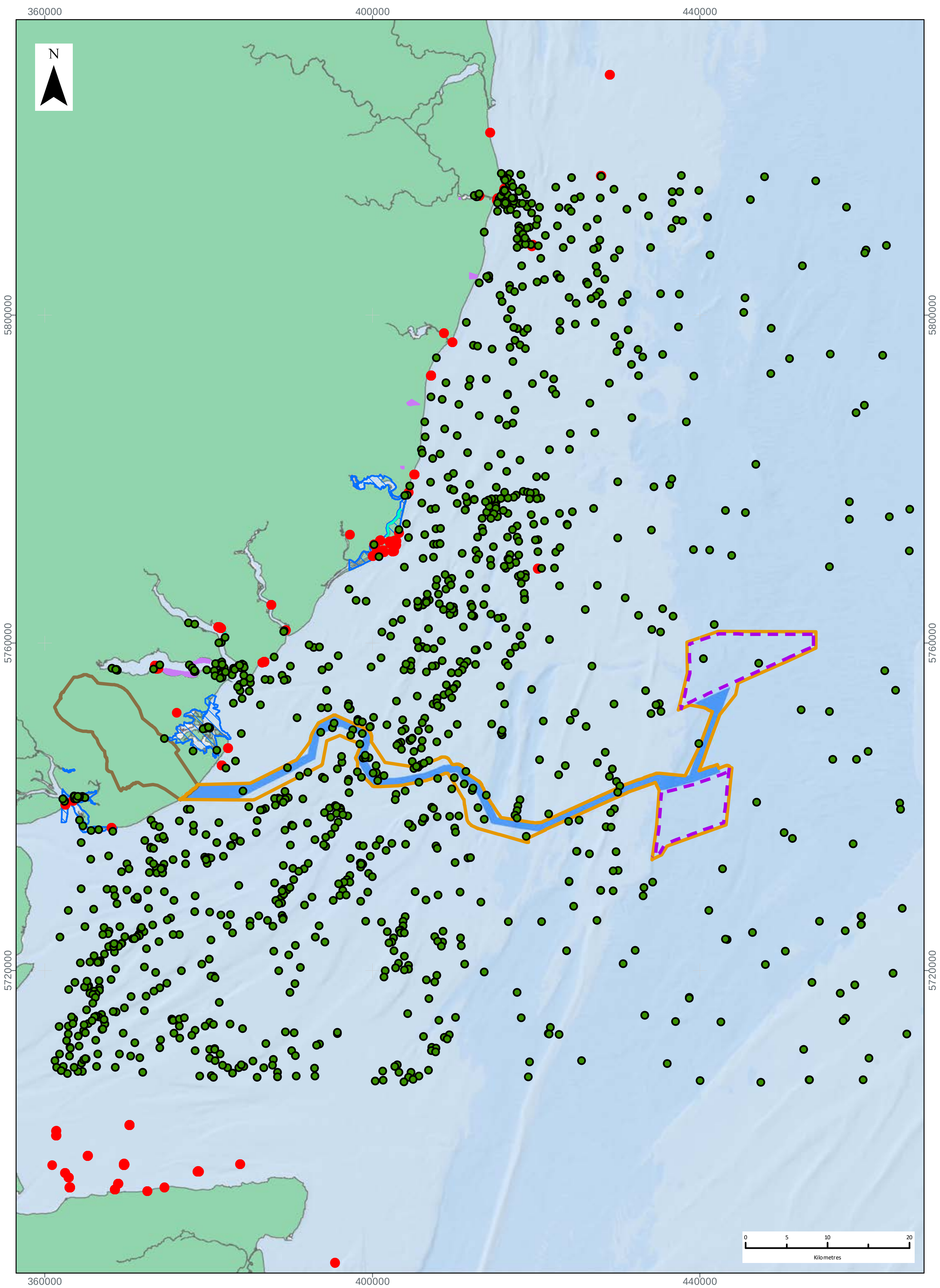
18.4.23 The RYA's Coastal Atlas (RYA, 2019) identifies medium-use recreational sailing routes within the vicinity of the Inner Gabbard and Galloper banks. Full characterisation of recreational vessels will be provided in Shipping and Navigation PEIR (and subsequent ES) chapter. Recreational vessels will be captured through consultation with recreational stakeholders as per guidance in the MCA's Marine Guidance Note (MGN) 654 to identify any recreational vessels not required to broadcast via AIS. Further details are provided in Chapter 14: Shipping and Navigation.

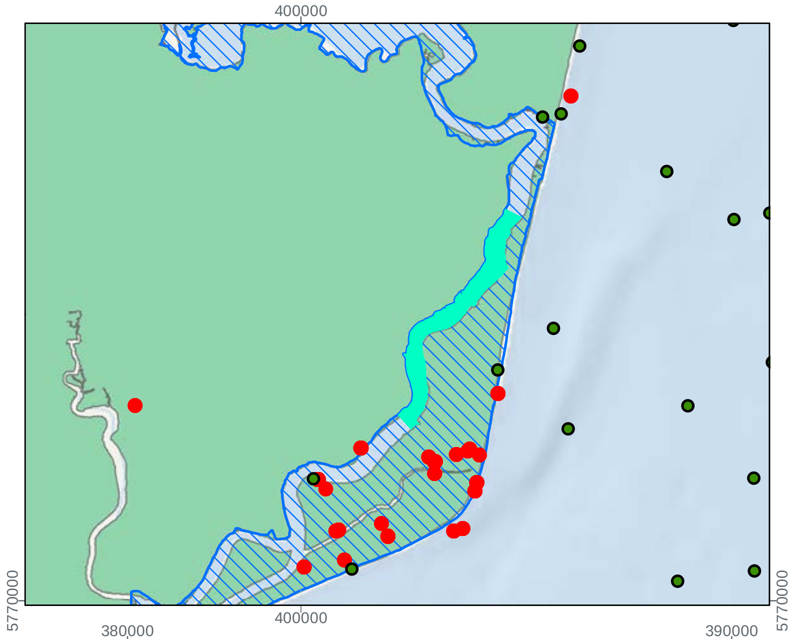
RECREATIONAL ACTIVITIES

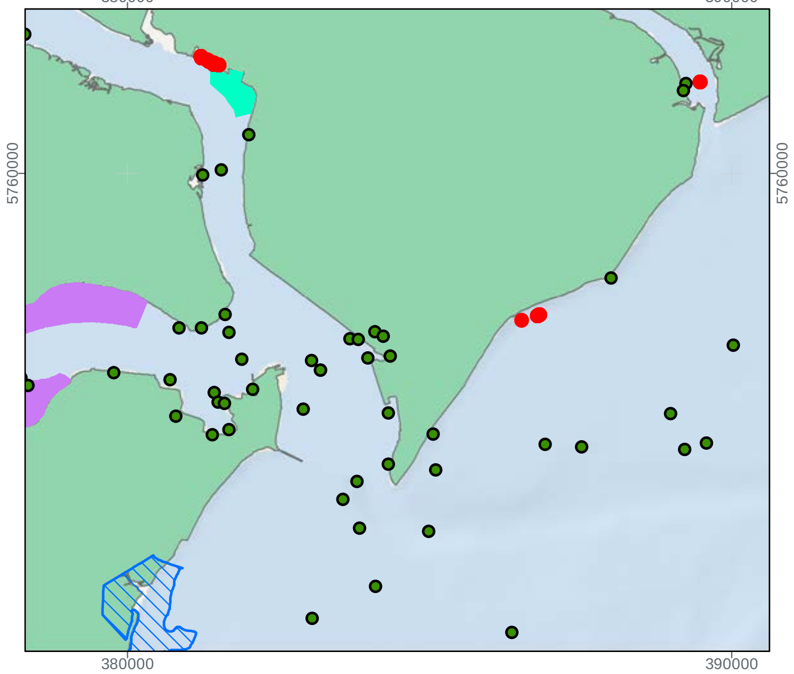
18.4.24 Recreation in the region tends to be highly seasonal with kayaking, water skiing, sailboarding, canoeing and personal watercraft occurring within the inshore waters, creeks and rivers that feed into the Outer Thames. The Inner Gabbard, Outer Gabbard and Galloper sandbanks are used by recreational anglers and charter boats with boats operating out of Brightlingsea and West Mersea. Cod, whiting, dabs and pout are caught throughout the year, peaking from October to April, with bass, smoothound, thornback ray and dogfish also targeted through to November and codling throughout autumn, winter and spring.

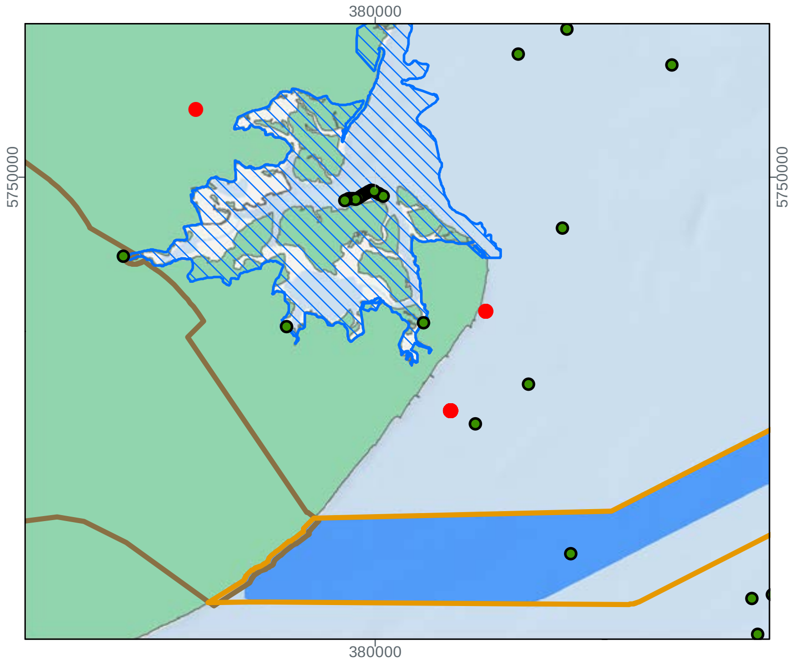
DIVING

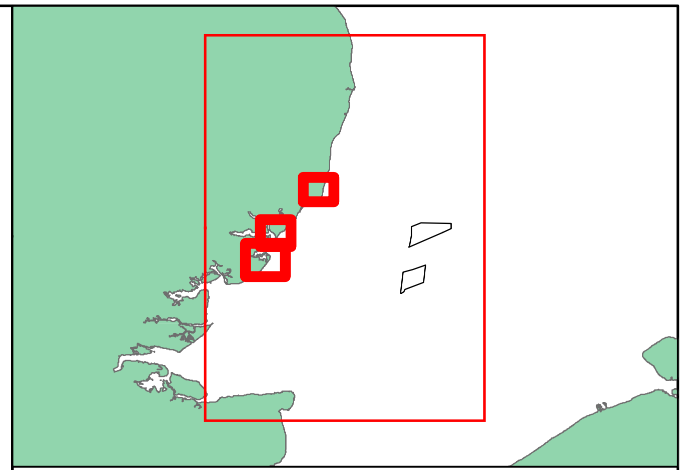
18.4.25 It is understood from anecdotal evidence that diving occurs within the offshore AoS. Diving within the offshore AoS and in the wider Outer Thames Estuary tend to be clustered closer inshore, associated with wrecks (Figure 18.3). Diving has not been identified in the VE array areas given the distance required to travel from the shore to the site, and that the sand banks provide limited interest to divers.











LEGEND

- Study Area
- Array Areas
- Preferred Offshore Export Cable Route
- Onshore Cable Corridor Area of Search
- Dive Sites (Seasearch)
- Bird Sanctuary
- Historic Wreck Area
- Nature Reserve
- Water Skiing Area
- Wrecks

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

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Marine recreational users in the indirect impacts study area

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	SM	BPHB

DRAWING NUMBER:

18.3

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:600,000	A3	WGS84	UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

Z:\GIS\GIS_Projects\0144 Five Estuaries\GIS\Figures\Scoping\Other Users\VE_OU_Fig18_3_Recreational_Activity.mxd

18.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

18.5.1 The assessment of infrastructure and other marine users will adopt the principles outlined in Chapter 4. As part of the assessment of other marine users and infrastructure within the EIA, a comprehensive desk study and consultation with operators and licensing bodies will establish the current status of known and planned infrastructure and other marine users within the array areas and offshore AoS. Existing and planned licences will be identified and a timeline for future activities associated with existing or planned infrastructure will be established.

POTENTIAL PROJECT IMPACTS

18.5.2 The potential impacts for infrastructure and other marine users across the VE study area are described in Table 18.3.

18.5.3 Construction (and to a lesser extent maintenance works) such as the installation of cables or wind turbine foundations have the potential to directly impact on infrastructure and other marine users within the VE array areas and offshore AoS.

18.5.4 Based on the datasets on existing and planned infrastructure and other marine users currently available and the project description, a number of impacts are proposed to be scoped out of the EIA for this topic (see Table 18.4). Impacts associated with vessels associated with VE will be assessed as part of the Navigation Risk Assessment (see Chapter 14).

18.5.5 On the basis of no known spatial overlap several development and infrastructure and the associated impacts are proposed to be scoped out. These impacts are described in Table 18.4, together with a justification for scoping them out.

Table 18.3 - Impacts proposed to be scoped into the assessment for infrastructure and other marine users

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
18.1	Increased vessel movements associated with the construction and installation of WTGs, platforms and export cables.	Increased vessel movements associated with the construction and installation of WTGs, platforms and export cables may impact on: > Aggregates; > Subsea cables; > Wastewater assets; > PEXA; > Recreational boating and sailing; > Water sports; and > Recreational fishing.	This assessment will be informed by the maximum number of return trips and types of vessels associated with the construction of VE. The sensitivity of each of the potential receptors will be considered for increased vessel activity. This assessment will also be informed by and draw on, the conclusions of the Shipping and Navigation PEIR (and ES) chapter and the NRA.
18.2	Activity or access displacement	Displacement of activities or access associated with construction activities, potentially affecting: > Aggregates; > Subsea cables; > Wastewater assets; > PEXA; > Recreational boating and sailing; > Water sports; and	This assessment will consider the presence of VE vessels engaged in active construction, such as foundation or platform installation, and the associated activity or displacement effects on each of the identified receptors.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		> Recreational fishing.	
18.3	Temporary increases in subsea noise	Temporary increases in subsea noise associated with the installation of WTG foundations by percussive piling may directly impact recreational users including divers and have indirect effects on recreational anglers resulting from potential effects on fish.	This assessment will be informed by project specific noise modelling of piling of foundations on fish (see Chapter 11 Fish and Shellfish Ecology). The modelling results will be presented in the context of recreational anglers and targeted species and on human divers.
18.4	Direct disturbance and damage to existing assets and infrastructure	Direct interaction with subsea cables and/ or wastewater assets which could result in direct damage or alteration in operation of the asset.	This assessment will consider the mitigation measures (see below) and will determine the sensitivity of receptors to the proposed activities with these measures in place.
OPERATION			
18.5	Increased vessel traffic	Increased vessel movements associated with operation and maintenance activities.	The same approach will be adopted as impact 18.1.
18.6	Activity or access displacement	Displacement of activities or access associated with operation and maintenance activities.	The same approach will be adopted as impact 18.2.
18.7	Physical presence of infrastructure	Physical presence of infrastructure could interfere with other marine users, including: > Aggregates; > Subsea cables; > Military operations within PEXAs;	This assessment will consider the mitigation measures (see below) and will determine the sensitivity of receptors to the physical presence of infrastructure.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		> Recreational boating and sailing; > Water sports; and > Recreational fishing.	
DECOMMISSIONING			
18.8	Increased vessel movements associated with the construction and installation of WTGs, platforms and export cables.	Increased vessel movements associated with the decommissioning of WTGs, platforms and export cables.	The same approach will be adopted as impact 18.1.
18.9	Activity or access displacement	Displacement of activities or access associated with decommissioning activities.	The same approach will be adopted as impact 18.2.
18.10	Direct disturbance and damage to existing assets and infrastructure	Direct interaction during decommissioning with assets could result in direct damage or alteration in operation of the asset.	The same approach will be adopted as impact 18.5.

Table 18.4 – Impacts proposed to be scoped out of assessment for infrastructure and other marine users

IMPACT NO	IMPACT	JUSTIFICATION FOR SCOPING OUT
CONSTRUCTION		
18.14	Effects on wind farm arrays	There is no spatial overlap with existing or proposed OWF arrays and so a pathway for a likely significant effect in EIA terms has not been identified.
18.15	Effects on CCS	There is no spatial overlap with existing or planned CCS sites overlap within or near the other marine users and infrastructure study area, and so a pathway for a likely significant effect in EIA terms has not been identified.
18.16	Effects on active, closed or disused disposal sites	There is no spatial overlap with active, closed or disused disposal sites and so a pathway for a likely significant effect in EIA terms has not been identified.
18.17	Effects on oil infrastructure	No existing or planned oil extraction sites or pipelines overlap within or near the other marine users and infrastructure study area and so a pathway for a likely significant effect in EIA terms has not been identified.
18.18	Effects on nuclear facilities	There is no spatial overlap with existing or proposed nuclear facilities and so a pathway for a likely significant effect in EIA terms has not been identified.
18.19	Effects on wave and tidal energy sites.	There is no spatial overlap with existing or proposed wave or tidal energy sites and so a pathway for a likely significant effect in EIA terms has not been identified.
18.20	Effects on UXO disposal sites	There is no spatial overlap with existing or proposed UXO disposal sites and so a pathway for a likely significant effect in EIA terms has not been identified.
18.21	Alterations in wave energy direction and periods from the presence of infrastructure could affect recreational users (for example. Surfers and kite surfers).	No measurable changes in wave energy at the coast is anticipated as a result of VE based on analogous local projects (including Galloper and Greater Gabbard OWFs).

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

18.5.6 As part of the design process for VE the following mitigation measures are proposed:

- Where possible avoidance of interaction with infrastructure and other marine user receptors is proposed through project design;
- Where potential interaction between VE and other infrastructure are identified, owners and operators will be consulted, and legal agreements, for example crossing agreements and protective provisions, will be put in place to mitigate against any effects;
- The required Notices to Mariners and Kingfisher Bulletin notices will also be published prior to, and updated during, any relevant construction, maintenance or decommissioning activities;
- In accordance with the Electricity (Offshore Generating Stations) (Safety Zones) (Applications Procedures and Control of Access) Regulations, 2007 (SI No 2007/1948), Safety Zones will be applied for around relevant construction activities;
- Following a risk assessment, if required, guard vessels may be used for relevant construction, maintenance and decommissioning activities;
- Notifications will be provided prior to relevant works to local marine user groups such as diving clubs, recreational angling clubs; and
- Notifications will be provided prior to relevant works to other marine users and infrastructure owners and operators.

18.5.7 VE OWFL are committed to implementing these measures, and also various standard sectoral practices and procedures including notifying relevant stakeholders and the design and implementation of cable plans and navigational safety and vessel management plans. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/out presented in Table 18.3 and Table 18.4.

POTENTIAL CUMULATIVE IMPACTS

18.5.8 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed. For infrastructure and other marine users, cumulative interactions may occur with other planned OWF as well as other activities in the study area. Potential cumulative impacts with other projects and activities are the same as those detailed in Table 18.3.

18.5.9 The main source of potential for cumulative effects is with the potential construction of Neuconnect, North Falls OWF, National Grid SEAlink and associated offshore infrastructure. The timelines and scope of these projects will require further consideration within the EIA.

18.5.10 Any potential cumulative impacts on the navigational safety and displacement of recreational users will be assessed within the Navigation Risk Assessment.

POTENTIAL TRANSBOUNDARY IMPACTS

18.5.11 A description of how potential transboundary effects will be assessed is outlined in Chapter 4: Environmental Impact Assessment approach and methodology. As presented in Chapter 4, the limits of the Dutch, Belgian and French Exclusive Economic Zones are located approximately 16 km (south east), 25 km (south) and 18 km (north east) of the VE array areas respectively.

18.5.12 Due to the localised nature of any potential impacts and mitigation options available, transboundary impacts are unlikely to occur on infrastructure or other marine users and therefore it is proposed that this impact will be scoped out from further consideration within the EIA.

18.6 SUMMARY OF NEXT STEPS

18.6.1 The proposed approach to the assessment for other marine users and infrastructure chapter is to undertake a desk study during the EIA as part of which consultation will be undertaken with relevant stakeholders. VE OWFL will undertake consultation with all relevant offshore developers, operators and marine users to ascertain any concerns relating to the project.

18.6.2 Consultation with developers and regulating authorities will also identify the status and timing of any proposed or foreseeable new infrastructure or activities (including Neuconnect, North Falls OWF and National Grid SEAlink), which will be taken forward for assessment where there is overlap with the OWF.

18.6.3 It is proposed that a standalone chapter will be provided within the PEIR/ ES for all tourism aspects (i.e. both offshore and onshore) to ensure that a comprehensive assessment is undertaken. It is anticipated that this chapter will be prepared based on literature review, desk-based research, consultation with relevant stakeholders within the array areas and export cable route. The standalone chapter will consider those impacts on tourism associated with recreational activities identified in this chapter (e.g. diving, angling, waterbased sports and sailing etc.) and tourism impacts identified in Chapter 28 of this Scoping Report.

18.7 FURTHER CONSIDERATIONS FOR CONSULTEES

- Do you agree that the data sources identified are sufficient to inform the offshore infrastructure and other marine users baseline for the VE PEIR and ES?
- Do you agree that all planned and proposed infrastructure in the study area have been identified?
- Have all potential impacts resulting from VE been identified for infrastructure and other marine users receptors?
- Do you agree that the impacts described in Table 18.4 can be scoped out?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of VE on fixed infrastructure and other marine users receptors?

19. TERRESTRIAL ECOLOGY AND NATURE CONSERVATION

19.1 INTRODUCTION

19.1.1 This section of the Scoping Report identifies the onshore ecology receptors of relevance to the onshore AoS. It describes the potential effects from the construction, operation and maintenance, and decommissioning of VE on onshore ecology and sets out the proposed scope for this topic of the EIA. The proposed methods for this topic of the EIA are also presented.

19.1.2 This chapter should be read alongside the following chapters of this Scoping Report:

- Chapter 9: Benthic and Intertidal Ecology;
- Chapter 12: Offshore Ornithology;
- Chapter 21: Airborne Noise and Vibration;
- Chapter 23: Air Quality; and
- Chapter 24: Hydrology and Flood Risk.

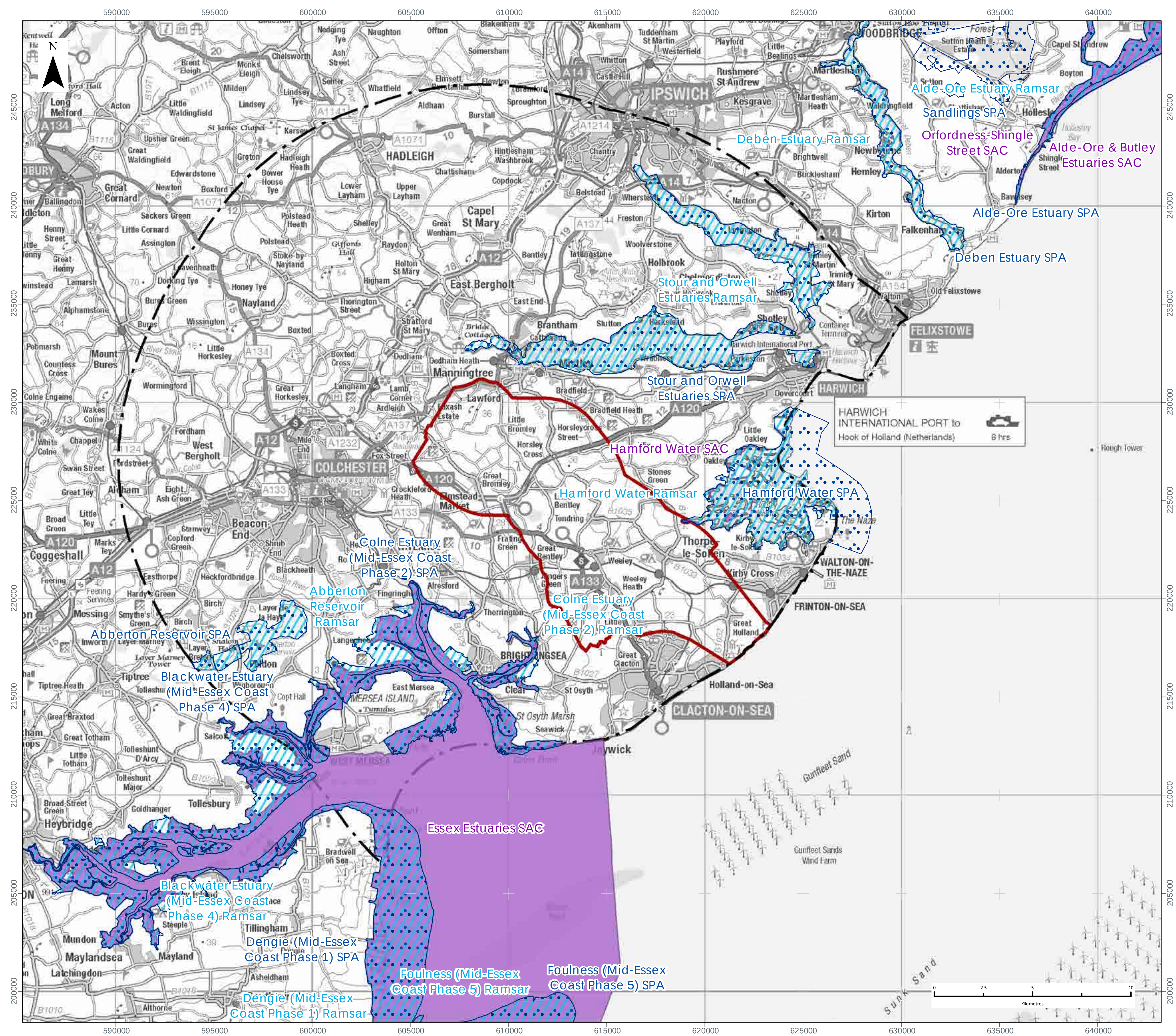
19.1.3 The VE Habitats Regulation Assessment (HRA) Screening report (VE OWFL, 2021) provides a Stage 1 screening assessment of VE on National Site Network and Ramsar sites.

19.2 STUDY AREA

19.2.1 The maximum study area for the scoping exercise comprises the full onshore AoS shown on Figure 19.1 plus the land and coastal areas up to 15 km distant from the outer edge of the onshore AoS (a 15 km ‘buffer’). Coastal means landward of Mean High-Water Springs (MHWS) for all onshore ecology features apart from waterbirds, for which intertidal areas have also been included within the study area. A 15km buffer is a precautionary and pragmatic starting point which exceeds Natural England’s Impact Risk Zones around the relevant designated sites. Whilst significant effects on designated sites beyond this distance are unlikely, setting this distance for the scoping exercise does not preclude considering designated sites and features beyond this distance in later stages of the assessment for example when routes for construction traffic are known, or if substantial impacts on migratory or highly mobile species are identified. The same principles apply to all the buffers applied to the various ecological receptors.

19.2.2 The maximum study area was divided concentrically in accordance with the sensitivity and mobility of different ecological features, as indicated in Table 19.1. Table 19.1 provides information on the sources of information obtained at scoping stage, whereas Table 19.2 indicates what will be obtained for later stages of the assessment.

19.2.3 Species records were obtained from one of the identified sources (Essex Field Club) based on an earlier configuration of the onshore AoS. This provided coverage for the majority of the current onshore AoS plus 2 km (and beyond in most directions) however species records have not yet been obtained for about 10% of the onshore AoS and the associated 2 km buffer. This incorporates an area to the northwest of the AoS, near Ardleigh. The large volume and wide geographical spread of the data obtained to date has been sufficient to inform the approach and scope of the ecological surveys, noting that there will always be gaps in existing biological records due to the way it is collected. The project specific surveys will provide more comprehensive information upon which to base the impact assessment.



LEGEND

- Onshore Area of Search
- Onshore Area of Search 15 km Buffer
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Ramsar

Data Source:
© Crown copyright [and database rights] (2021) 0100031673 OS OpenData.
© Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right 2021.

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE: Internationally Designated Sites within 15km

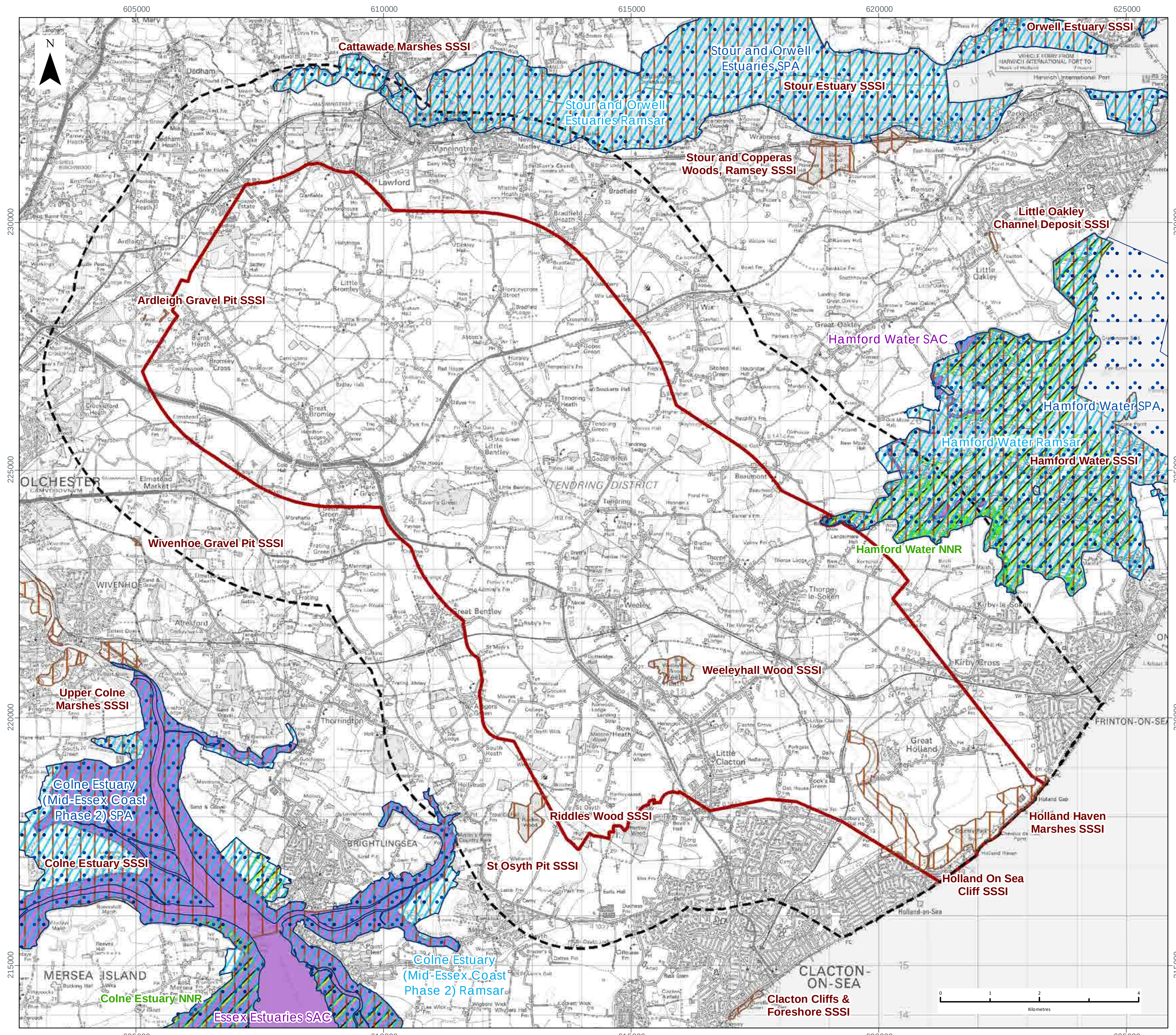
VER	DATE	REMARKS	Drawn	Checked
1	17/09/2021	For Issue	JRS	SF

DRAWING NUMBER: 19.1

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:200,000	A3	ODN	British National Grid

FIVE ESTUARIES OFFSHORE WIND FARM

\\gisfs1\G\Projects\05356 - GoBe Consultants Ltd\00010 Five Estuaries\Tech\GIS\Dwgs\Wking\2021 07 Scoping\Ecology\05356.00010.0009.1 Internationally Designated Sites.mxd



LEGEND

- Onshore Area of Search
- Onshore Area of Search 2 km Buffer
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Ramsar
- Site of Special Scientific Interest (SSSI)
- National Nature Reserve (NNR)

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Internationally and Nationally Designated Sites within 2km

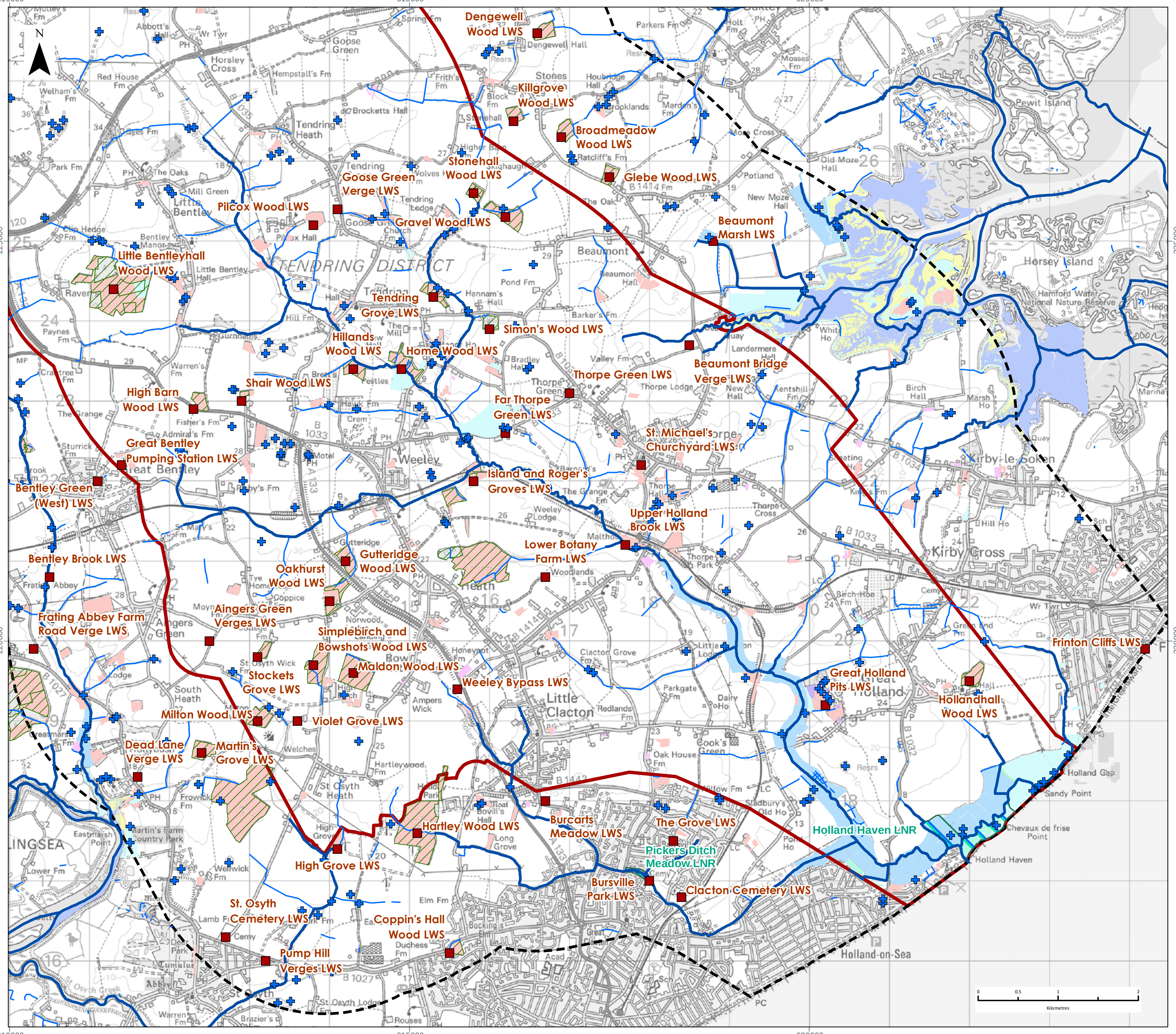
VER	DATE	REMARKS	Drawn	Checked
1	17/09/2021	For Issue	JRS	SF

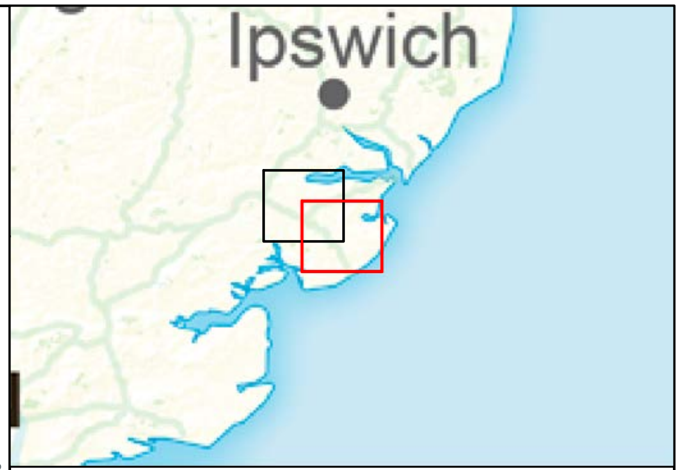
DRAWING NUMBER:

19.2

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:80,000	A3	ODN	British National Grid

FIVE ESTUARIES
OFFSHORE WIND FARM





LEGEND

- Onshore Area of Search
- Onshore Area of Search 2 km Buffer
- Local Wildlife Site Centroid (LWS)
- Waterbody Centroid
- Main River
- Minor Watercourse
- Local Nature Reserve (LNR)
- RSPB Reserve
- Ancient Woodland

Priority Habitats Inventory

- Coastal and Floodplain Grazing Marsh
- Coastal Saltmarsh
- Deciduous Woodland
- Good Quality Semi-improved Grassland
- Lowland Fens
- Lowland Heathland
- Mudflats
- No Main Habitat but Additional Habitats Present
- Reedbeds
- Traditional Orchard

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Local Designations and Ecological Features

VER	DATE	REMARKS	Drawn	Checked
1	17/09/2021	For Issue	JRS	SF

DRAWING NUMBER:

19.3

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:50,000	A3	ODN	British National Grid

FIVE ESTUARIES OFFSHORE WIND FARM

\\gisfs1\G\Projects\05356 - GoBe Consultants Ltd\00010 Five Estuaries\Tech\GIS\Dwgs\Wkings\2021 07 Scoping\Ecology\05356.00010.0018.1 Locally Designated Sites.mxd

Table 19.1 - Study Area for Onshore Ecology receptors for the Scoping Report

ECOLOGICAL RECEPTOR	STUDY AREAS (BUFFER)
European and Ramsar sites.	onshore AoS + 15 km, see Figure 20.1.
SSSIs (which are not also European and Ramsar sites).	onshore AoS + 2 km, see Figure 20.2.
Local Sites.	onshore AoS + 2 km, see Figure 20.3.
Ancient Woodlands and Priority Habitats (which are not included in the designated sites).	onshore AoS + 2 km, see Figures 20.2 and 20.3.
Protected, priority and invasive species.	onshore AoS + 2 km (minimum) for which data was obtained for c.90% of the onshore AoS +2 km.

Onshore AoS in this table means the onshore AoS shown on Figure 19.1.

19.2.4 If necessary, based on the configuration of the onshore AoS at the next stage of the assessment, species data for the remaining 10% of the current onshore AoS and its associated buffer will be obtained. For bats, the buffer will be expanded to 5 km of the onshore AoS, either that shown on Figure 19.1 to Figure 19.3 or a refined onshore AoS.

19.2.5 The study area will be further reviewed and amended for future stages (PEIR and subsequently ES) in response to, for example, more information on functional links between the onshore AoS (or a refined onshore AoS) and other sites, refinement of the onshore/ offshore AoS, feedback from consultees, and/ or the identification of additional constraints (environmental and/ or engineering). It is expected that there will be a significant reduction in the size of the onshore AoS and therefore the study area, as it is refined to more closely follow the preferred onshore cable route corridor and preferred substation location once these have been selected.

19.2.6 Information derived from noise, air quality and hydrology assessments may also influence the extent of the study area as a whole and for the various ecological receptors. For example, hydrological links between the working areas and nationally designated sites greater than 2 km distant may necessitate consideration of such designated sites. Similarly, the presence of highly mobile species within potential working areas may necessitate consideration of species populations and designated sites beyond the distances indicated in Table 19.1.

19.3 BASELINE DATA

19.3.1 An initial desk-based study has been undertaken to identify sources of existing ecological data and to collect some of that data to inform this Scoping Report.

19.3.2 The initial desk-based study included internationally important sites (Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar Sites); nationally important sites (Sites of Special Scientific Interest (SSSIs) and National Nature Reserves (NNRs)) and locally important sites (Local Nature Reserves (LNRs) and Local Wildlife Sites (LWSs)); and protected and notable species records.

19.3.3 The initial desk-based study comprised a review of standard online sources and an initial biological records centre search. Table 19.2 lists these data sources that have been used to inform this scoping report (giving the date that data were obtained where applicable), and data that will be obtained to inform the EIA, and their spatial coverage (where known). In Table 19.2, the onshore AoS means either that shown on Figure 19.1 to Figure 19.3 included in this scoping report or, more likely, a refined onshore AoS based around the preferred onshore VE infrastructure. Data gathered for the North Falls OWF will also be reviewed, where available.

Table 19.2 - Key sources of existing information for Onshore Ecology

SOURCE (DATE OBTAINED)	SUMMARY	SPATIAL COVERAGE
Joint Nature Conservation Committee (JNCC) jncc.gov.uk website (21 July 2021)	SAC and SPA details including qualifying interest features, conservation objectives, standard data forms.	Onshore AoS plus 15 km buffer.
Multi-agency Geographic Information Centre (MAGIC) website and Natural England's Designated Sites Viewer Magic.gov.uk/ designatedsites.naturalengland.org.uk/ (21 July 2021).	SACs and possible SACs and Impact Risk Zones, spatial extent and citation.	Onshore AoS plus 15 km buffer.
	SPAs and potential SPAs and Impact Risk Zones, spatial extent and citation.	Onshore AoS plus 15 km buffer.
	Ramsar Sites and proposed Ramsar Sites, spatial extent and citation.	Onshore AoS plus 15 km buffer.
	SSSIs and National Nature Reserves (NNR) and Impact Risk Zones, spatial extent and citation.	Onshore AoS plus 2 km buffer.
	Local Nature Reserves (LNR), spatial extent.	Onshore AoS plus 2 km buffer.
	Ancient Woodland Inventory, spatial extent.	Onshore AoS plus 2 km buffer.
	Priority Habitat Inventory for grasslands, heathlands, wetland, woodland and other habitats, type and spatial extent.	Onshore AoS plus 2 km buffer.
	Great Crested Newt Pond Surveys 2017 – 2019,	Onshore AoS plus 2 km buffer.

SOURCE (DATE OBTAINED)	SUMMARY	SPATIAL COVERAGE
	location of GCN breeding ponds. Great Crested Newt Survey Licence Returns, location of GCN breeding ponds.	
	Granted European Protected Species Licences, location and species.	Onshore AoS plus 2 km buffer.
Essex Field Club (EFC) (20 April 2021).	Protected and Notable Species records, location and date.	c.90% of the onshore AoS + 2 km (minimum) obtained to date however data search will be expanded to full onshore AoS + 2 km for species other than bats and onshore AoS + 5 km for bats, to inform the EIA.
Essex Wildlife Trust (EWT) Biological Records Centre.	Protected and Notable Species Records location and date, and Local Wildlife Sites, location and citation.	None obtained from this source to date, however data will be obtained for full onshore AoS + 2 km for species other than bats and onshore AoS + 5 km for bats, to inform the EIA.
	Living landscapes in Essex (areas for which Essex Wildlife Trust are promoting enhancements for nature conservation).	None obtained from this source to date, however data will be obtained for full onshore AoS + 2 km.
Tendring Council Local Plan Proposals Map (21 July 2021) and associated documentation.	Local Wildlife Sites, location.	onshore AoS + 2 km buffer.
Wetland Bird Survey Data held by the British Trust for Ornithology (TBC).	Wetland and coastal bird data from specific count areas, species and counts.	None obtained from this source to date, however data are available for wetland SSSI, SPA and Ramsar sites within/ near the onshore AoS, plus Ardleigh Reservoir. Data from count sectors within and adjacent to the onshore AoS will be

SOURCE (DATE OBTAINED)	SUMMARY	SPATIAL COVERAGE
		obtained, including Holland Marshes SSSI
North East Essex Badger Group (NEEBG)	Badger Records not otherwise held by EFC or EWT Biological Records Centre.	None obtained from this source to date, however data will be obtained for the onshore AoS + 2 km buffer.
The Essex Birdwatching Society	Recent Essex Bird Reports and other recent sightings data	A brief review of recent records for Ardleigh Reservoir (https://www.ebws.org.uk/index.php/sites/latest-sightings/20010) has been undertaken for the scoping exercise, with further data obtained for sites up to 15 km distant from the onshore AoS as required.
Essex County Council	Details for Special Road Verges	None obtained from this source to date, however data will be obtained for the onshore AoS + 2 km buffer.

Note: Onshore AoS in this table means either the onshore AoS shown on Figure 19.1 to Figure 19.3 of this scoping report or a refined onshore AoS if this is available at the next stage of the assessment.

19.4 BASELINE ENVIRONMENT

DESIGNATED SITES

19.4.1 There are no sites of international importance within the current onshore AoS, however, Hamford Water SAC, SPA and Ramsar is immediately adjacent. The Stour and Orwell Estuaries SPA and Ramsar and the Colne Estuary SPA and Ramsar are also less than 2 km from the onshore AoS, see Figure 19.1. Excluding geological sites, there are three nationally important SSSIs within the onshore AoS, see Figure 19.2. There are also 37 locally important sites, one Local Nature Reserve and 36 Local Wildlife Sites (LWS), which are mostly woodlands, see Figure 19.3. Details of statutory and non-statutory designations are listed in Table 19.3 and Table 19.4 respectively. Descriptions of LWSs are available but have been omitted from Table 19.4 for brevity; relevant LWS descriptions will be presented in full in the PEIR and ES.

19.4.2 A separate HRA Screening report is being produced which will cover in more detail matters associated with European and Ramsar sites.

Table 19.3 – Statutory sites designated with relevance to Onshore Ecology

SITE	CLOSEST DISTANCE TO AOS (KM)	FEATURE OR DESCRIPTION
INTERNATIONAL (WITHIN 15 KM OF ONSHORE AOS)		
Hamford Water SSSI NNR SAC SPA and Ramsar	0	Hamford Water is of international importance for breeding little tern *Sternula albifrons* and wintering dark-bellied brent geese *Branta bernicla,* wildfowl and waders, and of national importance for many other bird species. It also supports communities and species of coastal plants which are rare or extremely local in Britain, including Hog's Fennel *Peucedanum officinale* which elsewhere is found only in Kent. It is also one of only two localities for Fisher's estuarine moth *Gortyna borelii lunata*.
Stour and Orwell Estuaries SSSI SPA and Ramsar	1.42	The Stour Estuary is nationally important for 13 species of wintering waterfowl and three species on autumn passage. The estuary is also of national importance for coastal saltmarsh, sheltered muddy shores, two scarce marine invertebrates and a scarce vascular plant assemblage. The component SSSIs are the Stour Estuary SSSI, Orwell Estuary SSSI and Cattawade Marshes SSSI. The Stour Estuary includes an RSPB reserve.
Colne Estuary (Mid-Essex Coast Phase 2) SSSI SPA and Ramsar, and part of Essex Estuaries SAC	1.64	The Colne Estuary is of international importance for wintering dark-bellied brent geese and black-tailed godwit *Limosa limosa* and of national importance for breeding little tern and five other species of wintering waders and wildfowl. The variety of habitats, which include mudflat, saltmarsh, grazing marsh, sand and shingle spits, disused gravel pits and reed beds, support outstanding assemblages of invertebrates and plants.
Essex Estuaries SAC	1.64	Essex Estuaries contains a very wide range of marine and estuarine sediment communities, including extensive saltmarsh, and intertidal mudflats and sandflats, The component SSSIs are the Blackwater Estuary SSSI, Colne Estuary SSSI, Crouch and Roach Estuaries SSSI, Dengie SSSI and Foulness SSSI. Those within 15 km of the onshore AoS are described elsewhere in this table.

SITE	CLOSEST DISTANCE TO AOS (KM)	FEATURE OR DESCRIPTION
Abberton Reservoir SSSI SPA Ramsar	8.93	Abberton Reservoir is the largest freshwater body in Essex, with a water area of about 500 ha. About thirty thousand birds visit the reservoir annually including internationally important numbers of Wigeon *Anas penelope* and nationally important numbers of 12 other species. It is therefore one of the most important reservoirs in Britain for wildfowl.
Blackwater Estuary (Mid-Essex Coast Phase 4) SSSI NNR SPA Ramsar, and part of Essex Estuaries SAC	11.2	The Blackwater Estuary is one of the largest estuarine complexes in East Anglia. It supports internationally important numbers of overwintering of dark-bellied brent geese, ringed plover *Charadrius dubius* and dunlin *Calidris alpina*, and nationally important numbers of nine other species overwintering waterbirds. The surrounding terrestrial habitats are also of high conservation interest, supporting an outstanding assemblage of nationally scarce plants and a nationally important assemblage of rare invertebrates. It lies in between the Colne Estuary and the Dengie.
Dengie (Mid-Essex Coast Phase 1) SSSI NNR SPA Ramsar, and part of Essex Estuaries SAC	12.5	Dengie supports internationally important wintering populations of dark-bellied brent geese and grey plover *Pluvialis squatarola* and nationally important wintering populations of other wildfowl and waders including knot *Calidris canutus*, dunlin and turnstone *Arenaria interpres*. In summer, it supports a range of breeding coastal birds, including bearded tit *Panurus biarmicus*. It is a large area of intertidal mudflat and saltmarsh, with the latter being the largest continuous example of its type in Essex. The foreshore, saltmarsh and beaches support an outstanding assemblage of rare coastal flora.
NATIONAL (WITHIN 2 KM OF ONSHORE AOS)		
Holland Haven Marshes SSSI	Inside onshore AoS	The ditch network at Holland Haven Marshes represents an outstanding example of a freshwater to brackish water transition intimated by the aquatic plant communities, which include several nationally and locally scarce species. The adjoining grasslands are of botanical importance as well as acting as a buffer zone to

SITE	CLOSEST DISTANCE TO AOS (KM)	FEATURE OR DESCRIPTION
		the ditch system. Further interest is provided by the aquatic and terrestrial invertebrates and the birds which frequent the area, especially in winter. Includes Holland Haven LNR.
Riddles Wood SSSI	Partly inside onshore AoS	Riddles Wood contains some of the best examples in Essex of chestnut *Castanea sativa* coppice, derived from ancient pedunculate oak *Quercus robur* -hazel *Corylus avellana* and pedunculate oak -hornbeam *Carpinus betulus* woodland. The soils are varied, being derived from glacial sands and gravels in the west and London Clay in the east. This results in a diversity of woodland types and a rich and varied ground flora, including several uncommon Essex species.
Weeleyhall Wood SSSI	Inside onshore AoS	Weeleyhall Wood is one of the largest ancient woods in the Tendring peninsula. It contains one of the best examples in Essex of base-poor spring line alder *Alnus glutinosa* woodland, a type of woodland which is rare in the county, as well as good examples of lowland hazel-pedunculate oak and some wet ash *Fraxinus excelsior* -maple *Acer campestre* woodland, and chestnut coppice-with-standards.
Ardleigh Gravel Pit SSSI	0.10	Geological site, see Chapter 25: Geology and Ground Conditions.
Holland-on-Sea Cliff SSSI	0.05	Geological site, see Chapter 25: Geology and Ground Conditions.
St. Osyth Pit SSSI	1.75	Geological site, see Chapter 25: Geology and Ground Conditions.
LOCAL NATURE RESERVES (WITHIN 2 KM)		
Pickers Ditch Meadow LNR	1.16	The Pickers Ditch Meadow reserve represents a valuable green space in the Great Clacton area.

Note: To avoid duplication, sites are listed based on the highest level of designation, where a site has multiple designations. Where multiple designations apply to a single site, the boundaries of the designations may vary, sometimes substantially, but all internationally important designations will also be designated as an SSSI.

Table 19.4 - Non-statutory sites designated with relevance to Onshore Ecology

SITE	CLOSEST DISTANCE TO AOS (KM)
Te20 Money Wood	Inside onshore AoS
Te27 Mill Wood	Inside onshore AoS
Te33 Manning Grove	Inside onshore AoS
Te37 Great Bromley Churchyard	Inside onshore AoS
Te40 Wignall Street Grassland	Inside onshore AoS
Te44 Little Bromley Churchyard	Inside onshore AoS
Te53 Little Bentleyhall Wood	Inside onshore AoS
Te55 Great Bentley Pumping Station	Inside onshore AoS
Te59 High Barn Wood	Inside onshore AoS
Te62 Aingers Green Verges	Inside onshore AoS
Te64 Shair Wood	Inside onshore AoS
Te65 Milton Wood	Inside onshore AoS
Te66 Stockets Grove	Inside onshore AoS
Te68 Violet Grove	Inside onshore AoS
Te69 Simplebirch and Bowshots Wood	Inside onshore AoS
Te70 Pilcox Wood	Inside onshore AoS
Te72 Oakhurst Wood	Inside onshore AoS
Te74 Goose Green Verge	Inside onshore AoS
Te75 Gutteridge Wood	Inside onshore AoS
Te76 Maldon Wood	Inside onshore AoS
Te77 Hillands Wood	Inside onshore AoS
Te79 Home Wood	Inside onshore AoS
Te81 Tendring Grove	Inside onshore AoS
Te83 Weeley Bypass	Inside onshore AoS
Te84 Island and Roger’s Groves	Inside onshore AoS
Te85 Stonehall Wood	Inside onshore AoS
Te86 Simon's Wood	Inside onshore AoS
Te87 Far Thorpe Green	Inside onshore AoS
Te88 Gravel Wood	Inside onshore AoS
Te93 Lower Botany Farm	Inside onshore AoS
Te95 Thorpe Green	Inside onshore AoS

SITE	CLOSEST DISTANCE TO AOS (KM)
Te98 Upper Holland Brook	Inside onshore AoS
Te99 St. Michael's Churchyard	Inside onshore AoS
Te106 Beaumont Bridge Verge	Inside onshore AoS
Te109 Great Holland Pits	Inside onshore AoS
Te114 Hollandhall Wood	Inside onshore AoS
Te73 High Grove	0.1
Te92 Burcarts Meadow	0.1
Te80 Hartley Wood	0.2
Te125 Bentley Green (West)	0.3
Te42 Lawford Churchyard	0.35
Te45 Wignall Brook Grasslands	0.35
Te89 Killgrove Wood	0.37
Te97 Glebe Wood	0.37
Te25 Shir Burn Wood and Meadow	0.4
Te10 Springhead Corner Meadow	0.45
Te94 Broadmeadow Wood	0.53
Te9 Manor House Meadow	0.6
Te61 Martin's Grove	0.6
Te108 Beaumont Marsh	0.71
Te103 The Grove	0.75
Te58 Furze Hills Complex	0.9
Te91 Dengewell Wood	1.1
Te34 Judas Gap Marsh	1.3
Te100 Bursville Park	1.3
Te6 Wall's Wood	1.4
Te7 Chapel Lane Verge	1.4
Te50 Bentley Brook	1.4
Te105 Clacton Cemetery	1.4
Te8 Pyecats Corner Verges	1.5
Te56 Dead Lane Verge	1.5
Te67 Pump Hill Verges	1.5
Te117 Frinton Cliffs	1.5

SITE	CLOSEST DISTANCE TO AOS (KM)
Te63 St. Osyth Cemetery	1.6
Te15 Palegate Wood	1.7
Te24 Fratinghall/ Captains Woods	1.7
Te49 Frating Abbey Farm Road Verge	1.7
Te52 Hopping Bridge Marsh	1.7
Te82 Coppin's Hall Wood	1.7
Te5 Churn Wood	1.8
Te17 Park Wood	2

19.4.3 Although not itself designated, Ardleigh Reservoir lies 1.6 km outside the onshore AoS. The reservoir is reported to support a range of waterbirds, including green sandpiper *Tringa ochropus*, tufted duck *Aythya fuligula*, gadwall *Anas strepera*, goosander *Mergus merganser*, great crested grebe *Podiceps cristatus*, little grebe *Tachybaptus ruficollis* and little egret *Egretta garzetta*.

TERRESTRIAL AND FRESHWATER HABITATS

19.4.4 The onshore AoS is c.12,070 ha in size and primarily arable land, with large field sizes typically between 10 and 50ha (and up to 70ha), although occasional clusters of smaller fields are also present, giving an average field size overall of c.11ha. The large arable fields are typically divided by thin hedgerows and/ or ditches.

19.4.5 Amongst the arable land are small patches of woodland, which average just under 1 ha in size, the largest being 37 ha (Riddles Wood, of which only 0.26ha is within the onshore AoS), and total 317 ha or about 2.5% of the onshore AoS. Of the nearly 390 small parcels of woodland in the onshore AoS, approximately 40, with a total area of 220 ha, are included in the Ancient Woodland Inventory. The larger parcels of woodland and ancient woodlands are mostly included within the designated sites listed in Table 19.3.

19.4.6 Other semi-natural habitats are scarce in the onshore AoS. Based on the data obtained for the scoping study, which is not definitive, they include:

- Coastal and Floodplain Grazing Marsh – c.167 ha, 1.3%, all of which is along the Hollands Brook and within either the Upper Holland Brook LWS or Holland Haven Marshes SSSI;
- Open mosaic habitat – c.20 ha, 0.16%, within two sites only;
- Traditional Orchards – c.11 ha, 0.09%;
- Lowland Heathland – c.3.4 ha, 0.03%, all of which is within Great Holland Pits Nature Reserve and LWS;
- Lowland Fen – 1.87 ha, all of which is within Holland Haven Marshes SSSI;
- Wood Pasture and Parkland – extent unknown;
- Hedgerows;
- Rivers; and

- Ponds.

19.4.7 The habitats listed above are priority habitats in England. Other semi-natural habitats may include semi-improved grassland, which appears to occur predominately in small fields close to settlements, and ditches, which appear to be widespread in the arable land. Semi-natural habitats make up an estimated 5-10% of the onshore AoS, with the remainder being mainly arable farmland.

19.4.8 There are villages and hamlets but no large settlements within the onshore AoS.

PROTECTED AND NOTABLE SPECIES

19.4.9 A review of biological records obtained to date indicates that several priority species occur within and around the 2 km study area. Again, the records should not be seen as definitive; other species may be present and some may no longer occur.

PLANTS

19.4.10 Numerous notable, scarce and rare plant species have been recorded within the 2 km study area. Most of these species are confined to priority habitats which, as described above, are thinly distributed in the onshore AoS and mostly included within designated sites. Within and around the onshore AoS, the coastal habitats support the most notable and rare plant species, with wetland, woodland, heathland and other semi-natural habitats also supporting such species. However, the records also include approximately 10 species of scarce plants of arable and wasteland habitats. These species could be found away from the designated sites within the onshore AoS. By definition, populations of these plants are likely to be very localised and probably occur mostly in areas where conservation actions are being undertaken to sustain their populations, on recently abandoned land and land recently set aside from agriculture.

INVERTEBRATES

19.4.11 Like plants, numerous notable, scarce and rare invertebrate species have been recorded from within the 2 km study area and again these are strongly associated with priority habitats and designated sites, especially coastal sites. Other places where such species have been recorded include roadsides, churchyards, golf courses, parks and gardens. Unlike plants, the arable habitats are unlikely to support scarce species of invertebrate.

AMPHIBIANS

19.4.12 Three species of amphibian have been recorded within the 2 km study area:

- Great crested newt *Triturus cristatus*;
- Common toad *Bufo bufo*; and
- Common frog Rana temporaria.

19.4.13 The first of these is a protected and priority species, while the second is a priority species. Common frog does not have this status, however, populations can still be of importance where this species is scarce.

19.4.14 The available data indicate that great crested newt is very localised within and around the 2 km study area, with all records being in the southern part of the onshore AoS, south of Weeley, and in areas where agriculture is less intensive.

REPTILES

19.4.15 Four species of reptile have been recorded from within the 2 km study area:

- Adder Vipera berus;
- Slow worm Anguis fragilis;
- Grass snake *Natrix helvetica*; and
- Common lizard Zootoca vivipara.

19.4.16 The records are from scattered locations within the study area. These species are generally associated with open, semi-natural habitats. All four species are protected (although their habitats are not directly protected) and priority species.

BIRDS

19.4.17 A large number of bird species have been recorded within the 2 km study area.

19.4.18 The records include most of the non-breeding wildfowl and wader species that are part of the qualifying interest species for the Special Protection Areas and Ramsar sites, plus their component SSSIs, that are listed in Table 19.3.

19.4.19 The records also include a range of other non-breeding wildfowl and wader species plus regular records of the following other notable non-breeding species:

- Bittern Botaurus stellaris;
- Lapwing Vanellus vanellus
- Golden plover Pluvialis apricaria
- Hen harrier Circus cyaneus;
- Short-eared owl *Asio flammeus*;
- Merlin Falco columbarius;
- Peregrine Falco peregrinus; and
- Bearded tit Panurus Biarmicus.

19.4.20 Notable species for which there are confirmed or probable breeding records within and around the onshore AoS include the following Schedule 1 species:

- Marsh harrier Circus aeruginosus;
- Quail Coturnix coturnix;
- Avocet Recurvirostra avosetta;
- Little ringed plover;
- Mediterranean gull Ichthyaetus melanocephalus;
- Little tern;
- Barn owl *Tyto alba*;
- Kingfisher Alcedo atthis;
- Hobby Falco subbuteo;
- Cetti’s warbler *Cettia cetti*; and
- Marsh warbler Acrocephalus palustris.

19.4.21 Once again, these species are strongly associated with the designated sites, with some also occurring at Ardleigh Reservoir. However, quail, barn owl and hobby may occur more widely in the study area than is indicated by the records, including within areas of arable land. In addition, kingfisher may be found elsewhere on the Holland Brook and its tributaries.

19.4.22 There are also breeding records for several other notable bird species including declining farmland birds such as turtle dove *Streptopelia turtur*, nightingale *Luscinia megarhynchos* and corn bunting *Emberiza calandra* and breeding waders such as lapwing *Vanellus vanellus*, ringed plover and redshank. Again, many of these are associated with designated sites however the farmland birds and lapwing occur more widely in the onshore AoS, including within areas of arable land.

BATS

19.4.23 At least eleven species of bat have been recorded within the 2 km study area, namely;

- Common pipistrelle Pipistrellus pipistrellus;
- Soprano pipistrelle* *P. pygmaeus*;
- Nathusius' pipistrelle *P. nathusii*;
- Brown long-eared bat* *Plecotus auritus*;
- Daubenton's bat Myotis daubentonii;
- Natterer's bat *M. natterri*;
- Serotine Eptesicus serotinus;
- Leisler's bat Nyctalus leisleri;
- Noctule bat* *N. noctula*; and
- Barbastelle* Barbastella barbastellus
- Whiskered bat Myotis mystacinus

19.4.24 These are all protected species and four of them (marked with an asterisk) are priority species. While the majority are relatively common and widespread, the barbastelle is a rare species, with a strong association with woodland. This species has been recorded at scattered locations around the onshore AoS. The whiskered bat may also be locally uncommon with very few records from within and around the onshore AoS, although this could also reflect the difficulty of identifying this species.

OTHER MAMMALS

19.4.25 Records of other mammals within the 2 km study area include the following species, which are all protected and/ or priority species:

- Badger *Meles meles* (protected species);
- Brown hare *Lepus europaeus* (priority species);
- Water vole *Arvicola amphibius* (protected and priority species);
- Otter *Lutra lutra* (protected and priority species);
- Dormouse *Muscardinus avellanarius* (protected and priority species):
- Hedgehog *Erinaceaus europaeus* (priority species); and
- Harvest mouse *Micromys minutus* (priority species).

19.4.26 The majority are likely to be widespread in the onshore AoS. For example, water vole records are widespread in the study area, especially to the south of the A120. However, the otter and hazel dormouse are likely to have more restricted distributions. The otter records come mainly from the upper parts of estuaries and a very few inland locations, including Tenpenny brook. The dormouse records are from woodland near Weeley Heath, Thorpe-le-Soken, Alresford, Great Holland, Beaumont, Little Bentley and Cattawade, indicating this species occurs at scattered locations throughout the onshore AoS, where there is woodland but may actually be more widespread, in hedgerows.

INVASIVE NON-NATIVE PLANT SPECIES

19.4.27 Approximately 31 species of non-native invasive plant species have been recorded from within and around the onshore AoS, including Japanese knotweed *Fallopia japonica*, giant hogweed *Heracleum mantegazzianum* and Himalayan balsam *Impatiens glandulifera*.

19.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

19.5.1 The assessment methodology will be based upon the Chartered Institute for Ecology and Environmental Management's Guidelines for Ecological Impact Assessment (CIEEM, 2018).

19.5.2 The approach to assessment will be discussed and agreed with relevant bodies through the Evidence Plan. An outline survey scope of ecology surveys has now been agreed with Natural England. Further consultation will be undertaken at key stages throughout the EIA process.

POTENTIAL PROJECT IMPACTS

19.5.3 A range of potential impacts on onshore ecology have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 19.5, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/ or supporting analyses (e.g. modelling) to enable an assessment of the impact.

19.5.4 At this stage, no potential impacts or important ecological receptors have been scoped out of the assessment as not enough is yet known about the layout of the onshore infrastructure. However, it is expected that as the design progresses some potential impacts and many of the ecological receptors within the current study area can be scoped out of further assessment.

Table 19.5 - Impacts proposed to be scoped in to the assessment for Onshore Ecology

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
19.1	Damage[77] to Holland Haven Marshes SSSI, Holland Haven LNR, Upper Holland Brook LWS, and Great Holland Pits LWS, including the scarce plants and invertebrates present within these designated sites.	The landfall will be between Holland-on-Sea and Frinton-on Sea, which is also the location of the SSSI, meaning that the cable route will inevitably pass under or through the SSSI and potentially the adjoining and nearby LWSs.	Habitat survey and expanded desk study (for further details see Section 19.6: Summary of Next Steps) to gather more information on the SSSI and LNR, plus discussion with consultees and engineers on methods to avoid or minimise impacts on the SSSI and its interest features (such as the use of trenchless technologies/ horizontal directional drilling (HDD)).
19.2	Damage to other designated sites within the onshore AoS, such as Weeley Hall Wood SSSI, Riddles Wood SSSI and LWS, and ancient woodland.	It is expected that direct effects on all other SSSIs, LWS and ancient woodland can be avoided during the route selection process and the siting of temporary and permanent infrastructure however,	Habitat survey and expanded desk study to gather more information on the SSSIs, LWS and ancient woodland, calculation of risk zones around each to inform route selection and final alignment of the cable

[77] Damage means impacts other than temporary or permanent habitat loss, such as, disturbance of soils, trampling or removing vegetation, pollution, changes in hydrology, disturbance of 'keystone' species, spread of invasive species etc, which result in degradation of habitats and decline of species within the designated site.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		depending on the location of the cable route and substation, there is a risk of indirect effects, permanent and temporary, arising from site run-off and dust and damage to interconnecting habitats.	route, and locations for temporary and permanent infrastructure.
19.3	Damage to areas of priority habitat outside designated sites.	As with designated sites, it is expected that damage to most types of priority habitat can be avoided however some damage to hedgerows may occur, and depending on the location of the cable route and substation, there is also a risk of indirect effects to other priority habitats.	The assessment process will be as described above for designated sites, followed by surveys to inform assessment of impacts and mitigation requirements once the preferred substation location and cable route corridor(s) have been determined.
19.4	Permanent habitat loss.	The construction of the substation will result in the permanent loss of habitat, most likely arable land of low ecological value, however, it is not known whether other habitat types may also be affected at this stage.	Habitat survey of the preferred substation location(s).
19.5	Temporary habitat loss.	The installation of the cable and other temporary infrastructure,	Habitat survey of the preferred cable route corridor(s). The

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		such as site compounds, will result in temporary habitat loss, mostly arable land but also ditches and hedgerows and potentially other habitats depending on the route selected.	surveys will locate or confirm areas of priority and other semi-natural habitat.
19.6	Reduction or loss of populations of rare arable weeds (and potentially an increase in these populations).	Populations of arable weeds, if present in affected areas, may be vulnerable if site clearance resulted in plants being removed before setting seed, however, ground disturbance and construction activity can create or maintain suitable habitat for these species.	Survey of suitable areas within the preferred landfall, cable route corridor and substation location once known, using existing records and habitat survey information to target the most likely locations.
19.7	Pollution of waterbodies and watercourses, especially via suspended solids.	Construction activity will involve removal of vegetation, soil stripping and temporary stockpiling of excavated soils. Soil exposed in this way is more vulnerable to being washed into watercourses and can cause damage to aquatic ecosystems.	Desk-based assessment of affected watercourses and their water quality, followed by surveys should the potential for significant effects be identified when the preferred landfall, cable route corridor option and substation locations are known.
19.8	Killing, injury and disturbance of protected and priority species.	Protected and priority species including amphibians, reptiles,	Appropriate surveys to determine the location of

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		nesting birds, bats and other mammals may be impacted during site clearance which may result in an offence under wildlife legislation and could have significant impacts on populations of scarce and rare species.	protected and priority species once the preferred landfall, cable route corridor and substation location are known (for further details see Section 19.6: Summary of Next Steps).
19.9	Disruption of the movement of protected and priority species.	The cable route will form a linear construction corridor potentially extending for many kilometres, which has the potential to disrupt the movement of some species especially amphibians and mammals, including bats. This could prevent animals from reaching breeding, foraging or hibernation sites and affect the survival of vulnerable populations.	As above.
19.10	Loss and damage of habitat for protected and priority species.	The installation of below ground and above ground infrastructure may result in the permanent or temporary loss of habitat for protected and priority species.	As above

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
19.11	Disturbance and displacement of wintering waterbirds.	Wintering birds associated with coastal and wetland sites, including the designated sites, may also roost and forage on nearby farmland. Construction activity in proximity to the coast and wetlands and areas used by the birds outside of these areas may result in temporary disturbance and displacement. Location of above ground infrastructure in areas used by foraging birds outside the designated sites will result in permanent displacement.	Appropriate surveys to determine the location of land used by wintering waterbirds at the coast and in selected locations inland (for further details see Section 19.6: Summary of Next Steps).
19.12	Spread of invasive non-native species.	Invasive non-native plant and animal species (INNS) can be spread inadvertently in soil which is moved around the construction site and on machinery etc which is moved between construction sites, which may result in an offence under wildlife legislation and negative impacts on the ecosystems to which the species are transferred.	Appropriate surveys to determine the location of INNS to determine their type and location.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
19.13	Air quality impacts on all ecological receptors from construction generated road traffic.	Construction traffic and machinery will result in emissions to air with very limited potential to affect ecological receptors when considering the project alone, but which could contribute to cumulative impacts on sensitive species and habitats.	An air quality assessment (see Chapter 24. Air Quality) will be undertaken, which will include consideration of ecological receptors, and potential effects from changes in air quality will be considered in the cumulative impact assessment.
19.14	Damage to watercourse and aquatic life resulting from spillage of vehicle fluids from construction machinery.	Construction traffic and machinery will use and contain fuel, oils and other fluids which, if spilled, could damage terrestrial and aquatic ecosystems. This is unlikely to be significant for the project alone but could combine with existing pollution and other projects and therefore have a cumulative impact.	The habitat survey will identify sensitive receptors and the potential for cumulative impacts will be considered in the assessment.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
OPERATION			
19.15	Disturbance of protected and priority species or temporary habitat loss during planned and unplanned maintenance works when VE is operational.	The presence of site staff could result in the disturbance of species during maintenance which may not be significant on its own but could be when considered cumulatively with other human activity. The risk of an impact is generally low however the level of risk depends on the siting of the substation etc relative to sensitive ecological receptors.	Sensitive receptors will be identified through the desk study and surveys, and the risk will be considered as part of the cumulative impact assessment.
DECOMMISSIONING			
19.16	Impacts likely to be similar to construction, but more limited in geographical extent and timescale and there will be no permanent habitat loss.	Described above.	Prediction of the future baseline conditions at the time of de-commissioning to describe and evaluate the likely impacts and their significance.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

19.5.5 As part of the design process for VE a number of measures are proposed to reduce the potential for impacts on terrestrial and freshwater receptors. These are presented below. These will evolve over the development process as the EIA progresses and in response to consultation.

19.5.6 VE are committed to implement these measures, and also various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/ out presented in Table 19.5.

19.5.7 Measures intended to be adopted as part of the project will include:

- Avoidance of impact through cable route selection (e.g. avoiding designated sites or areas of important habitat, woodland areas, water bodies and streams as far as possible) where practicable;
- The cable will be installed using trenchless technology / HDD under Holland Haven Marshes SSSI and at other sensitive locations, e.g. river crossings;
- The onshore cable will be buried underground and therefore pose no collision risk to birds.
- Seasonal constraints for site clearance and other construction activity in relation to specific species will be adhered to where practicable (e.g. undertaking vegetation clearance outside the bird nesting season);
- Species-specific mitigation will be developed based on the findings of ecological surveys;
- Unnecessary land-take (permanent and temporary) will be avoided to reduce habitat loss;
- Habitats unavoidably removed during cable route construction will be reinstated upon completion of works, or compensatory habitat will be provided where appropriate;
- A Code of Construction Practice (CoCP) will be developed and implemented to manage and mitigate environmental risk. It is anticipated that the CoCP will include, but not be limited to, provision of chemical/fuel storage and handling procedures, environmental and ecological management measures; and
- A Decommissioning Programme will be developed and implemented.

19.5.8 The development and suitability of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

POTENTIAL CUMULATIVE IMPACTS

19.5.9 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For Terrestrial Ecology and Nature Conservation, cumulative interactions may occur with other planned projects and developments in the study area. Potential cumulative impacts with other projects and activities will be considered for each of the impacts considered in Table 19.5.

19.5.10 The habitats, birds and other species that are potentially affected by offshore wind are generally different from those which are affected by onshore development. Exceptions in this locality are (i) species of gull and some species of tern, which breed at the coast and forage at sea, and (ii) coastal habitats which could be affected by pollution, including suspended solid pollution, generated by construction activity at sea and on land. These features are covered in the offshore sections of this scoping document. In addition, other offshore wind projects will also have an onshore element, which could result in cumulative impacts in the same way as other activities. Onshore aspects of other windfarms and other relevant developments, will be considered in the cumulative impact assessment. These could include the North Falls OWF and the EACS.

19.5.11 The onshore cable will be buried underground and therefore poses little risk of contributing to significant cumulative ecological impacts when operational. The main risk of such effects is during the construction and decommissioning phases, where cumulative effects could occur with other developments happening at the same time.

POTENTIAL TRANSBOUNDARY IMPACTS

19.5.12 The only scope for transboundary impacts with respect to onshore ecology will be in the event of major impacts on the populations of migratory species which breed or winter overseas. Impacts at this level will be avoided through appropriate siting of infrastructure and the implementation of mitigation measures. It is therefore proposed to scope out transboundary effects from further assessment (unless major impacts on migratory species are predicted at later stages of the assessment).

19.6 SUMMARY OF NEXT STEPS

19.6.1 More detailed survey information will be obtained to identify the potential impacts upon onshore ecology, the detailed methodologies for which will be consulted upon through the Evidence Plan process.

19.6.2 As already described, the onshore AoS is under review and will be refined as the design progresses. The next phases of surveys and data gathering will be based on either the onshore AoS shown on Figure 19.1 to Figure 19.3 or more likely a refined onshore AoS, as available at the time of the study or survey. References to onshore AoS in this summary of next steps means the onshore AoS in place at the time of the assessment.

19.6.3 The next steps for the onshore ecology assessment are:

- Obtain biological records, including recent data from the national turtle dove survey (if available), and local wildlife site data, including locations of quarries which may have wildlife value, for the full onshore AoS plus the surrounding area and relevant Wetland Bird Survey data, as indicated in Table 19.2; Prepare an initial habitat map of the onshore AoS and a 100m buffer using aerial imagery and the UKHab classification system (https://ukhab.org/) to the highest resolution possible (most likely level 3, broad habitats), with minimum mapping units (MMU) of 400 m2 and 20 m length;
- Ground-truthing of selected areas within the onshore AoS to verify the mapping from aerial imagery and more detailed field survey at selected areas (e.g. potential substation sites), where access is possible; and
- Preparation of a Preliminary Ecological Appraisal Report (PEAR), which will include a summary of the desk study information, an audit of the habitats found within the onshore AoS, a map of known ecological constraints, the requirements for further survey and recommendations for avoidance and mitigation of ecological impacts based on what is known at that time. Survey to inform the PEA is in progress and it is anticipated that the PEAR will be completed in autumn 2021.

19.6.4 In parallel with the PEA a wintering bird survey will be undertaken. This will encompass (i) intertidal habitats where the onshore AoS meets the coast; (ii) agricultural fields known to support, or have the potential to support, dark-bellied brent geese within the onshore AoS plus 250 m and (iii) agricultural fields potentially suitable for flocks of waterbirds such as lapwing, golden plover *Pluvialis apricaria* and curlew *Numenius arquata* and/ or subject to regular flooding, where located within the onshore AoS plus 250 m.

19.6.5 The wintering bird survey will focus on wintering waterbirds however other notable species, including priority species, will also be recorded. The surveys will take place twice per month from September 2021 to April 2022 inclusive and July and August 2022 (i.e. 20 surveys in total), except for (iii) which will be once per month. All surveys will take place during daylight hours, with intertidal surveys covering low to high tide (or vice versa) on each visit.

19.6.6 The information derived from the PEA will be used to further develop the route options for the onshore cable route and the siting of above ground infrastructure including the substation, with the objective of minimising the overall environmental impact of the project, including ecological impacts.

19.6.7 It is expected that the information derived from the PEA will include all major ecological constraints and enable these to be considered in the overall layout and design of the project. However, some priority habitats, such as hedgerows, and some widespread protected and priority species, which occur in farmland, are likely to be affected in any event.

19.6.8 Therefore, as a preferred cable route corridor and substation are identified, targeted surveys of these habitats and species will be undertaken within these locations, and an appropriate buffer, as indicated in the list below. These surveys will be confirmed as part of the PEA however they are likely to include the following, all to be carried out in accordance with published good practice guidelines:

- Updated habitat mapping in the field using all levels of the UKHab classification hierarchy as appropriate, with the results presented in a separate vegetation survey report;
- Detailed surveys of habitats with potential to support important populations of protected or otherwise notable plant species, as part of the updated habitat mapping with additional visits if needed to ensure surveys are in the correct season;
- Recording and mapping of both rare arable weeds and invasive non-native plant species as part of the updated habitat mapping, ensuring that surveys are undertaken at a time when these species are in evidence and with additional visits if needed to ensure surveys are in the correct season;
- Targeted surveys for protected and notable invertebrates in suitable habitats if these will be affected directly or indirectly by construction activity;
- Surveys for great crested newts (and toads) for all ponds within 250 m using eDNA survey and following the standard protocol (Biggs *et al*., 2014)., with population size class assessments (English Nature, 2001) for ponds with great crested newts (or inconclusive results) within 250 m of permanent or 100 m of temporary habitat loss also undertaken, where such data does not already exist;
- An assessment of habitats for their suitability for common reptile species, followed by presence/ absence surveys (Sewell, 2013; Froglife 1999; Gent & Gibson,1998) for areas of moderate or high suitability habitat with potential to be subject to moderate or large-scale impacts;
- Targeted surveys for breeding birds (Gilbert, Gibbons & Evans,1998) within a minimum of 100 m of the preferred locations and route corridor(s) in areas where (i) specially protected species could occur i.e. those listed on Schedule 1 of the Wildlife and Countryside Act, as amended, and those listed in Annex 1 of the EC Birds Directive; (ii) wetland, scrub and woodland habitats potentially supporting sensitive and declining species such as corn bunting, turtle dove, nightingale, breeding waders or notable wildfowl could occur; and (iii) permanent above ground infrastructure will be built, with surveys extending into August for corn bunting;
- A badger survey within a minimum buffer of 30 m from the edge of the preferred substation location and route corridor (Neal & Cheeseman,1996);
- An assessment of woodlands and hedgerows for their suitability for dormouse, followed by a presence/ absence survey (Bright *et al*., 2006) where suitable habitat for this species could be affected by construction activity;
- Surveys for roosting bats, comprising (i) preliminary roost inspections from the ground, (ii) close inspections at height of trees/ structures initially assessed as having moderate or high suitability for roosting bats and that could be removed or damaged; and (iii) emergence surveys of all trees/ structures that could be removed or damaged which are confirmed as having moderate or high suitability on close inspection or which could not be closely inspected at height and/ or surveys in winter for potential hibernation roosts (Collins J. (ed.), 2016);
- Surveys for foraging bats by undertaking walked transects and/or point counts and deployment of static bat detectors to record bat activity, with multiple transects and a minimum of two static bat detectors per transect or at placed individually at point count locations (Collins J. (ed.), 2016):

- An assessment of watercourses for their potential to support otter, followed by a survey for otter signs on all suitable water courses crossing or within the preferred substation location or cable route corridor plus 250 m up and downstream (Chanin, 2003a, 2003b); and
- An assessment of watercourses for their potential to support water vole, followed by a survey for water vole signs on all suitable water courses crossing or within the preferred substation location or cable route corridor plus 200 m up and downstream (Strachan, 2011).

19.6.9 Following consultation, Natural England has agreed to the approach and scope of the ecology surveys outlined above. Responses from other consultees have also been considered.

19.7 FURTHER CONSIDERATION FOR CONSULTEES

19.7.1 For the scoping opinion, it will be helpful if you can include consideration of the following questions:

- Subject to the findings of the PEA, do you agree that the data sources and surveys identified are likely to be sufficient to inform the onshore baseline for the VE PEIR and ES?
- Do you agree that all the statutory and non-statutory designated sites within the potential zone of influence have been identified?
- Do you have any comments on proposed scope and extent of the further surveys for protected, priority and notable species?
- Do you agree that all potential impacts have been identified for important onshore ecological features in Table 19.5?
- Do you agree that the proposed mitigation measures described provide a suitable means for managing and mitigating the potential effects of the project on important onshore ecological features (insofar as it is possible to identify relevant mitigation requirements at this early stage)?

20. ARCHAEOLOGY AND CULTURAL HERITAGE

20.1 INTRODUCTION

20.1.1 This section of the Scoping Report will consider the potential onshore Archaeology and Cultural Heritage assets which are of relevance to the VE onshore AoS. It describes the potential effects from the construction, operation and maintenance, and decommissioning of VE on onshore archaeology and cultural heritage and sets out the proposed scope of the EIA. The chapter also considers effects on archaeological assets within the intertidal zone down to Mean Low Water Spring (MLWS).

20.1.2 This chapter should be read alongside the following assessment chapters of this Scoping Report:

- Chapter 16: Seascape, Landscape and Visual Impact
- Chapter 17: Marine Archaeology and Cultural Heritage

20.2 STUDY AREAS

20.2.1 For the purposes of the Scoping Report, the study area for Archaeology and Cultural Heritage comprises a precautionary buffer of 5km around the onshore AoS. The inclusion of the 5km buffer into the study area takes account of the uncertainty around the final location of the OnSS, onshore export cable route and landfall location within the onshore AoS and has been identified as an appropriate maximum zone of influence for identifying cultural heritage assets and historic landscapes which could be impacted by the presence of the VE onshore infrastructure. A 5 km radius is a standard study area for this stage of assessment which will allow for the maximum realistic co-visibility between assets and the VE project infrastructure to be assessed.

20.2.2 The above approach is in accordance with the approach outlined in Chapter 27: Landscape and Visual Impacts Assessment.

20.2.3 Archaeological and Cultural Heritage assets along the coastline will also be considered within 60km of the array areas to take account of the potential visual impacts as a result of the WTG visibility. The 60km boundary includes assets that may be impacted by VE on the Suffolk and Essex coastlines. The study area associated with the settings assessment on coastal heritage assets is based on ZTV analysis detailed within Chapter 16: SLVIA, which indicates that visibility of the array areas will be limited beyond 60 km. The ZTV assessment identified that impacts on visibility inshore of the coastline is limited due to the terrain within the Suffolk and Essex areas.

20.2.4 For the purposes of this report, the 5 km buffer around the onshore AoS will be referred to as the Archaeology Study Area. The coastal area within the 60 km buffer consider for potential impacts from the VE array areas will be referred to as the Coastal Study Area.

20.2.5 An intertidal area will be defined once the detailed landfall location has been identified. This will be subject to an archaeological walkover survey and an assessment of marine assets that may be subject to direct effects from any construction works in the vicinity.

20.2.6 The Archaeology Study Area will be refined and amended for PEIR in response to such matters as refinement of the onshore AoS, location of VE infrastructure, feedback from consultees, and/ or the identification of additional constraints (environmental and/ or engineering). This is expected to result in a significant reduction in the size of the study area for direct and indirect effects as it is refined to more closely follow the route of the preferred onshore cable route, and preferred locations for the landfall and substation when these are determined. The historic landscape and settings assessment will be refined around the confirmed infrastructure locations to comprise a 2 km buffer around the final substation location and a 500 m buffer from the centre point of the preferred onshore export cable route. Direct effects on archaeological and cultural heritage assets will be focused on the construction activities associated with the VE onshore infrastructure.

20.3 BASELINE DATA

20.3.1 The baseline data for both study areas used to inform the PEIR and EIA will comprise information from the sources shown in Table 20-1. This scoping report considers the National Heritage List for England (NHLE) and available HER data only.

Table 20-1 - Key sources of information for Cultural Heritage

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Historic England	Designated Heritage Assets: > world heritage sites; > listed buildings; > scheduled monuments; > registered parks and gardens; and > registered battlefields. National Mapping Programme (aerial photographs)	This is a national dataset providing full coverage of the study area.
Essex County Council	Historic Environment Record: non-designated assets and Portable Antiquities Scheme finds, Historic Landscape Characterisation	Full coverage
Tendring District Council	Conservation Areas, Local Planning Policy	Full coverage
Publicly available LiDAR, air-photographs and terrain and geological data	BGS geological data, terrain modelling (DSM and DTM)	Full coverage

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
OS	Base Mapping	Full coverage
Multi-agency Geographic Information Centre (MAGIC) website and Natural England's Designated Sites Viewer Magic.gov.uk and designatedsites.naturalengland.org.uk Chapter 20: Terrestrial Ecology and Nature Conservation	Ancient woodland and hedgerows	Unknown coverage
National and regional research frameworks, e.g.: Historic England, 2000- *Research and Archaeology: a Framework for the Eastern Counties, 2. research agenda and strategy*	For targeting research into key areas of cultural heritage and add value to development.	Full coverage
Previous Heritage reports for OWF, EA1, EA2	For reference and taking holistic view of research aims and the wider heritage of the southeast coast	Limited coverage

BASELINE ENVIRONMENT

ARCHAEOLOGY STUDY AREA

20.3.2 The Archaeology Study Area is typical of areas of ancient countryside as defined by Rackham (1986).

20.3.3 This is defined by small hamlets spread across parishes with wide geographical areas, often with related place names. These include Great Bentley and Little Bentley; Weeley and Weeley Heath; Thorpe-le-Soken and Thorpe Green; and Tendring, Tendring Green and Tendring Heath. These dispersed settlements may originate from a process identified during two key investigations, West Stow in Suffolk and Mucking in Essex (Hamerow 1993). These small villages were occupied in single-generational households and over time 'wandered' across the landscape. Over time this process left small settlements of the same name across the locality.

20.3.4 The settlement and landscape form of the Archaeology Study Area has remained relatively unchanged and retained its rural character, with small, dispersed settlements and little urban sprawl.

COASTAL STUDY AREA

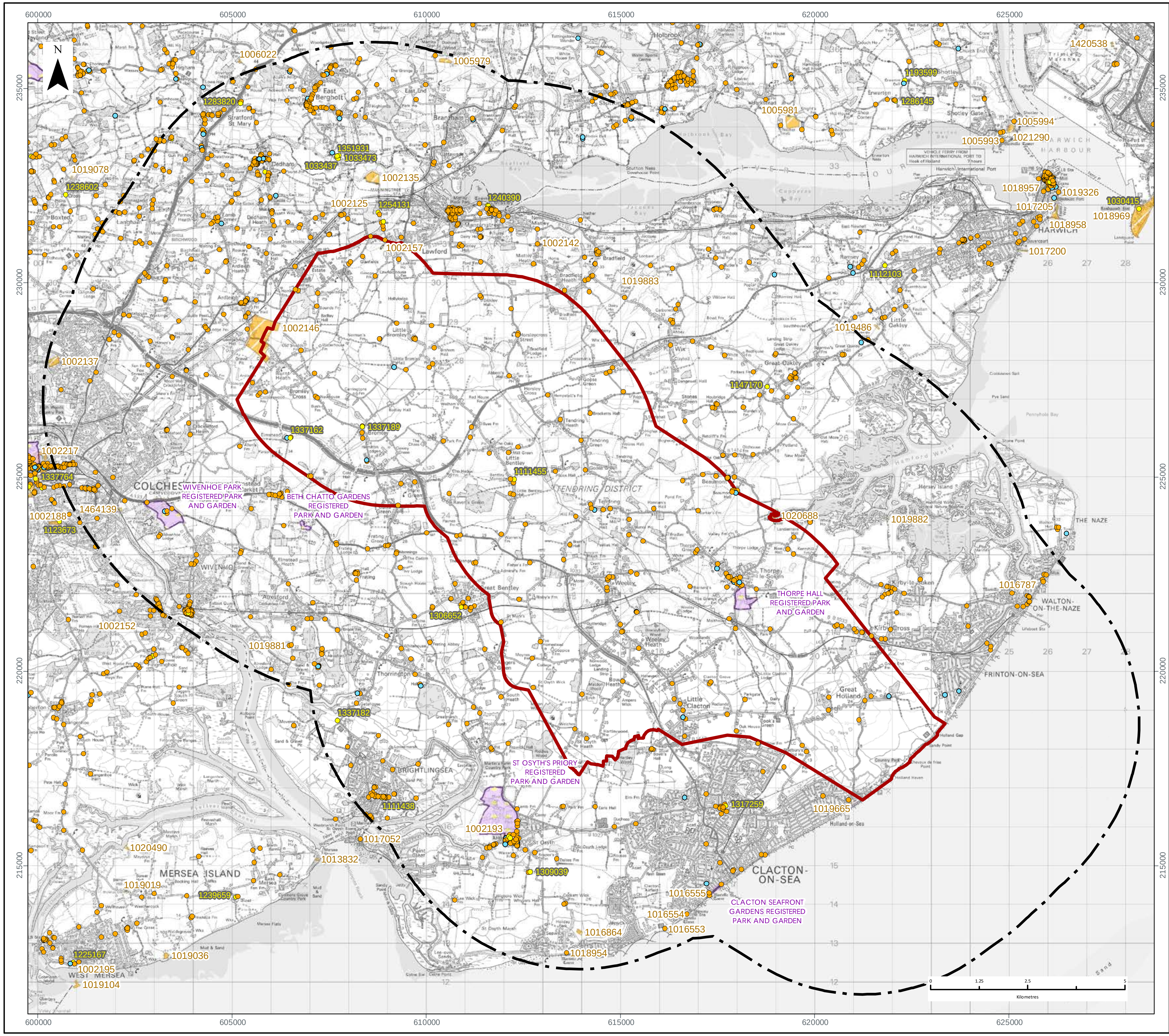
20.3.5 The southern part of the Coastal Study Area is predominantly industrial and commercial, dominated by the ports of Felixstowe and Harwich. However, the landfall area is largely rural and can be characterised in much the same way as the inland landscape in Tendring.

20.3.6 The Suffolk coast is a rural manorial landscape with numerous historic villages along the shoreline, such as Bawdsey, Orford, Southwold and Dunwich. The landscape contains larger nucleated settlements as opposed to the dispersed settlements found in Essex and field systems show greater evidence of Parliamentary Planned Enclosure.

DESIGNATED SITES

20.3.7 Designated Heritage Assets within the Archaeology Study Area and within the Coastal Study Area comprise:

- World heritage sites: none;
- Listed buildings: 1888 (41 grade I, 106 grade II* and 1741 grade II);
- Scheduled monuments: 50;
- Registered parks or gardens: 8;
- Registered battlefields: none; and
- Conservation Areas (CAs): there are 21 CAs listed in the Tendring District Council website, the CAs within the Archaeology Study Area.



LEGEND

- Onshore Area of Search
- Archaeology Study Area
- Registered Park and Garden
- Scheduled Monument
- Listed Building (Grade)
  - I
  - II
  - II*

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Onshore Designated Heritage Asset Assessment

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	NJG	MS

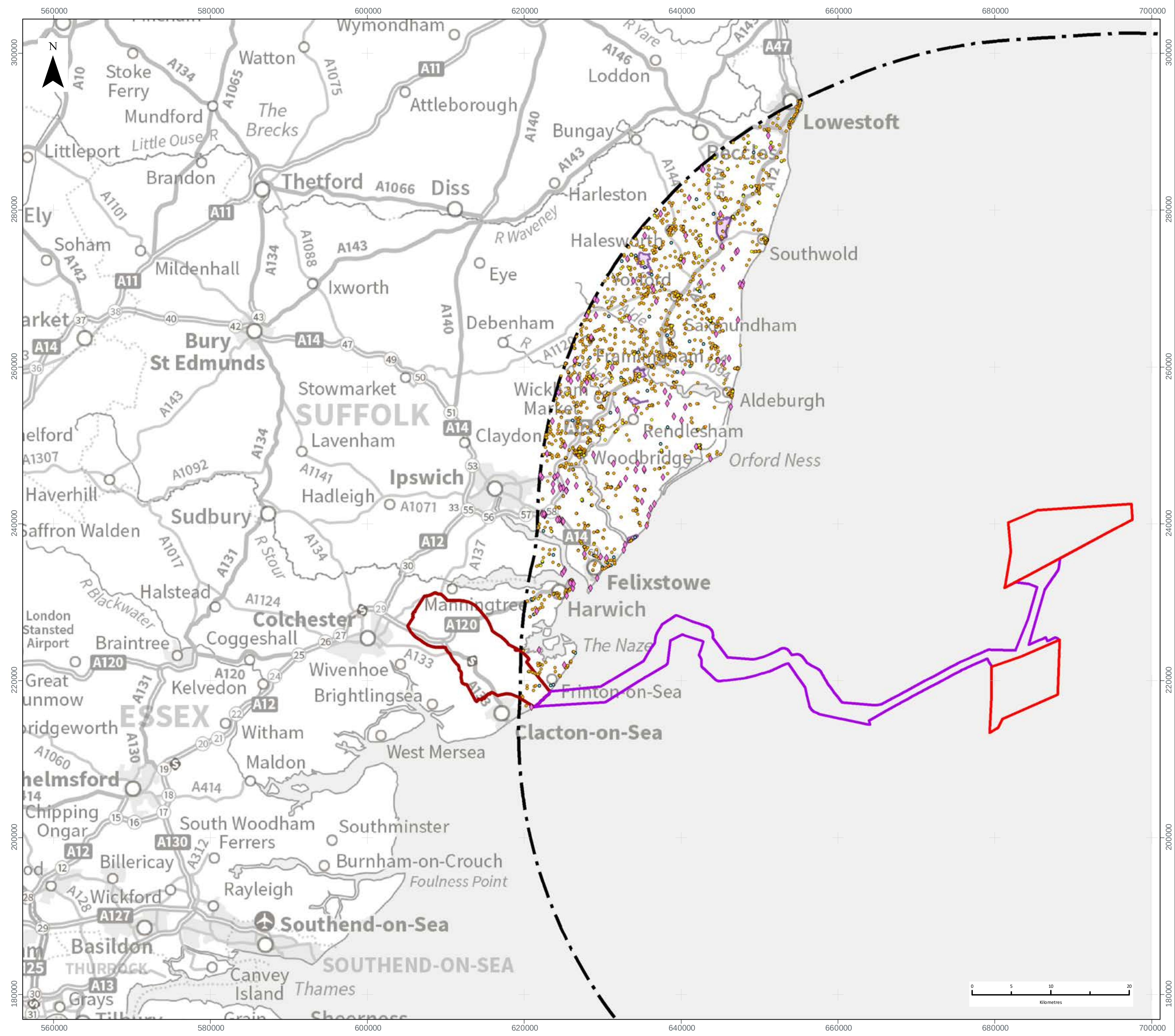
DRAWING NUMBER:

20.1

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:100,000	A3	ODN	British National Grid

FIVE ESTUARIES
OFFSHORE WIND FARM

\\gisfs1\G\Projects\05356 - GoBe Consultants Ltd\00010 Five Estuaries\Tech\GIS\Dwgs\Wking\2021 07 Scoping\Cultural Heritage\05356.00010.0022.2 Cultural Heritage.mxd



LEGEND

- Array Areas
- Coastal Study Area
- Offshore Area of Search
- Onshore Area of Search
- Scheduled Monument (Point)

Listed Building (Grade)

- I
- II
- II*
- Registered Park and Garden

Data Source:
© Crown copyright [and database rights] (2021) 0100031673 OS OpenData.

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Coastal Designated Heritage Asset Assessment

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	JRS	SF

DRAWING NUMBER:

20.2

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:500,000	A3	ODN	British National Grid

FIVE ESTUARIES
OFFSHORE WIND FARM

20.4 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

GENERAL EIA METHODOLOGY

20.4.1 Heritage assets are assessed in terms of their significance, following the requirement in NPPF paragraph 189, and taking account of Historic England's guidance on 'Managing Significance in Decision-Taking in the Historic Environment' (GPA2). Significance, in relation to heritage policy, is defined by the NPPF as:

> *'the value of a heritage asset to this and future generations because of its heritage interest. That interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting.'*

20.4.2 The NPPF glossary and the Planning Practice Guidance (PPG) provide that an asset's significance derives from its heritage 'interests', which the latter defines as follows:

- Archaeological interest: "As defined in the Glossary to the National Planning Policy Framework, there will be archaeological interest in a heritage asset if it holds, or potentially holds, evidence of past human activity worthy of expert investigation at some point."
- Architectural and artistic interest: "These are interests in the design and general aesthetics of a place. They can arise from conscious design or fortuitously from the way the heritage asset has evolved. More specifically, architectural interest is an interest in the art or science of the design, construction, craftsmanship and decoration of buildings and structures of all types. Artistic interest is an interest in other human creative skills, like sculpture."
- Historic interest: "An interest in past lives and events (including pre-historic). Heritage assets can illustrate or be associated with them. Heritage assets with historic interest not only provide a material record of our nation's history but can also provide meaning for communities derived from their collective experience of a place and can symbolise wider values such as faith and cultural identity."

20.4.3 Historic England's recently published guidance: *Statements of Heritage Significance: Analysing Significance in Heritage Assets, Historic England Advice Note 12* (2019),[78] concurs with the use of this terminology and methodology, both of which are thus adopted for the purposes of this report.

20.4.4 This approach allows for a detailed and justifiable determination of heritage significance and the interests from which that significance derives. In accordance with the NPPF and the PPG, the level of significance attributed to heritage assets is articulated as follows:

- **Designated heritage assets of the highest significance,** as identified in paragraph 194 of the NPPF, comprising Grade I and II* Listed buildings, Grade I and II* Registered Parks and Gardens, Scheduled Monuments, Protected Wreck Sites, World Heritage Sites and Registered Battlefields (and also including some Conservation Areas) and non-designated heritage assets of archaeological interest which are demonstrably of equivalent significance to Scheduled Monuments, as identified in footnote 63 of the NPPF;

[78] *Historic England, Statements of Heritage Significance: Analysing Significance in Heritage Assets, Historic England Advice Note 12 (Swindon, October 2019).*

- **Designated heritage assets of less than the highest significance,** as identified in paragraph 194 of the NPPF, comprising Grade II Listed buildings and Grade II Registered Parks and Gardens (and also some Conservation Areas); and
- **Non-designated heritage assets.** Non-designated heritage assets are defined within the PPG as "buildings, monuments, sites, places, areas or landscapes identified by plan-making bodies as having a degree of significance meriting consideration in planning decisions, but which do not meet the criteria for designated heritage assets".[79]

SETTINGS ASSESSMENT METHODOLOGY

20.4.5 Settings assessment was undertaken in accordance with the industry-standard methodology provided by Historic England in their *'Good Practice Advice in Planning Note 3: The Setting of Heritage Assets'* (revised 2017). This guidance promotes a 'stepped' (iterative) approach, as follows:

- **Step 1** assess which assets would be affected and identify their setting.
- **Step 2** assess the degree to which these settings and views make a contribution to the significance of the heritage asset(s) or allow significance to be appreciated.
- **Step 3** assess the effects of the proposed development, whether beneficial or harmful, on that significance or on the ability to appreciate it.
- **Step 4** explore ways to maximise enhancement and avoid or minimise harm.
- **Step 5** monitor outcomes.

STEP 1: IDENTIFY WHICH HERITAGE ASSETS AND THEIR SETTINGS ARE AFFECTED

20.4.6 The first objective of GPA3 Step 1 is essentially a scoping exercise, ensuring that the scope of the heritage settings assessment is proportionate and relevant.

20.4.7 Collected datasets (using sources identified in Table 20-1) will be processed and analysed using industry-standard GIS software in order to interrogate such factors as building height, line of sight, historic and extant surface features, built form, boundaries, vegetation, roads, and modes of pedestrian and vehicular movement, amongst others.

IMPACT ASSESSMENT METHODOLOGY

20.4.8 Potential development effects (impacts) are discussed in terms of harm to heritage significance with reference to the NPPF (2019), as follows:

- Substantial harm or total loss
- Being a level of harm that would "have such a serious impact on the significance of the asset that its significance was either vitiated altogether or very much reduced"; and
- Less than substantial harm
- Being any lesser level of harm than that defined above; recent case law has confirmed that this includes any level of harm (not considered substantial) regardless of its quantification, e.g., the finding of a 'negligible' level of harm must still be treated as less than substantial harm and be weighed in the balance under paragraph 196.

[79] *MHCLG, PPG, paragraph 039, reference ID: 18a-039-20190723.*

20.4.9 The Planning Policy Guidance provides that the category of harm identified for any given asset be 'explicitly identified', and that the extent of that harm be 'clearly articulated'. For purposes of this assessment, this is done with reference to a 'spectrum', e.g., at the lower/upper end of the spectrum of less than substantial.

20.4.10 The NPPF does not provide that harm to non-designated heritage assets be categorised as 'substantial' or 'less than substantial', only that the scale of any harm or loss is articulated.

20.4.11 As clarified in the High Court, preservation does not mean no change; it specifically means no harm. This is echoed in GPA 2, which states that "Change to heritage assets is inevitable but it is only harmful when significance is damaged".

20.4.12 The assessment of anticipated development effects can thus be seen to have been undertaken in accordance with a robust methodology, formulated within the context of current best practice, the relevant policy provisions, and key professional guidance.

DETAILED ASSESSMENT METHODOLOGY

LEGISLATION, PLANNING POLICY AND GUIDANCE

20.4.13 The EIA will address the requirements outlined in relevant legislation, national and local planning policy and guidance.

20.4.14 The National Policy Statement sets out the following requirements that are of particular relevance to the Archaeology and Cultural Heritage assessment:

Overarching National Policy Statements EN – 1 (Energy)[80] and EN – 3 (Renewable Energy Infrastructure)[81] (published by the Department of Energy and Climate Change July 2011) contain sections 5.8 and 2.5.34 respectively, which outline the need to assess potential impacts on the historic environment, and for planning authorities to balance potential harm against need to deliver national targets for renewable energy and emissions reductions.

Section 5.8.18 in EN – 1 discusses the potential effects from new development to the setting of designated heritage assets and states that planning authorities should seek to "preserve those elements of the setting that make a positive contribution to, or better reveal the significance of, the asset".

20.4.15 Chapter 1 of this Scoping Report notes that the NPSs are currently being reviewed and will be superseded following the ongoing consultation on the draft NPSs. The assessment will take into account the policy requirements set out in the NPS that is formally adopted at the time.

80 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf

81 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47856/1940-nps-renewable-energy-en3.pdf

20.4.16 The key relevant legislation comprises

- The Planning (Listed Buildings and Conservation Areas) Act 1990 for listed buildings and conservation areas;
- The Ancient Monuments and Archaeological Areas Act 1979 (as amended) for scheduled monuments and Archaeological Areas of Importance; and
- Hedgerows Regulations 1997 for hedgerows considered historically important under the Regulations.

20.4.17 National planning policy is set out in NPPF (Ministry of Housing, Communities and Local Government (MHCLG) 2019). This recognises that heritage assets are an irreplaceable resource and places weight on the conservation of designated assets. It requires planning authorities to favour schemes which enhance the settings of designated heritage assets and to consider effects on non-designated heritage assets. It requires assessment to be proportionate to the importance of the assets assessed. Developers are required to mitigate any harm to or loss of heritage assets by recording and advancing understanding of them and by making any evidence produced publicly available.

20.4.18 Relevant local planning policies are set out in:

- Tendring District Local Plan 2013-2033 and Beyond: North Essex Authorities' Shared Strategic Section 1 Plan;
- Colchester Borough Local Plan 2013-2033;
- East Suffolk Council Suffolk Coastal Local Plan; and
- East Suffolk Council Waveney Local Plan.

20.4.19 The assessment will be carried out in accordance with the relevant historic environment guidance. The key relevant guidance is:

- Historic England:
  - Managing Significance in Decision-Taking in the Historic Environment (Historic Environment Good Practice Advice in Planning 2) 2015,
  - The setting of Heritage Assets (Historic Environment Good Practice Advice in Planning 3)
  - Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment (English Heritage) 2008.
- The Chartered Institute for Archaeologists:
  - Standard and Guidance for Historic Environment Desk-Based Assessment, 2014 updated 2017;
  - Standard and Guidance for Archaeological Field Evaluation, 2014;
  - Standard and Guidance for archaeological Geophysical Survey, 2014; and
  - Standard and Guidance for Archaeological Excavation, 2014.

ASSESSMENT OF DIRECT IMPACTS

20.4.20 Assessment of direct impacts will be informed by the archaeology desk-based assessment, site walkovers, and any additional surveys that may be required.

20.4.21 Site walkover inspections and review of historical aerial photography data (See Historic England's National Mapping Programme Table 21.1) will be carried out over the final onshore export cable route (including landfall) area and intertidal area) and substation location to establish the condition of known heritage assets and identify the potential for the existence of additional assets not currently identified in the HER or National Heritage List (including built structures, earthworks, but also other relevant data such as surface artefacts and visible evidence of existing ground disturbance). It will also assist with identifying suitable ground conditions for other surveys such as geophysics that may be required.

20.4.22 The combined results of the desk-based assessment and site walkover inspections will identify currently un-investigated areas of ground where disturbance from the construction of the onshore export cable route and substation site could occur. Route refinement in these areas will be considered and then if required, further investigations at these locations will be undertaken such as geophysical survey and trial trenching. All survey work will be specified in a Written Scheme of Investigation and approved by the Essex County Council Planning Archaeologist prior to commencement.

ASSESSMENT OF INDIRECT IMPACTS

20.4.23 The historic landscape and other settings assessment will inform the assessment of indirect impacts.

20.4.24 ZTVs of the onshore substations, air photographs (for vegetation and built screening) and computer modelling and professional judgement of other potential effects (such as noise, air quality) will be used to identify potentially affected heritage assets within the refined study areas.

20.4.25 Where it is found that the proposed change to the setting will not affect the significance of specific assets this will be noted in the ES and no further assessment of those assets undertaken.

20.4.26 The settings of potentially affected assets will initially be identified on a desk-based basis. Assets receiving potentially significant indirect impacts through change in setting will be inspected along with their settings to help understand the contribution of setting, both positive and negative, to significance.

20.4.27 A review of cultural heritage assets located onshore which might be susceptible to significant change as a result of the presence of WTGs will be undertaken to identify relevant sensitive receptors with reference to the asset clusters below (Table 20-2). It is proposed that the assessment for the potential onshore visual impacts from the offshore turbines will be limited to specific assets whose heritage significance is related to maritime and long distance views that might be changed by the proposed offshore array such as port facilities, lighthouses, castles or hillforts.

20.4.28 It is not proposed that all DHAs within the Archaeology and Coastal Study Areas would need detailed assessment, but a representative selection of these might require computer modelling (wirelines and/or photomontages) to assist in compiling a robust evidence base for assessment. Some of these locations might coincide with the Landscape and Visual Impact Assessment viewpoints, and SLVIA viewpoints for heritage assets.

20.4.29 The final cultural heritage assets will be agreed with relevant stakeholders including Essex County Council, Suffolk County Council, East Suffolk Council and Historic England

Table 20-2 Proposed Coastal Asset Clusters for Offshore Settings Assessment

ASSET CLUSTER LOCATION	JUSTIFICATION	OS GRID REFERENCE
Lowestoft	Representative of coastal assets at the northern extent of the 60km buffer	TM 54552 91879
Southwold	High density of assets facing VE array areas	TM 50994 76060
Dunwich	Two SMs facing VE arrays	TM 47925 70511
Aldeburgh	High density of assets facing VE array areas	TM 46553 56634
Orford	High density of assets facing VE array areas and nearest (37km)	TM 43843 48430
Felixstowe	High density of assets facing VE array areas	TM 31505 34906
Walton-on-the-Naze	High density of assets facing VE array areas, representative of Essex coast views	TM 25476 21785

POTENTIAL PROJECT IMPACTS

20.4.30 A range of potential impacts on Cultural Heritage and Archaeology have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 20-3 - Impacts proposed to be scoped into the assessment for Cultural Heritage, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) to enable an assessment of the impact.

20.4.31 Based on the baseline environment information currently available and the project description (outlined in Chapter 3: Project Description) a number of impacts are proposed to be scoped out of the EIA for Cultural Heritage and Archaeology. These impacts are outlined in Table 20-4, together with a justification for scoping them out.

Table 20-3 - Impacts proposed to be scoped into the assessment for Cultural Heritage

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
20.1	Direct permanent	The impact of construction activities such as onshore export cable route and substation would involve groundworks which are likely to physically disturb and damage any buried archaeological remains.	Desk-study of known assets, field visit walk-over survey, geophysical prospection, and intrusive trial trenching to identify survival of previously unknown historic assets.
20.2	Direct Permanent	The impact of construction activities relating to the cable at the landfall. These activities are likely to cause direct harm to any heritage assets (known or unknown) in the intertidal zone, if construction works are required in this area.	Desk-study of known assets, field visit walk-over survey, geophysical prospection, and collaborate with marine archaeologists to identify survival of previously unknown historic assets and design mitigation.
20.3	Indirect temporary	The construction of substation and export cable route might result in temporary impacts on designated historic assets within the defined study areas. This includes coastal	Assessment of visual, noise, air quality impacts on designated heritage assets that might be affected whilst construction is in progress through comparison of

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		assets around the landfall area.	existing baseline conditions against predicted change.
OPERATION			
20.4	Indirect permanent	The impact of onshore structures such as substations receptors which would remain for the lifetime of the wind farm would be considered permanent through change to heritage significance due to development within the setting of the heritage asset.	Identify potentially affected assets, analyse the heritage significance of assets, and what within their setting contributes to that significance; assess how the significance would be changed by the proposed development. In addition to synthesis of existing knowledge, a site visit would be conducted to see the asset in its setting, and visual modelling may be used to help assess the final effect.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
20.5	Indirect permanent	The impact of tall offshore structures (turbines) which would remain for the lifetime of the wind farm would be considered permanent through change to heritage significance due to development within the setting of the heritage asset.	Identify potentially affected assets, analyse the heritage significance of assets, and what within their setting contributes to that significance; assess how the significance would be changed by the proposed development. In addition to synthesis of existing knowledge, site visits to selected asset clusters (, and visual modelling may be used to help assess the final effect.
DECOMMISSIONING			
20.6	Indirect temporary	The demolition of the substation could result in temporary impacts on designated historic assets within the defined study area	Inner study area: assessment of visual, noise, air quality impacts on designated heritage assets that might be affected whilst demolition is in progress through comparison of existing baseline conditions against predicted change.

Table 20-4 Impacts proposed to be scoped out of assessment for Cultural Heritage

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
CONSTRUCTION		
20.7	Settings impact on assets greater than 500m away from the centre point of the onshore cable routes and other temporary disturbances (indirect permanent)	Harm resulting from cable routes will occur as a result of disturbance to the area during the construction phase. As such, harm will be more likely to result from noise and construction activity rather than damage to landscape settings or spatial relationships. Therefore a smaller, more focused assessment area of 500m around the centre point of the cable routes would form the best approach
OPERATION		
20.8	Settings impact on assets greater than 2km away from permanent onshore installations I.e. the substation (indirect permanent)	Visibility of the onshore installations beyond 2km is extremely limited and beyond this distance direct spatial relationships between the asset and the final substation location are not likely to be present.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

20.4.32 As part of the design process for VE a number of designed-in measures are proposed to reduce the potential for impacts on onshore heritage assets. These are presented below. These will evolve over the development process as the EIA progresses and in response to consultation.

20.4.33 VE are committed to implement these measures, and also various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/out.

20.4.34 The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

20.4.35 A holistic approach to mitigation across all disciplines will be provided but will include the implementation of a CoCP which will be followed throughout construction of the onshore export cable and substation.

20.4.36 Mitigation of unavoidable direct physical impacts will include archaeological investigation, recording, analysis and dissemination of the results. This will be designed following the EIA and detailed within a Written Scheme of Investigation.

20.4.37 Mitigation of visual impacts from the substation could include screening by planting trees or hedges in particularly sensitive locations.

20.4.38 Mitigation of visual impacts from onshore export cable installation could where possible (and feasible) in the location, include full or partial restoration of the pre-construction landscape features.

POTENTIAL CUMULATIVE EFFECTS

20.4.39 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the cumulative impact assessment (CIA). For Cultural Heritage, cumulative interactions may occur with other planned projects and developments in the study area. A cumulative effect is considered to occur when there is:

- An effect on an asset or group of assets due to changes which would be caused by the main development under assessment; and
- An effect on the same asset or groups of assets which would be caused by another development or developments.

20.4.40 Consideration of the other potential contributor developments on the settings of coastal heritage assets would be limited to those of the following kind:

- Wind farm developments which have been applied for with decision pending; and
- Wind farm developments which been granted permission but not yet implemented.

20.4.41 Effects from operational wind farms would be included in the baseline position.

20.4.42 Consultation with Essex County Council, Suffolk County Council and East Suffolk County Council will assist with identifying any developments to be considered within the cumulative assessment.

20.4.43 Potential cumulative impacts with other projects and activities are synonymous with those considered for the project alone and as listed in Table 20-3 - Impacts proposed to be scoped into the assessment for Cultural Heritage Table 20-3.

20.5 SUMMARY OF NEXT STEPS

20.5.1 Impacts to coastal cultural heritage assets will be undertaken in coordination with the SLVIA and associated visual models will be used to help identify further potential assets for assessment due to visibility of the offshore turbines.

20.5.2 Assess HE baseline data such as HER monuments information, previous archaeological work and historic landscape characterisation to ensure correct areas are covered. Additional data will also be acquired for the western part of the Archaeology Study Area through Essex County Council. This will inform both the Historic Environment and settings assessment and the archaeological desk-based assessment and determine the scope of any geophysical survey and evaluation required. Once the export cable route, landfall and substation location have been decided, a staged approach for preliminary desk studies, geophysical surveys and trial trenching in any agreed locations, would be undertaken to establish the baseline.

20.5.3 A ZTV would be used to assist with identifying which assets would need settings assessment due to potential indirect visual impacts from the substation within the refined study area (2km).

20.5.4 Identify intertidal area where there may be direct or indirect effects from construction activities and conduct any required surveys and assessments.

20.5.5 Conduct a settings assessment to determine impact on coastal assets resulting from VE array areas through photographs and wirelines (provisionally from locations identified in Table 20-2). Consultation with stakeholders will be undertaken through the Evidence Plan process to confirm appropriate coastal cultural heritage assets for assessment.

20.5.6 The assets to be assessed, will be reviewed in consultation with the historic environment stakeholders (Essex County Council, Suffolk County Council and Historic England).

20.5.7 Any required fieldwork (for example, trial trench evaluation, monitoring and/or mitigation excavation) will be designed in a Written Scheme of Investigation and approved by the Planning Archaeologist.

20.6 FURTHER CONSIDERATION FOR CONSULTEES

- Do you agree that the data sources identified are sufficient to inform the onshore Archaeology and Cultural Heritage baseline for the VE PEIR and ES?
- Do you agree that all the designated assets within the study areas have been identified?
- Have all potential impacts resulting from VE been identified for archaeology and cultural heritage receptors?
- Do you agree that the impacts described in Table 20-4 can be scoped out?
- For those impacts scoped in Table 20-3, do you agree that the methods described are sufficient to inform a robust impact assessment?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of VE on Archaeology and Cultural Heritage receptors?
- Do you have any specific requirements for the Archaeology and Cultural Heritage methodology?

21. AIRBOURNE NOISE AND VIBRATION

21.1 INTRODUCTION

21.1.1 This section of the Scoping Report identifies the noise and vibration sensitive receptors of relevance to the VE onshore AoS, which includes landfall works, cable routes and the OnSS.

21.1.2 This section describes the potential noise and vibration effects from the onshore construction, operation and maintenance, and decommissioning of VE on sensitive receptors and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented. As the VE array boundaries (both north and south) lie approximately 37.3 km away from the Suffolk coastline, noise from the construction, operation and maintenance and decommissioning activities for VE is not anticipated to be audible to onshore noise sensitive receptors. No assessment will therefore be undertaken for activities within the array areas.

21.1.3 Noise and vibration associated with landfall, substation and export cable construction activities in the nearshore area will be considered.

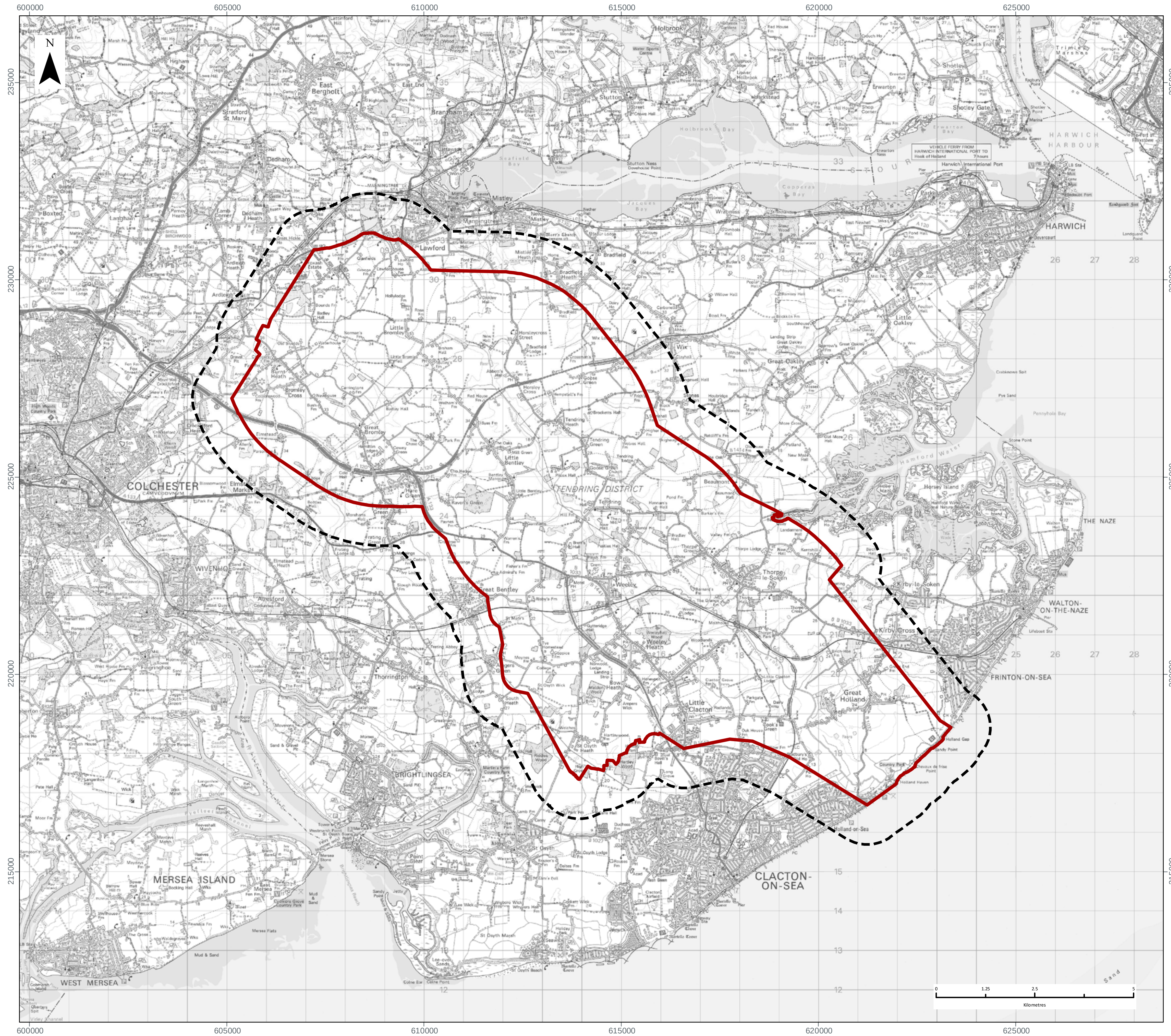
21.2 STUDY AREA

21.2.1 For the purposes of the EIA in respect of acoustics, it is proposed that the onshore acoustic study area will comprise a 1km corridor around the AoS. The 1km buffer has been adopted as this will pick up the closest noise-sensitive receptors (NSRs) likely to be impacted upon by the OnSS, cable route and landfall construction and the operation of the substation.

21.2.2 For the nearshore export cable construction activities, a boundary of 1km from MHWS at the landfall area will be considered for onshore sensitive noise receptors.

21.2.3 The Acoustic study area will be reviewed throughout the EIA lifecycle, upon refinement of the onshore working areas, such as the preferred onshore cable route, landfall, OnSS, location of construction compounds and HDD works, following identification of environmental/ engineering constraints and/ or feedback from consultees.

21.2.4 This is expected to result in a significant reduction in the size of the study area for the purposes of the PEIR and ES. Refinements to the study area, and consequential impacts on receptors will be fully evaluated and communicated to consultees via the Evidence Plan Process.



LEGEND

Onshore Area of Search

Onshore Area of Search 1 km Buffer

Data Source:
© Crown copyright [and database rights] (2021) 0100031673 OS OpenData.

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

AIRBOURNE STUDY AREA

VER	DATE	REMARKS	Drawn	Checked
1	28/09/2021	For Issue	JRS	SF

DRAWING NUMBER:

21.1

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:100,000	A3	ODN	British National Grid

FIVE ESTUARIES OFFSHORE WIND FARM

\\gisfs1\G\Projects\05356 - GoBe Consultants Ltd\00010 Five Estuaries\Tech\GIS\Dwgs\Wiking\2021 07 Scoping\Acoustic\05356.00010.0041.0 Airbourne Study Area .mxd

21.3 BASELINE DATA

21.3.1 No baseline sound monitoring has been undertaken to date. The survey locations will be identified from a review of the study area, and the locations will be representative of the closest NSRs. The survey locations for these baseline surveys will be agreed with Environmental Health Officers (EHO) of Essex County Council and Tendring District Council as appropriate.

21.3.2 It is envisaged that the surveys will be undertaken during suitable weather conditions over a 96-hour period to include a weekend. The measured noise data will be used to derive ambient and background sound levels for both daytime and night-time periods and implemented for assessment of the operational substation. The surveys and data screening will be in accordance with the requirements of British Standard BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' and British Standard 7445:1991 'Description and measurement of environmental noise Part 2: Guide to the acquisition of data pertinent to land use'.

21.3.3 Baseline data contained within ES for ScottishPower Renewables' East Anglia One North and East Anglia Two projects and other past and ongoing projects in the local area such as the original Galloper or Greater Gabbard OWF (Offshore Wind Farm) proposals or the Sizewell C proposals will be reviewed, and where appropriate, any relevant background information be considered for use in this assessment. Whilst data within these studies will be helpful to provide background context to proposed developments in the area they will not be used as a substitute for the specific baseline surveys which will be undertaken in accordance with the methodology described in paragraph 21.3.2.

21.4 BASELINE ENVIRONMENT

21.4.1 A large proportion of the study area, is located within rural locations, which are likely to be indicative of low ambient noise levels. These rural locations are ranked moderate to high in terms of tranquillity according to the Campaign to Protect Rural England tranquillity maps of England. However, the urban areas including some of the towns/villages and associated road network within the study area are rated less tranquil.

DESIGNATED SITES

21.4.2 There are no international, national or local designations specifically related to matters of noise and vibration, or how it should be controlled. Noise and vibration effects have the potential to impact upon sensitive receptors, including residential properties, members of the public using publicly accessible resources (for example, public rights of way (PROWs), common land, playing fields, visitor attractions), wildlife, commercial properties and designated heritage assets.

21.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

PROPOSED ASSESSMENT METHODOLOGY

21.5.1 The assessment will be conducted in accordance with The Guidelines for Environmental Noise Impact Assessment, produced by the Institute of Environmental Management and Assessment (IEMA), and published in October 2014.

21.5.2 The guidelines address the key principles of noise impact assessment and are applicable to all development proposals where noise effects are likely to occur. The guidelines provide specific support on how noise impact assessments fit within the EIA process. They cover:

- How to scope a noise assessment;
- Issues to be considered when defining the baseline noise environment;
- Prediction of changes in noise levels as a result of implementing development proposals; and
- Definition and evaluation of the significance of the effect of changes in noise levels.

21.5.3 Construction noise will be assessed in accordance with BS5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise. This standard sets out a methodology for predicting noise levels arising from a wide variety of construction and related activities and contains tables of sound power levels generated by a wide variety of mobile and fixed plant equipment.

21.5.4 Compliance with BS5228-1:2009+A1:2014 is expected when assessing the impact of construction noise upon the existing noise environment at nearby sensitive receptors.

21.5.5 Noise generated by construction traffic will be assessed in accordance with the guidance in the Design Manual for Roads and Bridges LA111 (DMRB). The additional vehicles associated with the development (i.e. off-site traffic during construction) will be undertaken based on the results of a transport assessment (refer to Transport Chapter) and with reference to the DMRB.

21.5.6 The effects of vibration resulting from construction activities will be assessed in accordance with BS5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration. This standard sets out recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels, including industry-specific guidance. Guidance is provided concerning methods of measuring vibration and assessing its effects on the environment.

21.5.7 Compliance with BS5228-1:2009+A1:2014 is expected when assessing the impact of construction vibration upon the existing vibration environment at nearby sensitive receptors.

21.5.8 Operational sound associated with the OnSS only, will be assessed in accordance with BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound. This standard is intended to be used to assess the potential adverse impact of sound, of an industrial and/or commercial nature, at nearby sensitive receptor locations within the context of the existing sound environment.

21.5.9 The assessment of impacts contained in BS4142:2014+A1:2019 is undertaken by comparing the sound rating level, i.e. the specific sound level of the source plus any penalties, to the measured representative background sound level immediately outside the sensitive receptor location. Consideration is then given to the context of the existing sound environment at the sensitive receptor location to assess the potential impact.

21.5.10 The operational sound associated with the OnSS will also be assessed with reference to the principles of NANR45 Procedure for the assessment of low frequency noise complaints. This guidance is primarily intended to be used as a procedure to determine whether low frequency sound that might be expected to cause disturbance is present in a complainant's premises; however, the guidance does contain procedures and internal noise limits which will be beneficial for the assessment of any potential low frequency noise.

21.5.11 For ecological receptors, the assessment of noise effects during construction and operation will make reference to AQTAG09 (Air Quality Technical Advisory Group 09), Guidance on the effects of industrial noise on wildlife, which is intended to be used to assess the potential adverse impact of sound, of an industrial and/or commercial nature on wildlife. The guidance enables planning officers involved with Pollution Prevention and Control applications for installations with relevant noise emissions and relates these to the requirements of the Habitats Regulations.

21.5.12 The effects of noise arising from the construction and operation of offshore infrastructure on marine wildlife will be assessed in the relevant offshore technical chapters.

21.6 POTENTIAL PROJECT IMPACTS

21.6.1 A range of potential impacts of noise and vibration have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts have been scoped into the VE EIA and outlined in Table 21.1, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) to enable an assessment of the impact.

21.6.2 Based on the baseline information currently available and the project description (outlined in Chapter 3: Project Description), a number of impacts are proposed to be scoped out of the EIA for this topic. These impacts are described in Table 21.2, together with a justification for scoping them out.

Table 21.1 - Impacts proposed to be scoped in to the assessment for onshore noise and vibration

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
21.1	Temporary increase in noise and vibration due to onshore cable route construction.	The impact of noise and vibration from construction activities due to the onshore cable route construction phase. The main noise sources from construction activities to include HDD at railway and major road crossings, operational mobile plant for trenching / excavation and associated HGV movements. This is applicable for the selected landfall location and the associated onshore cable corridor where underground cable installation passes close to NSRs.	A desk-based study to identify noise and vibration sensitive receptors will be undertaken and where appropriate baseline measurements will be made at representative NSR locations agreed with the Environmental Health Officer (EHO) for ECC as appropriate. The noise levels associated with construction will be predicted at the identified NSRs implementing the proprietary noise modelling software CadnaA®, which incorporates the calculation methodology outlined in BS5228:2009+A1:2014. The predicted noise levels will then be assessed in accordance with BS5228:2009+A1:2014 Part 1 – Noise. The vibration levels associated with each construction phase will be predicted and assessed in accordance with BS5228:2009+A1:2014 Part 2 – Vibration. The significance of effects will be determined with reference to the IEMA Guidelines. The

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			results of the modelling and prediction work will be assessed in accordance with the relevant criteria to identify the significance of construction noise and vibration impacts. Where appropriate, specific mitigation measures will be detailed to prevent, reduce or offset any significant adverse effects, and residual effects to an acceptable level.
21.2	Temporary increase in noise and vibration due to onshore substation and landfall construction.	The impact of noise and vibration from construction activities due to the substation and landfall construction (including HDD) phase on the nearest noise and vibration sensitive receptors	As above for noise and vibration impact number 22.1.
21.3	Temporary increase in noise levels due to construction traffic.	The impact of noise due to the increase in the number of construction related vehicles at the nearest NSRs during the onshore cable route, substation construction and landfall construction phases.	A desk-based study to identify noise sensitive receptors along the construction haul routes will be undertaken. The specific sound levels generated by construction traffic movements travelling to and from the site will be predicted at the properties using CadnaA® and the calculation methodologies contained in BS5228:2009+A1:2014. The predicted noise levels will then be assessed in accordance with DMRB. The significance of effects will be determined with reference to the IEMA Guidelines. The

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			results of the modelling and prediction work will be assessed in accordance with the relevant criteria to identify the significance of construction traffic impacts. Where appropriate, specific mitigation measures will be detailed to ensure residual effects are at an acceptable level.
21.4	Temporary increase in noise and vibration due to offshore construction activities along the nearshore export cable route	The impact of noise and vibration from construction activities due to the offshore construction phase on the nearest noise and vibration sensitive receptors. Offshore construction noise may arise from; vessel movements and cable laying.	For onshore receptors, as above for noise and vibration impact number 22.1. For offshore receptors, assessments will be in accordance with The Merchant Shipping and Fishing Vessels Control of Noise at Work Regulations for occupational receptors and the Offshore Technology Report for offshore accommodation receptors.
21.5	Temporary increase in noise due to construction activities on wildlife.	The impact of construction noise on the nearest ecological receptors	A desk-based study to identify ecological receptors and cross reference with ecology/ornithology for data relating to designated nature conservation areas and sensitive species from publicly available sources. The specific sound levels generated by construction activities will be predicted at the ecological receptors using CadnaA® and the calculation methodologies contained in BS5228:2009+A1:2014.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			The predicted noise level will be assessed at the nearest ecological receptors in conjunction with AQTAG09. In accordance with the IEMA Guidelines noise impact may be determined by comparing the predicted noise level with an absolute noise limit. The significance of any effects will be determined and if necessary, mitigation measures proposed.
OPERATION			
21.6	Operation of the onshore substation on the nearest noise sensitive receptors.	The impact of noise due to the operational substation on the nearest NSRs.	A desk-based study to identify noise sensitive receptors will be undertaken and where appropriate baseline noise measurements will be made. The noise levels associated with the operation of the substation will be predicted at the identified NSRs implementing the proprietary noise modelling software CadnaA®, which incorporates the calculation methodology in this instance the calculation algorithms contained in ISO 9613-2:1996-2 will be utilised. The predicted noise levels will be assessed at the nearest noise-sensitive receptors in conjunction with BS4142:2014+A1:2019.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			Low frequency noise (LFN) associated with the operation of the substation will also be assessed at the nearest receptors in conjunction with the principles of NANR45. The significance of effects will be determined with reference to the IEMA Guidelines. Predicted noise levels will be assessed in accordance with the relevant criteria to identify the significance of operational impacts. Where appropriate, specific mitigation measures will be detailed to ensure residual effects are at an acceptable level.
21.7	Operation of the onshore substation on wildlife.	The impact of noise due to the operational substation on the nearest ecological receptors.	A desk-based study to identify ecological receptors will be undertaken and where appropriate baseline noise measurements will be made. The noise levels associated with the operation of the substation will be predicted at the identified NSRs implementing the proprietary noise modelling software CadnaA®, which incorporates the calculation methodology in this instance the calculation algorithms contained in ISO 9613-2:1996-2 will be utilised. The predicted noise level will be assessed at the nearest ecological receptors in conjunction with AQTAG09.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			The significance of effects will be determined with reference to the IEMA Guidelines. Predicted noise levels will be assessed in accordance with the relevant criteria to identify the significance of operational impacts on ecological receptors. Where appropriate, specific mitigation measures will be detailed to ensure residual effects are at an acceptable level.
DECOMMISSIONING			
21.8	Temporary increase in noise and vibration as a result of cable decommissioning.	The decommissioning of the VE onshore cable could directly affect sensitive receptors.	As above for noise and vibration impact number 22.1. It is assumed that the potential impacts associated with the decommissioning phase will be similar to, and no worse than, those presented for the construction phases.
21.9	Temporary increase in noise and vibration as a result of the decommissioning of the onshore substation.	The decommissioning of the onshore substations could directly affect sensitive receptors.	As above for noise and vibration impact number 22.1. It is assumed that the potential impacts associated with the decommissioning phase will be similar to, and no worse than, those presented for the construction phases.

Table 21.2 - Impacts proposed to be scoped out to the assessment for onshore noise and vibration

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
21.10	Vibration effects arising from the operation of the substation.	It is considered unlikely that the operation of the substation will lead to any significant vibration effects. Therefore, subject to consultation with the EHO and feedback received on this Scoping Report, it is intended to scope this impact out of further consideration within the EIA.
21.11	Noise and vibration effects associated with the operation of the underground cable.	The operation of the underground cable will not lead to any significant noise and vibration effects. Therefore, subject to consultation with the EHO and feedback received on this Scoping Report, it is intended to scope this impact out of further consideration within the EIA.
21.12	Construction, operation and maintenance and decommissioning of the offshore extent of the export cable route and the VE array areas on the nearest onshore NSRs.	The noise from construction, operation and maintenance, and decommissioning on onshore NSRs is intended to be scoped out of further assessment due to the distance of the proposed offshore extent of the export cable route and the VE array areas from the coastline. The array area boundary is located approximately 37.3 km from the closest area of coastline on the Suffolk coast. Noise for the construction, operation and maintenance, and decommissioning of the offshore export cable and array is therefore not anticipated to be audible to onshore NSRs.

21.7 MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

21.7.1 As part of the design process for VE a number of designed-in measures are proposed to reduce the potential for impacts on noise and vibration receptors. These are presented below. These will evolve over the development process as the EIA progresses and in response to consultation

21.7.2 VE OWFL are committed to implement these measures, and various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/out presented in Table 21.1 and Table 21.2.

21.7.3 The adoption of Best Practicable Means (BPM) is usually the most effective means of controlling noise from construction sites and measures may include:

> All plant will have noise emission levels that comply with the limiting levels defined in European Commission Directive 2000/14/EC8, and any subsequent amendments;

> Consideration will be given to the recommendations set out in Annex B of BS5228-1:2009+A1:2014 with respect to noise sources, remedies and their effectiveness;

> Plant and materials will be operated and handled in a proper manner with respect to minimising noise emissions, e.g. no unnecessary revving of engines, minimising drop heights, etc.; and

> Plant will be subject to regular maintenance and kept in good working order in meet manufacturers' noise emission levels.

21.7.4 BPM will also be implemented to minimise the effects of vibration from construction activities. Measures provided to illustrate the range of techniques available may include:

> Where practicable, stationary plant will be isolated using resilient mountings, e.g. for generators, pumps, etc.;

> Plant will be operated in a proper manner with respect to minimising vibrations, e.g. low vibration working methods will be employed;

> Consideration will be given to the most suitable plant and hours of working for the operations which may give rise to perceptible vibrations and where practicable, these will be replaced by less intrusive plant and/or working methods; and

> Control of vibration at sources, where practicable, by reducing the speed of plant, e.g. limiting the rotational speed or progress rate.

21.7.5 With regards to the operational noise of the VE OnSS the requirement and feasibility of any mitigation measures will be dependent on the significance of the effects on noise and vibration. The requirement and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

21.8 POTENTIAL CUMULATIVE IMPACTS

21.8.1 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For airbourne noise and vibration, cumulative interactions may occur with other planned projects and developments in the study area. Potential cumulative impacts with other projects and activities will be considered for each of the impacts considered in Table 21.1.

21.8.2 The predicted effects of construction and operation from VE on noise and vibration are considered to be localised to within the noise and vibration study area. However, there is the potential for cumulative effects to occur from other projects or activities within the VE noise and vibration study area where projects or plans could act collectively with VE to affect sensitive receptors. The cumulative assessment will consider projects that are likely to produce levels of noise within 10 dB of that from VE at the same time at the considered receptor location. Other projects, where noise is generated at a lower level or during a period that does not coincide with VE will not be included in the cumulative assessment.

21.8.3 The following projects or activities will be considered within the onshore study area:

- Other offshore wind farms and associated onshore cabling and infrastructure;
- Onshore energy generation projects (excluding householder scale projects);
- Onshore electrical transmission projects;
- Road and rail projects;
- Major residential, commercial and leisure projects; and
- Minerals extraction and landfill projects.

21.8.4 VE will monitor the status of identified and emerging projects throughout the pre-application phase and consider these within the assessment of cumulative impacts within the EIA as necessary.

21.9 POTENTIAL TRANSBOUNDARY IMPACTS

21.9.1 Due to the localised nature of any potential impacts, transboundary impacts are unlikely to occur and therefore this impact will be scoped out from further consideration within the EIA.

21.10 SUMMARY OF NEXT STEPS

21.10.1 Once the noise and vibration study area has been refined following selection of the preferred VE landfall, onshore cable corridor and onshore substation location, baseline conditions will be established by undertaking baseline noise surveys. The survey locations will be identified from a review of the proposed cable corridor and locations of the substation, landfall works and the closest NSRs to the development area. Survey locations will be agreed with EHO of ECC , through ongoing engagement.

21.11 FURTHER CONSIDERATIONS FOR CONSULTEES

21.11.1 Specific questions relating to the scope of the noise and vibration assessment are detailed below:

- Do you agree that the proposed surveys will be sufficient to inform the onshore noise baseline for VE and the associated EIA, subject to further consultation on locations once the landfall, cable route and substation location has been identified?
- Have all potential impacts resulting from VE been identified for the noise and vibration sensitive receptors?
- Do you agree that the impacts described in Table 21.2 can be scoped out?
- For those impacts scoped in Table 21.1, do you agree that the methods described are sufficient to inform a robust impact assessment?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of VE on noise and vibration sensitive receptors?
- Do you have any specific requirements for the noise and vibration modelling methodology?

22. TRAFFIC AND TRANSPORT

22.1 INTRODUCTION

22.1.1 This section of the Scoping Report will consider the potential environmental onshore traffic and transportation effects associated with the construction, operation and maintenance and decommissioning of VE, including effects on communities along access routes, users of Public Rights of Way (PROW), disruption to the railway and users of the local and strategic road networks. Cumulative effects will also be considered. The effects of noise from vehicular traffic resulting from the construction of the onshore components of VE is considered in Chapter 21: Airborne Noise and Vibration.

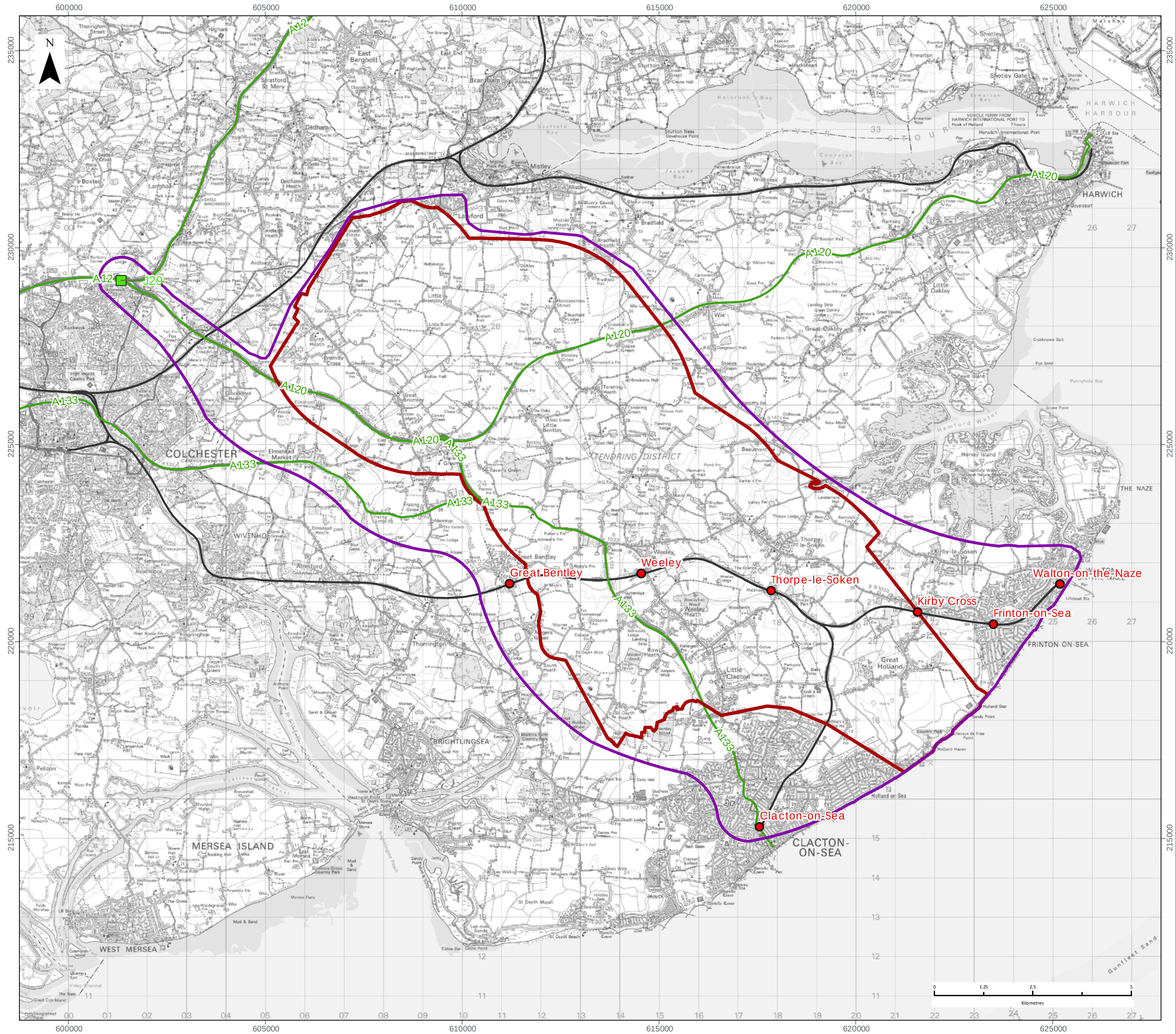
22.1.2 This chapter should be read alongside the following chapters of this Scoping Report:

- Chapter 21: Airborne Noise and Vibration;
- Chapter 23: Air Quality and Health;
- Chapter 26: Landscape and Visual;
- Chapter 27: Socioeconomics and Tourism; and
- Chapter 28: Health.

22.2 STUDY AREA

22.2.1 The study area as shown in Figure 22.1 for onshore traffic and transportation has been defined as the onshore AoS which has been increased to include for key routes into the onshore AoS for access to construction sites for the onshore VE infrastructure based on:

- The Strategic Road Network (SRN), for Heavy Goods Vehicle (HGV) movements and movements associated with the construction workforce; and
- Local settlements outside of the onshore AoS in which the construction workforce are likely to reside; e.g. Clacton-on-Sea, Frinton-on-Sea and Colchester.



LEGEND

- Onshore Area of Search
- Train Station
- A12 - Junction 29
- A Road Network
- Railway Line
- Traffic and Transport Study Area

Data Source:
© Crown copyright [and database rights] (2021) 0100031673 OS OpenData.

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

TRAFFIC AND TRANSPORT STUDY AREA

VER	DATE	REMARKS	Drawn	Checked
1	28/09/2021	For Issue	JRS	DM

DRAWING NUMBER:

22.1

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:100,000	A3	ODN	British National Grid

FIVE ESTUARIES
OFFSHORE WIND FARM

22.2.2 It is assumed that all potential traffic and transport impacts will either be at or near to the construction sites and on the routes identified above, which will be dependent on the location of the VE infrastructure.

22.2.3 The elements of the study area of relevance to traffic and transport includes the Local Road Network (LRN), the SRN, the Sunshine Coast Line (Railway) and a network of PROW. The study area and key transport infrastructure is indicated in Figure 22.1.

22.2.4 The LRN in the search area is maintained by Essex County Council (ECC) and predominantly comprises a number of ‘B’ and unclassified roads connecting various villages, and the A133 to the A12 via the A120, which are both part of the SRN and maintained by Highways England (HE). The A12, which is immediately to the west of the onshore AoS is the main route between the M25 London Orbital Motorway and Lowestoft, connecting the towns of Chelmsford, Colchester and Ipswich.

22.2.5 The Sunshine Coast Line, which runs through the southern section of the onshore AoS (some sections of the railway line are within the onshore AoS, some are outside of the onshore AoS) between Colchester and Clacton-on-Sea or Walton-on-the-Naze, with intermediate stations at Great Bentley, Weeley, Thorpe-le-Soken, Kirby Cross and Frinton-on-Sea. There is an extensive network of PROW throughout the onshore AoS, which is also considered in Chapter 26: Landscape and Visual and Chapter 27 Socioeconomics and Tourism.

22.2.6 The Study Area for the traffic and transport assessment will be reviewed and amended to take account of responses from stakeholders for the PEIR, and following identification of the final landfall location, the preferred onshore cable route, the onshore substation (OnSS) and any additional constraints (environmental and/ or engineering) identified through consultation. This is expected to result in a significant reduction in the size of the study area as it is refined to reflect the location of the construction sites and OnSS when these are selected (Please refer to Chapter 5 Site Selection and Alternatives). As the project progresses, and the study area refined, this will be discussed with relevant stakeholders through the Evidence Plan Process.

22.3 BASELINE DATA

The data used for the purposes of scoping is presented in Table 22.1.

Table 22.1 - Key sources of information for traffic and transport

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Department for Transport (DfT)	Traffic flow data on the LRN and SRN in the study area	This is a national dataset providing data on some highway links in the study area.
County Council website	Existing bus and rail routes serving the study area	Full coverage of the study area.
County Council website	Details of the PROWs	Full coverage of the study area

22.3.1 The following additional existing data are available and will be used to inform the PEIR and assessment within the ES, once the location of landfall, the preferred onshore cable route and OnSS have been identified:

- Collison data on the LRN from ECC and on the SRN from HE
- Existing pedestrian, cycle, bus and rail routes serving the study area (a detailed analysis);
- PROW network (a detailed analysis);
- Highway boundary plans to assess any new access onto the LRN;
- Details of Abnormal Indivisible Load (AIL) routes;
- Details of extant permissions (committed development) and associated traffic flows on the LRN and SRN in the study area; and
- Details of sensitive receptors (such as junctions operating over capacity, district centres, hospitals, schools, leisure facilities etc.).

22.3.2 Additional data will be obtained to inform the PEIR:

- Automatic Traffic Count (ATC) data on highway links (Classified, 24-hour, seven-day counts, including speeds); and
- Classified turning count data and queue lengths at junctions (07:00 to 10:00 and 16:00 to 19:00, weekday counts), if any sensitive junctions that are likely to see an increase of more than 30 two-way vehicle movements on any arm of the junction in the peak hours are identified.

22.3.3 It is proposed to undertake traffic surveys (ATCs, and peak period turning count data /queue lengths if required) to inform the assessment in PEIR and the DCO submission, in August 2022, with several sample surveys in a neutral month (with typical operating conditions on the highway network) to enable the consideration of the likely inflated baseline on the highway network associated with tourism.

22.3.4 The potential implications of seasonality in terms of any new traffic data collection and assessment will be discussed further and agreed through the Evidence Plan Process.

22.4 BASELINE ENVIRONMENT

HIGHWAY NETWORK

22.4.1 The highway network comprises a network of ‘B’ roads and two key ‘A’ roads (the A120 trunk road and the A133), which will provide the core access for construction traffic for VE. The A120 connects to the A12 at Junction 29 (Ardleigh Crown Interchange), which is a grade separated junction with an offline circulating carriageway above the A120 and long connecting on and off-slip roads to and from the A12.

22.4.2 To provide some context, Table 22.2 provides some current traffic flows (excluding any 2020 counts given the implications of the Covid-19 pandemic) using the DfT data, including HGV proportions, at key sections of the LRN and SRN in the study area.

22.4.3 Whilst the data in Table 22.2 is available (should it be required), whether it is used for PEIR and the ES will depend on the location of landfall, the preferred onshore cable route and the OnSS and the identification of routes on the highway network that will be used by traffic associated with VE. Some of the counts are estimated from previous years and therefore if it proposed to use it in the PEIR and ES, its use will be agreed with ECC and HE, as set out in Table 22.3.

Table 22.2 - Existing traffic count data (2-way AADT)

COUNT LOCATION	YEAR	TOTAL FLOW	HGV	HGV (%)
A133 at Little Clacton	2019 (estimated from 2018 manual count)	21,796	689	3.2
A133 north of B1033	2019 (estimated from 2017 manual count)	30,732	1,134	3.7
A120 east of A133	2019 (estimated from 2012 manual count)	12,561	1,591	12.7
A120 north of A133	2019 (estimated from 2017 manual count)	44,278	2,685	6.1
A12 east of A120	2019 manual count	60,190	5,704	9.5
A12 west of A120	2019 manual count	71,427	6,066	8.5

PUBLIC TRANSPORT

22.4.4 There are hourly rail services between the railway stations within the onshore AoS and Clacton-on-Sea, Walton-on-the-Naze, Colchester, Chelmsford and London Liverpool Street.

22.4.5 The bus network within the onshore AoS consists of inter-urban routes between Colchester, Clacton-on-Sea and Walton-on-the-Naze, and rural services connecting the villages between the urban centres. There are also local bus services that serve each of the urban areas and their hinterlands.

22.4.6 A detailed review of public transport provision within the onshore AoS will be undertaken once the location of landfall, the preferred onshore cable route and the OnSS have been defined. This review will identify opportunities for construction workers to travel to and from the construction sites by bus or rail.

PUBLIC RIGHTS OF WAY

22.4.7 The network of PROW within the onshore AoS consist of Footpaths, Bridleways and Restricted Byways and Byways.

22.4.8 A statutory definitive map is available to view at ECC offices (County Hall) and an interactive map for general purposes is available online at:

https://www.essexhighways.org/getting-around/public-rights-of-way/prow-interactive-map

22.4.9 A detailed review of the PROW will be undertaken once the location of landfall, the preferred onshore cable route and the OnSS have been defined. This will identify all PROW that will be affected (directly and indirectly) by construction activity and to identify any that require assessing in the ES.

22.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

PROPOSED ASSESSMENT METHODOLOGY

22.5.1 The assessment of potential traffic impacts will be undertaken with reference to the following key guidance documents:

- **Department for Communities and Local Government (DCLG) Planning Practice Guidance -** Overarching principles on Travel Plans, Transport Assessments and Statements. This contains overarching principles on Travel Plans, Transport Assessments and Statements;
- **Circular 02/2013: Strategic Road Network and the Delivery of Sustainable Development, Highways England (2013)** - This circular explains how Highways England will engage with the planning system. It also gives details on how Highways England will fulfill its remit to be a delivery partner for sustainable economic growth whilst maintaining, managing and operating a safe and efficient strategic road network. This document is currently under review;
- **Guidance for Environmental Assessment of Road Traffic (GEART).** This contains the principle guidelines for the assessment of the environmental impacts of road traffic associated with new developments. GEART was published by the Institute of Environmental Assessment in January 1993. The guidance provides a framework for the assessment of traffic borne environmental impacts, such as pedestrian severance and amenity, driver delay, accidents and safety; and noise, vibration and air quality; and
- **Design Manual for Roads and Bridges (DMRB) LA112 Population and Human Health, Highways England (2019)** gives guidance on assessing a scheme's impact on the journeys which people make in its locality. It considers journeys made by people as pedestrians (including ramblers), cyclists and equestrians.

22.5.2 The DCLG guidance sets out how the transport impacts of a proposed development on the highway and public transport networks should be assessed within a Transport Assessment and, should include measures to promote sustainable travel through the preparation of a Travel Plan and identify mitigation measures to address any impacts. These are the requirements for assessment as set out in the Overarching National Policy Statement for Energy (EN-1) (see Chapter 1) and therefore the assessment will take account of this guidance.

22.5.3 In terms of the assessment of the associated environmental impacts of a proposed development, GEART states that to determine the scale and extent of the assessment, and the level of effect a proposed development will have on the surrounding road network, the following two ‘rules’ should be followed:

- Rule 1 - Include road links where flows are predicted to increase by more than 30% or where the number of HGVs is predicted to increase by more than 30%; and
- Rule 2 - Include any other specifically sensitive areas where total traffic flows are predicted to increase by 10% or more.

22.5.4 Rules 1 and 2 are used as a screening tool to determine whether or not a full assessment of effects on routes within the refined study area is required as a result of intensification of road traffic. Where anticipated construction traffic volumes are not greater than 30% (or 10% at sensitive locations), a detailed assessment of effects is not necessary, as set out in Table 22.3.

22.5.5 The significance of likely effects will then be determined by the consideration of the sensitivity of receptors to change, taking account of the specific issues relating to the refined study area, and then the magnitude of that change, as set out in Table 22.3.

22.6 POTENTIAL PROJECT IMPACTS

22.6.1 At this stage, the traffic and transport assumptions regarding the construction phase of the onshore elements of VE are as follows:

- Deliveries by HGV will originate from the A12;
- There will be a series of construction compounds with direct access onto the LRN. The majority of HGV and Light Goods Vehicle (LGV) movements will be to and from these sites. The location of these is to be determined upon selection of the preferred route, the landfall location and the OnSS;
- Haul routes along the LRN will be identified and agreed with stakeholders between these compounds and the A12; and
- Trenchless installation techniques such as HDD will be used underneath any railways and major roads that the cable route needs to cross.

22.6.2 A range of potential impacts on traffic and transport have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 22.2, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) to enable an assessment of the impact.

22.6.3 Based on the baseline information currently available and the project description, a number of impacts are proposed to be scoped out of the EIA for traffic and transport. These impacts are outlined in Table 22.3, together with a justification for scoping them out.

Table 22.3 - Impacts proposed to be scoped in to the assessment for traffic and transport

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
22.1	Driver severance and delay	The potential delays to existing drivers and their potential severance from other areas	The expected vehicle movements (LGVs and HGVs) associated with the construction phase of the onshore elements of VE will be established (for each construction site and corresponding route from the A12 or settlement), using detailed project description information provided by VE OWFL and where necessary using previous project experience to inform the assessment using a range of assumptions, such as timing, frequency and distribution of movements. The peak period in terms of anticipated vehicle movements for each construction site, will be used as a worst-case scenario, for a robust assessment, which will be identified using an indicative construction programme. The forecast vehicle movements to and from each construction site will be agreed through the Evidence Plan Process prior to assessment and predicted profile across the day will be established. Where predicted construction traffic volumes are greater than the Rule 1 and 2 thresholds, the significance of the effects on receptors adjacent to highway links and junctions that form the haul routes from the A12 and routes used by vehicles associated with the construction workforce, will be evaluated using GEART. Existing traffic data will be reviewed, and new traffic counts (and queue length surveys where appropriate) will be commissioned where required, following a review of the

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			highway links / junctions to be included in the assessment. This will be undertaken upon confirmation of the preferred onshore cable route, landfall and OnSS location and establishment of the proposed routeing within the refined study area. Percentage impacts (total traffic and HGV) of the proposed development on Annual Average Daily Traffic (AADT) at the identified links will be established and based on the identification of GEART Rule 1 or Rule 2 for each link, the magnitude of impact will be established. GEART indicates that traffic flows will have to increase by more than 30% in order for a ‘slight’ change in severance to occur, 60% for a ‘moderate’ change to occur and 90% for a ‘substantial’ change to occur. The significance of effect will be determined based on the magnitude of impact, receptor sensitivity and professional judgement. GEART notes that the driver delays are only likely to be significant when the traffic on the network surrounding the development is already at, or close to, the capacity of the system. Junction capacity assessments will be undertaken at any sensitive locations on the LRN and SRN (to be agreed through the Evidence Plan Process) as part of the Transport Assessment element of the ES. The assessment of junction capacity and delay will be undertaken through the use of

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			standard practice analytical tools and junction analysis programs. For the potential delay to users of the highway links that may require a temporary closure (lane or road) to enable open trenching technology to be utilised for the onshore cable route, the assessment will be based on the relative importance of each link (including factors such as the types of suers affected, any disruption to access key services, disruption to bus services) and the availability of an alternative route, using professional judgement.
22.2	Community severance	The potential severance to communities	The AADT percentage impacts identified for Impact 23.6.1 will be used to assess against GEART, which indicates that traffic flows will have to increase by more than 30% in order for a 'slight' change in severance to occur, 60% for a 'moderate' change to occur and 90% for a 'substantial' change to occur. In addition to the GEART guidance, DMRB LA112 provides guidance to both the direct effects of a new scheme, and to effects caused by increases in traffic levels on existing roads. The guidance provides example definitions of the sensitivity to severance for walkers, cyclists and horse-riders at grade; a 'low' sensitivity with less than 4,000 AADT, a 'medium' sensitivity with 4,000 to 8,000 AADT, a 'high' sensitivity with over 8,000 to 16,000 AADT and a 'very high' sensitivity with over 16,000 AADT.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			The significance of effect will be determined based on the magnitude of impact (as per GEART), receptor sensitivity and professional judgement.
22.2	Road safety / vulnerable road users	The potential effect on users of the road, particularly. pedestrians/cyclists	An examination of the existing collisions occurring on the haul routes for construction over the previous three-year period will be undertaken to identify any areas of the highway with concentrations of collisions with similar patterns, or roads with collision rates that are higher than national averages (Road Casualties Great Britain, DfT, for the most recent year available) This will be undertaken upon confirmation of the location of landfall, the preferred onshore cable route and the OnSS and establishment of the proposed routeing within the refined study area. These sites will be considered sensitive to changes in traffic flows (sensitive receptors) and therefore a more detailed analysis of significance will be undertaken in the context of the proposals. The significance of effect will be determined based on the magnitude of impact, receptor sensitivity and professional judgement.
22.3	Dust and dirt	The potential effect of dust, dirt and other detritus being brought onto the road.	The AADT percentage impacts identified for Impact 23.6.1 will be used to assess against GEART. which indicates that traffic flows will have to increase by more than 30% in order for a ‘minor’ change to occur and 60% for a ‘moderate’ or ‘major’ change. The significance of effect will be determined

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			based on the magnitude of impact, receptor sensitivity and professional judgement.
22.4	Hazardous and dangerous loads	The potential effect on existing road users and local residents caused by the movement of abnormal loads.	A qualitative assessment of the proposed Abnormal Indivisable Load (AIL) will be undertaken. Once the haul route for any AIL has been identified, swept path analyses will be undertaken as part of an Abnormal Load Assessment Report (ALAR) to identify any sections of the route that might require improvements (which may be temporary) to ensure the safe movement of the AIL to the construction site. The significance of effect will be determined based on the magnitude of impact, receptor sensitivity and professional judgement.
22.5	Users of PROW	The potential effect of users of PROW	Upon confirmation of the location of landfall, the preferred onshore cable route and the OnSS, all PROW directly affected will be identified using the definitive map. This will take account of access roads and haul roads where these cross PROW, and any that connect to those and therefore, indirectly impacted. The qualitative assessment of the impacts of construction works affecting the PROW will be undertaken using the criteria in DMRB LA112 and professional judgement. The assessment will be cross referenced with the assessment within Chapter 27 Socioeconomics and Tourism. Mitigation measures for each PROW will be identified, which may include managed crossing, temporary diversions or temporary closures in some cases. The mitigation will be

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			agreed with Essex County Council and incorporated into an Outline PROW Management Plan.
DECOMISSIONING			
22.6	Impacts during decommissioning	Decommissioning impacts: similar in nature to those during construction but will be more limited in geographical extent and timescale.	At this stage the future baseline conditions cannot be predicted accurately and both the proposals for decommissioning and the future regulatory context are unknown. A detailed assessment of decommissioning impacts is therefore not proposed to be undertaken. Instead, it is proposed to assume that impacts from decommissioning will be similar to those for construction (albeit over a reduced timescale and affecting a smaller area since the assets will already be in situ) and that a similar range of embedded mitigation measures will be implemented.

Table 22.4 - Impacts proposed to be scoped out of the assessment for traffic and transport

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
CONSTRUCTION		
22.7	Noise	Whilst the potential impact of traffic and transport on noise will be appropriately assessed within the EIA, being partly based on information and assessments presented within the traffic and transport chapter, this aspect will be considered in detail within Chapter 21: Airborne Noise and Vibration chapter and is thus scoped out of this chapter.
22.8	Disruption to the railway	It is proposed to use HDD under any section of railway track that will be crossed by the onshore cable route. Notwithstanding the appropriate investigations for the feasibility of using this method at any required locations and the necessary consultation with Network Rail on any approvals required, the operation of rail services should not be affected and therefore no specific traffic and transportation impacts associated with the railway will be considered in the EIA.
OPERATION		
22.9	Any impacts during operation	The operation of the onshore components of the proposed development (including the substation) will not require any permanent personnel and maintenance and repairs will only be required infrequently. Therefore, there will be a negligible number of associated vehicles on the highway network, with none for the majority of the time. Impacts on traffic and transportation during operation are therefore proposed to be scoped out.

22.7 MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

22.7.1 As part of the design process for VE a number of designed-in measures are proposed to reduce the potential for traffic and transport impacts. These are presented below. These will evolve over the development process as the EIA progresses and in response to consultation.

22.7.2 VE OWFL is committed to implementing these measures, in addition to standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/out of the assessment.

22.7.3 Measures adopted as part of the project will include:

- HDD under key infrastructure, such as any sections of railway track and major roads;
- The consideration of maximising the length of temporary haul roads at construction sites, to remove as much HGV traffic from the local highway network as possible, whilst taking into account ecological and archaeological issues;
- Development of, and adherence to, a Construction Traffic Management Plan (CTMP) for each construction site;
- Development of, and adherence to a PROW Management Plan; and
- Preparation of an Outline Travel Plan (OTP) to endeavour to minimise the impact of vehicle movements associated with construction workers, including the promotion of public transport and car sharing.

22.7.4 Additional mitigation measures that may be considered, where appropriate include:

- Construction Consolidation Sites (CSS) to increase efficiency of HGV vehicle movements to and from construction sites; and
- Minibuses for construction workers.

22.7.5 The requirement and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process, based on the findings of the detailed assessments.

22.8 POTENTIAL CUMULATIVE IMPACTS

22.8.1 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the cumulative impact assessment (CIA). For traffic and transport, cumulative interactions may occur with other planned projects and developments in the study area. Potential cumulative impacts with other projects and activities will be considered for each of the impacts considered in Table 22.3. The potential impacts proposed to be scoped out of the cumulative impact assessment are those listed in Table 22.4.

22.8.2 The relevant vehicle flows will be added to the forecast vehicular flows for VE and the same approach for assessing each of the impacts identified in Table 22.3 will be undertaken to identify the likely cumulative impact.

22.8.3 The construction vehicle movements forecast within the study area associated with any other Nationally Significant Infrastructure Projects that may coincide with the construction phase of VE will also be considered. These will be identified for the assessment in the PEIR.

22.8.4 The relevant vehicle flows will be added to the forecast vehicular flows for VE and the same approach for assessing each of the impacts identified in Table 22.3 will be undertaken to identify the likely cumulative impact.

22.9 POTENTIAL TRANSBOUNDARY IMPACTS

22.9.1 Traffic and transportation effects arising as a result of the proposed development will be localised and will not be experienced across international boundaries therefore there is no potential for transboundary effects and these have been scoped out of the EIA.

22.10 SUMMARY OF NEXT STEPS

22.10.1 The next steps will be as follows:

- Refinement of the study area following selection of the landfall, the preferred onshore cable route and the OnSS;
- Undertake a comprehensive review of baseline data identified in Section 22.3 supplemented by direct communication with stakeholders through the ETG process;
- Agree locations for ATCs and classified turning counts at junctions as set out in Section 22.3.2
- Assemble project specific data and / or assumptions regarding anticipated traffic generation once the location of landfall, length of onshore cable route known and the site for OnSS identified;
- Engage with other specialist EIA teams such as socio-economic and LVIA to understand likely impacts on tourism and community receptors; and
- Finalise methodology accounting for the above and agree through the Evidence Plan Process.

22.11 FURTHER CONSIDERATIONS FOR CONSULTEES

- Do you agree that the data sources identified are sufficient to inform the traffic and transport baseline for the VE PEIR and ES?
- Have all potential impacts resulting from VE been identified for traffic and transport receptors?

Do you agree that the impacts described in Table 22.4 can be scoped out?

- For those impacts scoped in (Table 22.3), do you agree that the methods described are sufficient to inform a robust impact assessment?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of VE on traffic and transport receptors?
- Do you have any specific requirements for the traffic and transport modelling methodology?

23. AIR QUALITY

23.1 INTRODUCTION

23.1.1 This section of the Scoping Report identifies the Air Quality receptors of relevance to the VE onshore Area of Search. It describes the potential effects from the construction, operation and maintenance, and decommissioning of the onshore elements of VE on Air Quality and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

23.1.2 The assessment scope has been informed by both national and local planning policy and guidance. The proposed scope of the assessment is as follows:

- Baseline evaluation;
- Construction dust assessment;
- Construction phase road traffic screening assessment; and
- Mitigation measures – as required.

23.2 STUDY AREA

23.2.1 The study area that has been adopted for scoping is defined in relation to each assessment proposed, as detailed below in accordance with the relevant Institute of Air Quality Management (IAQM) guidance. Multiple study areas are proposed to account for the air quality component being assessed and the receptor being considered.

23.2.2 The study area will be reviewed throughout the EIA lifecycle, upon refinement of the onshore working areas, such as finalisation of the onshore cable route, landfall and onshore substation (OnSS) following identification of environmental/ engineering constraints and/ or feedback from relevant statutory consultees. This is expected to result in a significant reduction in the size of the study area for the purposes of the PEIR and ES. Refinements to the study area, and consequential impacts on receptors will be fully evaluated and communicated to relevant consultees.

CONSTRUCTION DUST ASSESSMENT

23.2.3 For the purposes of defining the onshore study area in relation to dust/ particulate matter (PM) generated from proposed onshore construction works on sensitive receptor locations, guidance provided by the IAQM (IAQM, 2016) will be used. This involves the consideration of:

- Human receptors within 350 m of any proposed onshore construction works, and within 50 m of routes used by construction vehicles on the public highway, up to 500 m from site exits; and
- Ecological receptors within 50 m of any proposed onshore construction works, and within 50 m of routes used by construction vehicles on the public highway, up to 500 m from site exits.

CONSTRUCTION ROAD TRAFFIC SCREENING ASSESSMENT

23.2.4 Human and ecological receptors within 200 m of roads which are expected to experience increases in traffic flows because of VE onshore construction activities will be assessed, where necessary.

23.2.5 If an ecological and/ or human receptor is located >200 m from an affected road link, further consideration is not required. The 200 m distance screening threshold is supported in various guidance documents for the context of both human and ecological receptors in relation to road traffic emissions ((IAQM, 2020) and (Highways England, 2019)) and is therefore considered appropriate.

23.2.6 Screening thresholds to determine the extent of the affected road network are provided within Section 23.5.

23.3 BASELINE DATA

23.3.1 The characterisation of the existing onshore environment will be undertaken using the latest publicly available data sources outlined in Table 23.1. At present, this will include the following sources (however these will be reviewed throughout the EIA lifecycle).

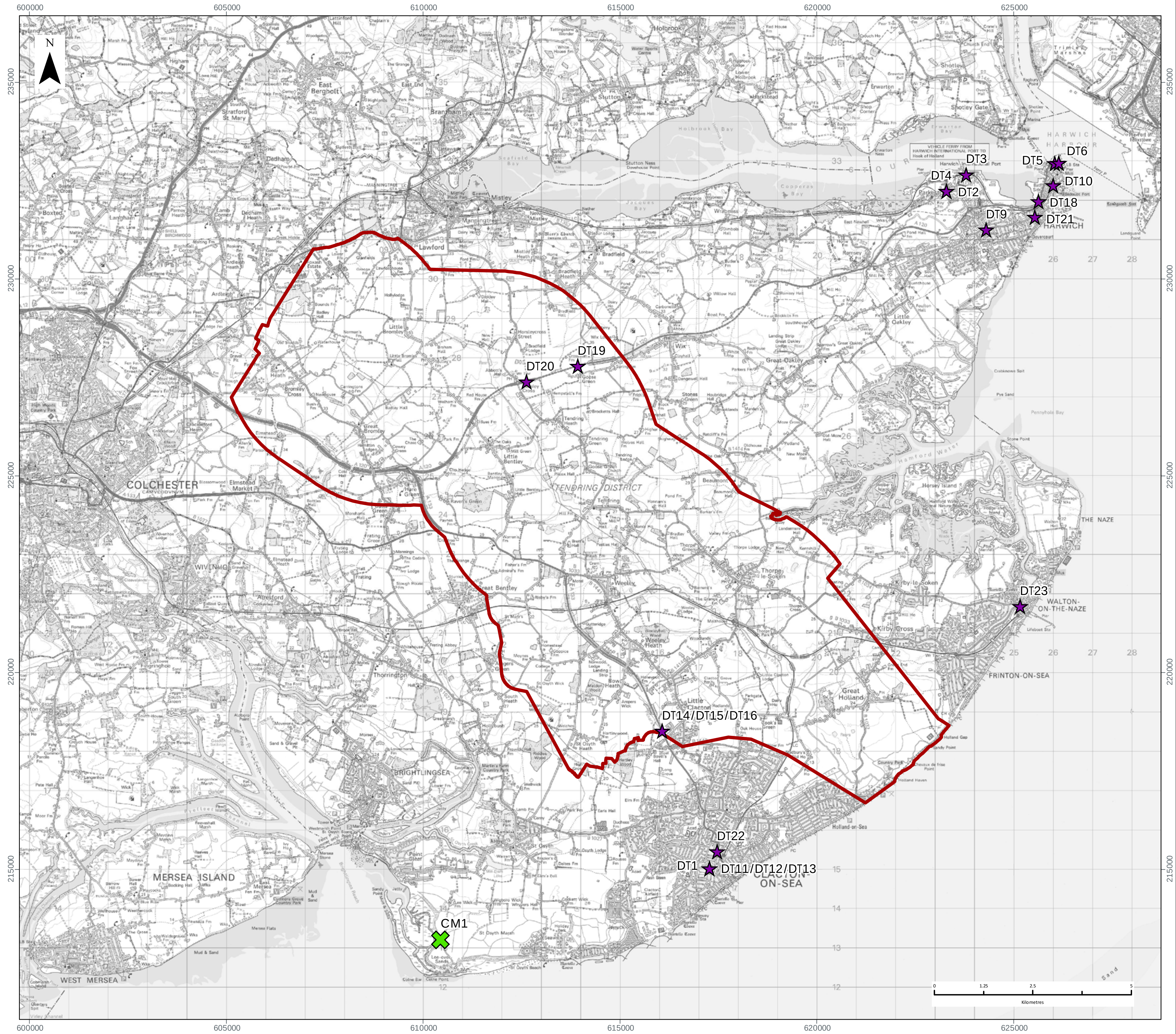
Table 23.1 -Key sources of information for Air Quality and Health

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
The Department for Environment, Food and Rural Affairs (DEFRA) Background Mapped Concentration Estimates (2018 reference year)	Semi-empirical background pollutant concentration estimates provided by DEFRA.	This is a national dataset providing full coverage of the study area.
Tendring District Council (TDC) 2020 Air Quality Annual Status Report (ASR) (TDC, 2020).	Monitoring data recorded locally by TDC.	Partial coverage of the study area.
Monitors associated with the Automatic Urban and Rural Network (AURN)	Monitoring data recorded nationally by DEFRA.	This is a national dataset providing full coverage of the study area.

23.3.2 From initial review of these datasets, three monitors are located within the onshore study area, at roadside locations (Figure 23.1). These are associated with TDC's Local Air Quality Management (LAQM) 2019 monitoring network and monitor nitrogen dioxide (NO_2) solely via passive diffusion tubes.

23.3.3 No project specific air quality surveys are proposed presently as it is assumed that baseline air quality data obtained from publicly available sources (such as those detailed above) will be sufficient for the purposes of characterising the onshore receiving environment. This is also considered proportionate to the nature of the proposed screening assessment.

23.3.4 However, the suitability of these publicly available datasets will be reviewed and confirmed with relevant statutory consultees, including Essex County Council (ECC) and Tendering District Council (TDC), throughout the design phase, and upon identification of relevant sensitive receptors to determine if supplementary surveys are required.



LEGEND

Onshore Area of Search

Automatic Monitoring Location

Diffusion Tube Location

Data Source:
© Crown copyright [and database rights] (2021) 0100031673 OS OpenData.

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

AIR QUALITY MONITORING LOCATIONS

VER	DATE	REMARKS	Drawn	Checked
1	17/09/2021	For Issue	JRS	AD

DRAWING NUMBER:

23.1

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:100,000	A3	ODN	British National Grid

FIVE ESTUARIES OFFSHORE WIND FARM

P:\05356 - GoBe Consultants Ltd\00010 Five Estuaries\Tech\GIS\Dwgs\Wking\2021 07 Scoping\Air Quality\05356.00010.0014.1 Air Quality Receptors.mxd

23.4 BASELINE ENVIRONMENT

23.4.1 The study area is located wholly within TDC's jurisdiction. TDC do not have any Air Quality Management Areas (AQMA) for exceedances of Air Quality Strategy (AQS) objectives at applicable human receptor locations, presently.

23.4.2 The nearest AQMA is located within Colchester town centre along a portion of East Street and Ipswich Road titled 'Area 2', approximately 4 km from the study area, declared for the exceedance of the NO_2 annual mean AQS objective (40 µg/m^3).

23.4.3 The study area is therefore not considered sensitive in relation to human health, however it is noted that Colchester town centre is and will be considered in relation to road traffic flows generated by the construction phase, if necessary.

23.4.4 As the locations of the onshore infrastructure are yet to be defined, identification of specific sensitive receptors has not yet been undertaken. However, potential sensitive human receptors in relation to road traffic and dust emissions are primarily anticipated to be residential receptor locations and other land uses housing sensitive populations. This will be reviewed throughout the EIA lifecycle, upon refinement of the onshore working areas, such as the final onshore cable route, landfall location and OnSS with reference to satellite imagery, and agreed with relevant statutory consultees.

DESIGNATED SITES

23.4.5 There are several declared ecological designations located within and adjacent to the study area. These consist of the following statutory designations:

- Special Area of Conservation (SAC);
- Special Protection Area (SPA);
- Ramsar;
- Site of Special Scientific Interest (SSSI);
- Local Nature Reserve (LNR); and
- National Nature Reserve (NNR).

23.4.6 A summary of these designations is provided in Table 23.2, however this does not represent a complete nor exhaustive list of designations. Furthermore, the quoted distances should be treated as indicative.

23.4.7 As discussed above, relevant ecological designations for consideration will be reviewed throughout the design phase, following refinements to the onshore infrastructure.

Table 23.2 - Ecological designations of relevance to Air Quality and VE

SITE	CLOSEST DISTANCE TO VE (KM)	FEATURE OR DESCRIPTION
INTERNATIONAL		
Hamford Water	Within	Special Area of Conservation (SAC)/ Special Protection Area (SPA)/ Ramsar
Colne Estuary	1.1	SPA/ Ramsar
Essex Estuaries	1.2	SAC
NATIONAL		
Weeleyhall Wood	Within	Site of Special Scientific Interest (SSSI)
Holland Haven Marshes	Within	SSSI
Riddles Wood	0.4	SSSI
Hamford Water	Within	SSSI/ National Nature Reserve (NNR)
Local		
Holland Haven	Within	Local Nature Reserve (LNR)

23.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

CONSTRUCTION DUST ASSESSMENT

23.5.1 Potential air quality impacts arising from dust generated from onshore construction activities will be assessed qualitatively in accordance with IAQM guidance (IAQM, 2016).

23.5.2 The IAQM construction dust assessment methodology provides a framework to establish the unmitigated risk of construction dust impacts associated with a development at both human and ecological receptors.

23.5.3 The likely unmitigated dust emission magnitude associated with four activities (demolition, earthworks, construction and trackout) is initially defined and used in conjunction with the sensitivity of the surrounding area to determine the risk of impact for each activity. These sensitivities are:

- Annoyance due to dust soiling,
- The risk of health effects due to an increase in exposure to particulate matter with an aerodynamic diameter ≤10 μm (PM_{10}), and
- Harm to ecological receptors.

23.5.4 Following determination of these risks, proportionate mitigation is recommended, with the aim of rendering residual effects as not significant.

23.5.5 Recommended mitigation will form inclusion of the Code of Construction Practice (CoCP) to secure anticipated mitigated effects. The CoCP is embedded into the project design which will be developed for the proposed onshore construction activities and adhere to construction industry good practice guidance for control measures and dust management.

23.5.6 Where the design includes optionality for the onshore elements of VE, the maximum design parameters/extents of any proposed construction area will be used for the purposes of defining potential dust sources, where not finalised. This is likely to provide a conservative assessment where undertaken, and ensure all potential impacts are understood in lieu of finalised working areas.

CONSTRUCTION ROAD TRAFFIC SCREENING ASSESSMENT

23.5.7 The proposed screening assessment of construction phase generated road traffic vehicles will consider both human and ecological receptors, where relevant.

23.5.8 Traffic data used to inform this screening assessment will be consistent with the analysis undertaken and presented as part of the Traffic and Transport chapter. The screening assessment will consider all proposed construction scenarios where relevant (to account for uncertainty in terms of location of final cable route options if required).

HUMAN RECEPTORS

23.5.9 Potential road traffic impacts associated with onshore construction works on sensitive human receptors will be screened initially to determine whether further detailed assessment is required (providing a human receptor is located within 200 m of the affected link) via the use of dispersion modelling.

23.5.10 Dispersion modelling is not proposed presently, as initial preference is to undertake a screening assessment to determine the extent of affected areas (if applicable). If these screening thresholds are exceeded, then dispersion modelling will be undertaken and agreed with the relevant statutory consultees.

23.5.11 For the screening exercise, criteria provided within the IAQM and Environmental Protection UK (EPUK) guidance document will be used (IAQM & EPUK, 2017), and is as follows:

- Outside of an AQMA:
  - A change of light duty vehicle (LDV) flows of more than 500 annual average daily traffic (AADT); and/ or
  - A change of heavy-duty vehicle (HDV) flows of more than 100 AADT.
- Within or adjacent to an AQMA:
  - A change of LDV flows of more than 100 AADT; and/ or
  - A change of HDV flows of more than 25 AADT.

23.5.12 If the onshore construction traffic flows are not found to exceed any of the screening criteria presented, then effects on human receptors are considered to be insignificant and can be screened out of further consideration.

ECOLOGICAL RECEPTORS

23.5.13 Potential road traffic impacts associated with onshore construction works on sensitive ecological habitats will initially be screened in accordance with IAQM guidance (IAQM, 2020).

23.5.14 This initially comprises a screening assessment to indicate whether onshore construction activities are likely to generate either >1,000 (and/ or >200 HDV) AADT movements on a road link within 200 m of a sensitive qualifying ecological feature or result in >1% of a Critical Level and/ or Critical Load.

23.5.15 For the purposes of assessing impacts on sensitive qualifying internationally and European designated ecological sites (e.g., SAC, SPA and Ramsar), screening will be undertaken in-combination with other projects and plans following the judicial outcomes of the Wealden Judgement, where located within 200 m of an affected road link. However, when assessing impacts on national and/ or local ecological designations, developmental trips will be assessed in isolation (i.e., project alone). This is reflective of the level of protection afforded to these sites (Chapter 20 Terrestrial Ecological and Nature Conservation).

23.5.16 The outcomes of the above will determine whether impacts could result in a likely significant effect on the assessed ecological feature (either alone, or in-combination in the context of international sites) and indicate where further detailed assessment is required via use of dispersion modelling.

23.5.17 Dispersion modelling is not proposed presently, as initial preference is to undertake a screening assessment to determine the extent of affected areas (if applicable). If these screening thresholds are exceeded, then dispersion modelling will be undertaken and agreed with the relevant statutory consultees.

23.5.18 If the above conditions are not met, then impacts on ecological designations are likely to be imperceptible, whereby resultant effects can be classed as insignificant and further consideration is not needed.

POTENTIAL PROJECT IMPACTS

23.5.19 A range of potential impacts on Air Quality have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 23.2, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/ or supporting analyses (e.g. modelling) to enable an assessment of the impact.

23.5.20 Based on the baseline environment information currently available and the project description (outlined in Chapter 3: Project Description) a number of impacts are proposed to be scoped out of the EIA for Air Quality. These impacts are outlined in Table 23.4, together with a justification for scoping them out.

Table 23.2 - Impacts proposed to be scoped into the assessment for Air Quality

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
23.1	Dust/ PM_{10} generated from temporary construction activities on both human and ecological receptors	The generation of fugitive dust and PM_{10} emissions from anticipated construction activities can impact human receptors (in terms of annoyances and health effects) as well as ecological receptors.	A qualitative assessment of the potential dust impacts arising from onshore construction activities will be undertaken in accordance with IAQM guidance (IAQM, 2016). The outcomes of this assessment will determine the unmitigated level of risk on both human and ecological receptors (if applicable), and inform proportionate mitigation and controls to render residual effects as not significant. Any proposed mitigation will form inclusion to the CoCP. Where optionality in terms of the design of the onshore elements of VE exists, the maximum design parameters/ extents of any proposed construction area will be used for the purposes of defining potential dust sources where not finalised. This will ensure all potential impacts are understood, allowing for greater flexibility for further design refinements.
23.2	Temporary construction-generated road traffic volumes on human receptors	Temporary increases in road traffic volumes on the public road network generated by construction activities can impact human receptors through a deterioration of local air quality via	Projected road traffic volumes on the public road network will be screened initially with reference to criteria provided by the IAQM and EPUK (IAQM & EPUK, 2017) to determine whether further assessment in relation to human receptors is required via use of dispersion modelling. If required, the technicalities of the dispersion modelling assessment will be agreed with the relevant statutory consultees. Where optionality in terms of the design of the onshore elements of VE exists, all potential scenarios in terms of consequential traffic generation and distribution will be assessed.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		increased exposure to vehicle emissions.	
23.3	Temporary construction-generated road traffic volumes on ecological receptors	Temporary increases in road traffic volumes on the public road network generated by construction activities can impact sensitive ecological receptors through a deterioration of local air quality via increased exposure to vehicle emissions.	Projected road traffic volumes on the public road network will be screened initially with reference to criteria provided by the IAQM (IAQM, 2020) to determine whether further assessment in relation to ecological receptors is required via use of dispersion modelling. If required, the technicalities of the dispersion modelling assessment will be agreed with the relevant statutory consultees. Where optionality in terms of the design of the onshore elements of VE exists, all potential scenarios in terms of consequential traffic generation and distribution will be assessed.
DECOMMISSIONING			
23.4	Impacts during decommissioning	Decommissioning impacts: similar in nature to those during construction but will be more limited in geographical extent and timescale.	Details surrounding the decommissioning phase are yet to be fully clarified. Despite this, decommissioning impacts are not considered to be greater than construction effects, given anticipated improvements in local air quality, and the potential for cables to remain in situ reducing the volume of works in comparison. In addition, it is also recognised that policy, legislation, and local sensitivities constantly evolve; which will limit the relevance of undertaking an assessment at this stage.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			A detailed assessment of decommissioning impacts is therefore not proposed to be undertaken. Instead, it is proposed to assume that impacts from decommissioning will be similar to those for construction (albeit over a reduced timescale and affecting a smaller area since the assets will already be in situ) and that a similar range of embedded mitigation measures will be implemented.

Table 23.4: Impacts proposed to be scoped out of assessment for Air Quality

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
CONSTRUCTION		
23.5	Emissions generated from operation of non-road mobile machinery (NRMM) during the construction phase.	An assessment of NRMM is scoped out from assessment, as following DEFRA technical guidance (DEFRA, 2021), providing suitable controls are applied, emissions generated from NRMM are unlikely to contribute to a significant impact upon local air quality. These measures include: > Ensure all equipment complies with the appropriate NRMM standards; > Where feasible, ensure further abatement plant is installed on NRMM equipment, e.g. Diesel Particulate Filters; > Ensure all vehicles switch off engines when stationary – no idling vehicles; > Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where possible; and > Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10 mph on unsurfaced haul roads and work areas. These measures will be detailed within the CoCP.
OPERATION		
23.6	Operational phase traffic movements and other works/ activities	Operational phase onshore activities will be limited to maintenance activities, expected to be intermittent/ infrequent in comparison to construction activities (which will be assessed in full). Despite this, air quality effects arising as a result of anticipated operational activities are believed to be negligible.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

23.5.21 As part of the design process for VE, a number of designed-in measures are proposed to reduce the potential for impacts on Air Quality receptors. These are presented below. These will evolve over the development process as the EIA progresses and in response to consultation.

23.5.22 VE OWFL are committed to implementing these measures, and also various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE.

23.5.23 Measures adopted as part of the project of relevance to Air Quality will include:

- Development of, and adherence to, a CoCP;
- Development of, and adherence to, a Decommissioning Plan.

23.5.24 The requirement and feasibility of any mitigation measures will be consulted upon with relevant statutory consultees throughout the EIA process, with respect of the assessment outcomes.

POTENTIAL CUMULATIVE IMPACTS

CONSTRUCTION DUST ASSESSMENT

23.5.25 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For air quality, cumulative interactions may occur with other planned projects and developments in the study area. Potential cumulative impacts with other projects and activities will be considered for the potential to arise of cumulative dust effects. Cumulative construction dust effects could arise where impacts from more than one scheme overlap at an affected receptor location. Consideration will be given to cumulative impacts arising from the generation of dust from other construction activities occurring locally and concurrently.

23.5.26 However, all schemes which are considered to pose a risk of cumulative effects will also have had to undertake a construction dust assessment separately relating to their own site activities and associated risks, with the recommendation of best practice mitigation to remedy residual effects not significant.

23.5.27 IAQM guidance (IAQM, 2016) states that, with the implementation of the recommended mitigation, effects will be not significant. As such, it is not anticipated at this stage that there will be significant cumulative effects associated with construction phase dust emissions. However, this will be reviewed for the purposes of PEIR and ES upon clarification of the extent of cumulative developments to consider, in conjunction with statutory consultees.

CONSTRUCTION ROAD TRAFFIC SCREENING ASSESSMENT

23.5.28 Consideration will be given to cumulative impacts for the purposes of the road traffic screening assessment, where necessary and required by guidance.

23.5.29 At present, this will be limited to the assessment of international ecological designations for the purposes of facilitating an in-combination assessment prior to screening out effects in isolation, as required by IAQM guidance (IAQM, 2020). This will involve the consideration of committed development trips along the extent of the affected road network for screening. Datasets used to fulfil this in-combination screening assessment will be consistent with analysis undertaken as part of the Traffic and Transport assessment.

POTENTIAL TRANSBOUNDARY IMPACTS

23.5.30 Air quality effects arising as a result of the proposed development will be localised and will not be experienced across international boundaries therefore there is no potential for transboundary effects and these have been scoped out of the EIA.

23.6 SUMMARY OF NEXT STEPS

23.6.1 The next steps will be as follows:

- Review feedback from stakeholders obtained as part of the scoping process;
- Gather baseline air quality data from publicly available sources and through direct contact with EDC and TDC;
- Determine onshore working areas for the purposes of informing the PEIR;
- Identify sensitive receptors following refinements to the onshore working areas;
- Collate information to inform the PEIR, such as road traffic volumes for the purposes of screening;
- Evaluate whether further assessment is needed in relation to the proposed road traffic screening assessment for both human and ecological receptors, in conjunction with statutory consultees;
- Review suitability of existing baseline air quality monitoring data in the public domain, and determine if supplementary surveys are required, in conjunction with statutory consultees; and
- Undertake the assessment as outlined in this chapter.

23.7 FURTHER CONSIDERATION FOR CONSULTEES

- Do you agree that the data sources identified are initially sufficient to characterise the onshore receiving environment for the VE PEIR and ES, pending refinement of onshore working areas?
- Have all potential air quality impacts resulting from VE been identified, as detailed in Table 23.2?
- For those impacts scoped in (Table 23.2), do you agree that the methods described are sufficient to inform a robust impact assessment, as detailed in Section 23.5?
- Do you agree that in-combination screening for the purposes of the proposed road traffic screening assessment will only be undertaken in relation to international and European designations?
- Do you agree that the impacts described in Table 23. can be scoped out?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential onshore effects of VE on air quality?
- Do you have any specific requirements for the assessment methodology?

24. HYDROLOGY AND FLOOD RISK

24.1 INTRODUCTION

24.1.1 This chapter of the Scoping Report identifies the hydrology, hydrogeology and flood risk receptors of relevance to the VE onshore AoS, which includes landfall works, cable routes and the OnSS. It describes the potential effects from the construction, operation and maintenance, and decommissioning of VE on hydrology, hydrogeology and flood risk and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

24.1.2 This chapter should be read alongside the following onshore assessment chapters of this Scoping Report:

- Chapter 19: Terrestrial Ecology and Nature Conservation; and
- Chapter 25: Geology and Ground Conditions.

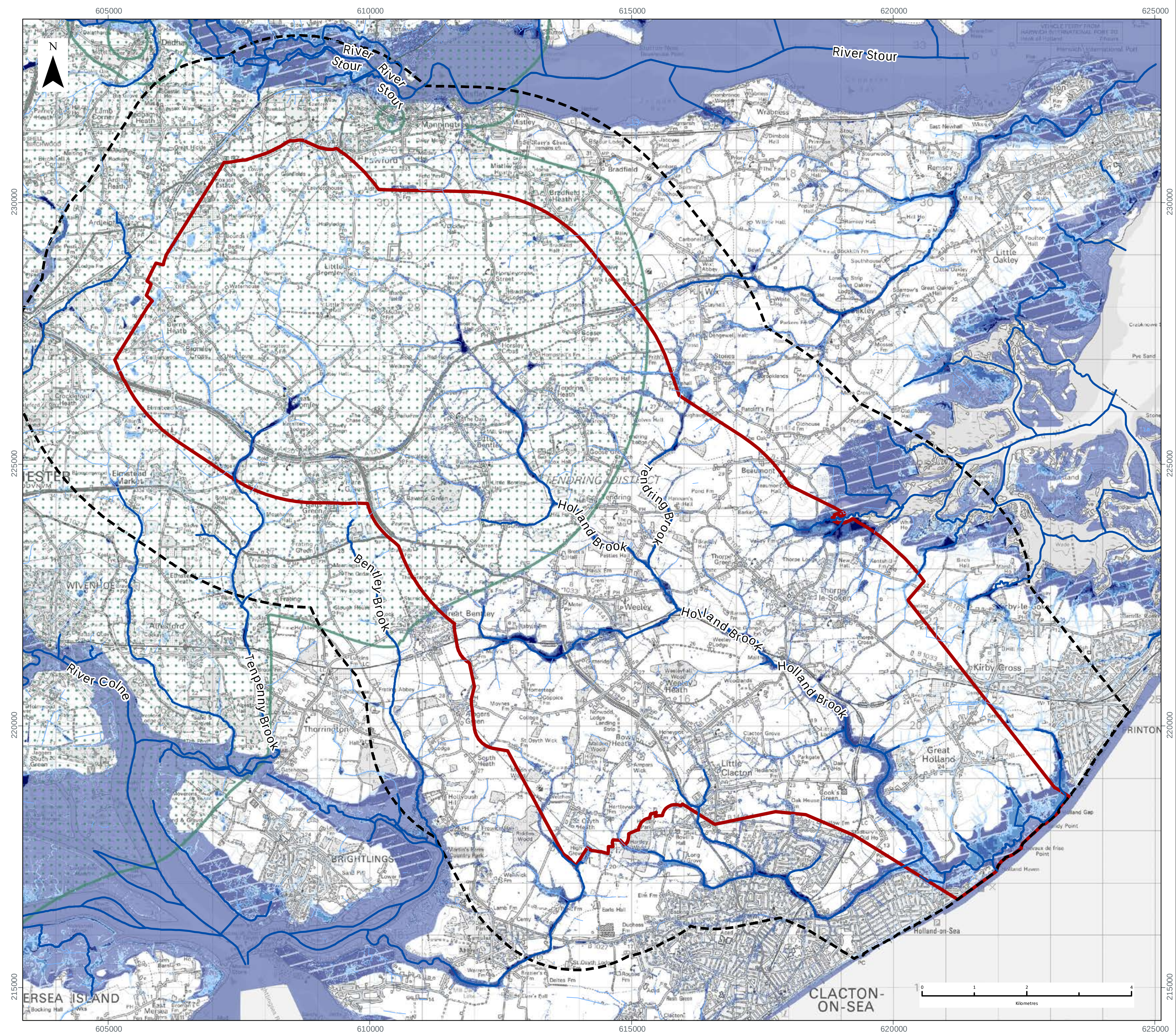
24.1.3 The water environment includes watercourses and surface water drainage, groundwater below the onshore element of the proposals and onshore flood risk. Offshore aspects of the water environment are covered separately at Chapter 7: Physical Processes and Chapter 8: Marine Water and Sediment Quality.

24.2 STUDY AREA

24.2.1 The VE study area for the onshore Hydrology, Hydrogeology and Flood Risk scoping includes land onshore above MHWS and is defined as the search area shown in Figure 1. For the purpose of scoping, the whole of the study area has been taken into consideration. Areas outside, but with potential hydraulic connectivity to the study area, have also been taken into consideration up to a distance of 2 km. Beyond this limit of hydraulic connectivity, no related impacts are expected to occur.

24.2.2 The study area is c. 120 km^2. It extends a short distance (c. 3 km) along the Essex coastline from Holland-on-Sea in the south-west to Frinton-on-Sea, and c. 20 km inland in a north-westerly direction, following the general direction of Holland Brook, towards Ardleigh and the River Stour. Ministry of Housing, Communities and Local Government data suggests that there are few “urban settlements” in the study area: Little Clacton is located a short distance inland in the southern part of the study area.

24.2.3 The study area will be refined and amended for future stages (PEIR and subsequently ES) in response to such matters as refinement of the onshore AoS, location of VE infrastructure, feedback from consultees, and/ or the identification of additional constraints (environmental and/ or engineering). This is expected to result in a significant reduction in the size of the study area as it is refined to more closely follow the route of the preferred onshore cable corridor, and preferred locations for the landfall and substation when these are refined.



LEGEND

- Onshore Area of Search
- Onshore Area of Search 2 km Buffer
- Statutory Main River
- Minor Watercourse
- Source Protection Zone
- Environment Agency Flood Zone 3
- Environment Agency Flood Zone 2
- Environment Agency Areas Benefiting from Flood Defences

Risk of Flooding from Surface Water Flooding Depth 0.1 % Annual Chance

- Below 150mm
- 150 - 300mm
- 300 - 600mm
- 600 - 900mm
- 900 - 1200mm
- Over 1200mm

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

WATERCOURSES AND FLOOD ZONES

VER	DATE	REMARKS	Drawn	Checked
1	17/09/2021	For Issue	JRS	MS

DRAWING NUMBER:

24.1

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:75,000	A3	ODN	British National Grid

FIVE ESTUARIES
OFFSHORE WIND FARM

24.3 BASELINE DATA

24.3.1 Baseline data to inform scoping for hydrology, hydrogeology and flood risk has been taken from publicly available information and opensource data from a range of sources. The key sources of information are summarised in Table 24.1.

Table 24.1 – Key sources of information for hydrology, hydrogeology and flood risk

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Environment Agency and data.gov.uk website	> Flood Zone mapping; > Spatial Flood Defence data and mapping; > Flood Warning and Flood Alert Areas; > Main Rivers; > Ordinary Watercourses; > Groundwater Source Protection Zones (SPZ); and > Water Framework Directive (WFD) surface water and groundwater classification data.	These are national datasets providing full coverage of the hydrology, hydrogeology and flood risk study area.
British Geological Survey (BGS) mapping	> Geology (artificial ground, superficial deposits, bedrock); > Borehole/ well data; > Aquifer designation; and > Groundwater Vulnerability.	These are national datasets providing full coverage of the hydrology, hydrogeology and flood risk study area.
Defra's MAGIC website/ Natural England	Statutory and non-statutory environmental designations.	These are national datasets providing full coverage of the hydrology, hydrogeology and flood risk study area.
Cranfield Soil and Agrifood Institute Soilscapes map viewer	Soil type and character.	This is a national dataset providing full coverage of the hydrology, hydrogeology and flood risk study area.
Essex County Council and Tendring District Council	> Local Flood Risk Management Strategy; > Shoreline Management Plan – SMP8 (Landguard Point to Two Tree Island); and	Full coverage of the hydrology, hydrogeology and flood risk study area.

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
	> Strategic Flood Risk Assessment.	
Channel Coastal Observatory	Anglian Coastal Monitoring data and reporting.	Partial coverage of the hydrology, hydrogeology and flood risk study area.

24.3.2 Previous planning applications and reporting for other similar scale schemes in the local area, including East Anglia 1 North Offshore Wind Farm and subsequent East Anglia wind farms, have also been reviewed to inform this scoping report[82]. It is however noted that these reports will specifically relate to defined cable corridors or infrastructure locations and a significant period of time has elapsed since most of these previous applications were submitted.

24.3.3 Preparation of the scoping report and work to prepare the PEIR/ ES will also include targeted data requests and consultation with a number of stakeholders and regulatory bodies, details relating to the consultation is found in Chapter 6: Consultation Process. The information and data to be requested will include:

- Environment Agency:
  - Flood modelling and mapping, flood defence asset information and flood event history;
  - Catchment data for the operational surface water catchments of Colne Essex and Stour relating to water quality and WFD classification;
  - Catchment data for the Essex Gravels groundwater catchment relating to water quality and WFD classification;
  - Coastal management data; and
  - Licensed abstractions or water users including data supporting groundwater Source Protection Zone (SPZ) designations.
- Essex County Council:
  - Registered private water supplies;
  - Shoreline monitoring data;
  - Sustainable drainage guidance to meet Lead Local Flood Authority (LLFA) requirements; and
  - Local flood event history.

[82] Additional schemes reviewed include North Falls, Gunfleet Sands I and II Offshore Wind Farms, London Array Wind Farm, Galloper Offshore Wind Farm and Greater Gabbard Offshore Wind Farm.

24.3.4 Review and survey of any public or private water supply abstraction may be required depending on the location and type of supply registered and the proposed location of VE infrastructure. This could include liaison with water supply companies such as Essex and Suffolk Water.

24.4 BASELINE ENVIRONMENT

24.4.1 Land within the study area extends inland from the Essex coastline across low lying topography towards higher ground in the north-west of the study area; maximum elevations tend to remain below c. 40 mAOD (Above Ordnance Datum). The study area is drained principally by the Holland Brook catchment, starting as an ordinary watercourse near Little Bromley and draining in a south-easterly direction towards the coast. River flows are measured at Thorpe le Soken, c. 5 km south-east of Tendring and c. 7 km upstream of the coast, where a tidal influence is noted as being important due to the low river gradient. The Holland Brook catchment is noted as comprising London Clay with some Boulder Clay cover in the north-west, mixed permeability bedrock and superficial deposits. It is a rural, predominantly arable, catchment with some grassland. The north-western/ western part of the study area also includes the upper reaches of Tenpenny Brook, Bentley Brook and St Osyth Brook, all of which drain south out of the study area and into the River Colne estuary near Brightlingsea. The northern part of the study area includes the upper reaches of ordinary watercourses that drain north towards the River Stour estuary near Manningtree. The lower eastern part of the study area includes the upper reaches of Landermere Creek which drains east towards Horsey Island. More generally, the study area is described as being located on marine-derived sedimentary bedrock, with a variety of coarse-to-fine-grained aeolian and fluvial superficial deposits.

24.4.2 Groundwater is present within the study area through the presence of Essex Gravels. This groundwater body is not used for public water supply but does support a number of uses including a significant number of small domestic supplies. It is classified as a secondary aquifer.

24.4.3 There are a large number of borehole records in the study area, along the route of the A120 and A133 and concentrated in the northern part of the study area north of the A120. Similarly, there are a large number of water wells in the same part of the study area. The northern part of the study area, north-west of Tendring, is also noted as being in Zone 3 of a groundwater Source Protection Zone (SPZ). The closest groundwater sources to the study area are located c. 1 km and c. 3 km to the north at Manningtree and Dedham respectively. There are known to be present small domestic abstractions and agricultural abstractions. Consultation with Essex County Council and Environment Agency will seek to clarify all potential water users that may be affected by the construction, operation and maintenance, and decommissioning of VE.

24.4.4 Fluvial and tidal flood risk mapping shows areas within the study area at risk of inundation during extreme events along the whole coastal reach, the whole length of Holland Brook, as well as in the upper reaches of Tenpenny Brook and Landermere Creek. However, Holland Brook downstream of Thorpe le Soken, and Landermere Creek, are shown to be areas benefitting from flood defences.

24.4.5 Surface water flood risk mapping produced by the Environment Agency indicates areas in the study area at potential risk of inundation from extreme rainfall. The majority of risk appears to be related to existing ordinary watercourses draining into main rivers, with limited smaller isolated zones of risk, generally in rural areas. Consultation with the Lead Local Flood Authorities (LLFA) and Environment Agency will seek to clarify further any notable surface water flood risk hotspots in the vicinity of proposed VE infrastructure locations.

DESIGNATED SITES

24.4.6 There are a small number of localised environmentally designated sites (Ramsar; Special Area of Conservation (SAC); Special Protection Area (SPA); Site of Special Scientific Interest (SSSI); Local Nature Reserves (LNR)) within the study area, as summarised in Table 24.2.

Table 24.2 – Statutory designated sites with relevance to hydrology, hydrogeology and flood risk and VE

SITE	CLOSEST DISTANCE TO VE	FEATURE OR DESCRIPTION
INTERNATIONAL		
Hamford Water Ramsar	On north-east boundary of the study area.	Site for nationally and internationally important numbers of wintering and nesting waterbirds, and refuge for migratory waterbirds.
Stour and Orwell Estuaries Ramsar	c. 1.5 km north of the study area at Manningtree.	Extensive mudflats, low cliffs, saltmarsh, and areas of vegetated shingle, supports internationally and nationally important numbers of wintering wildfowl and waders, nationally scarce plants and invertebrates.
Colne Estuary (Mid-Essex Coast Phase 2) Ramsar	c. 1.8 km west of the study area at Brightlingsea.	International importance for wintering Brent geese and Black-tailed Godwit; national importance for breeding little terns and other species of wintering waders and wildfowl.
Hamford Water SAC	On north-east boundary of the study area.	Fisher's estuarine moth.
Essex Estuaries SAC	c. 1.8 km west of the study area at Brightlingsea.	Estuaries; mudflats and sandflats not covered by seawater at low tide; Salicornia and other annuals colonizing mud and sand; Spartina swards; Atlantic salt meadows; Mediterranean and thermo-Atlantic halophilous scrubs.
Hamford Water SPA	On north-east boundary of the study area.	Site for nationally and internationally important numbers of wintering and nesting waterbirds, and refuge for migratory waterbirds.
Stour and Orwell Estuaries SPA	c. 1.5 km north of the study area at Manningtree.	Extensive mudflats, low cliffs, saltmarsh, and areas of vegetated shingle, supports internationally and nationally important numbers of wintering wildfowl and waders, nationally scarce plants and invertebrates.
Colne Estuary (Mid-Essex Coast Phase 2) SPA	c. 1.8 km west of the study area at Brightlingsea.	International importance for wintering Brent geese and Black-tailed Godwit; national importance for breeding little terns and other species of wintering waders and wildfowl.
NATIONAL		
Holland Haven Marshes SSSI	Within VE onshore study area.	Located in the lower reaches of Holland Brook, downstream of the "Sunshine Coast Line" railway, is a 208.8 ha biological SSSI providing important habitat for nationally scarce aquatic

SITE	CLOSEST DISTANCE TO VE	FEATURE OR DESCRIPTION
		plant species, botanically important grasslands and rare invertebrates.
Weeleyhall Wood Nature Reserve SSSI	Within VE onshore study area.	Located in the mid to lower end of the search area, is a 32 ha woodland habitat protecting vulnerable flora and fauna.
Riddles Wood SSSI	On south-west study area boundary, east of Brightlingsea.	A 37.3 ha biological SSSI, ancient oak and hazel, oak and hornbeam, chestnut coppice, with rich and varied ground flora.
Hamford Water SSSI	On north-east boundary of the study area.	Site for nationally and internationally important numbers of wintering and nesting waterbirds, and refuge for migratory waterbirds.
Stour Estuary SSSI	c. 1.5 km north of the study area at Manningtree.	2,523 ha biological and geological SSSI.
Colne Estuary SSSI	c. 1.8 km west of the study area at Brightlingsea.	2,915 ha biological and geological SSSI.
Holland Haven LNR	Within VE onshore study area.	22.1 ha Local Nature Reserve forming part of the wider SSSI.

24.4.7 There are no Ramsar sites, SAC, or SPA located in the study area, however a number of sites with potential hydraulic connection to the area of search have been identified within 2 km (Table 24.2).

24.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

24.5.1 There are no published guidelines or criteria for assessing and evaluating effects on hydrology or hydrogeology within the context of an EIA. The proposed assessment will be based on a methodology derived from the Institute of Environmental Management and Assessment guidance. The methodology sets out a list of criteria for evaluating the environmental effects and is outlined in Chapter 4: Environmental Impact Assessment Approach and Methodology.

24.5.2 Professional judgement and a qualitative risk assessment methodology will be used to assess the findings in relation to each of these criteria to give an assessment of significance for each impact.

24.5.3 Once the impact significance and likelihood of occurrence have been assessed, these will then be combined to determine the likelihood of each potential effect occurring. Effects assessed as minor or less will be considered not significant in terms of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017. If the assessment results in moderate or major effect, then this effect will be considered to be significant.

24.5.4 This approach provides a mechanism for identifying the areas where site specific mitigation measures will be required and for identifying mitigation measures appropriate to the risk presented by the development proposals. This approach also allows effort to be focused on reducing risk where the greatest benefit may result.

24.5.5 The approach to assessment and data gathering will be agreed through liaison with relevant bodies prior to commencement and consultation will be undertaken at key stages throughout the EIA process.

LEGISLATION AND PLANNING POLICY GUIDANCE

24.5.6 Regard will be given to technical guidance and other codes of best practice during the design phase of the development, in order to limit:

- The potential for contamination of ground and surface waters;
- The potential for flooding to be caused to the existing water environment and surrounding sensitive users;
- Potential for change to groundwater or surface water hydrology; and
- Other potential impacts on the water environment.

24.5.7 VE will be developed in accordance with the following European legislation, National legislation, National and Local Planning Policy and Strategy, and other relevant guidance.

EUROPEAN LEGISLATION

24.5.8 The Water Framework Directive (2000/60/EC) (the WFD) provides the foundation for the protection of the UK's water environment. The WFD seeks to protect all elements of the water cycle and to enhance the quality of groundwater, surface waters, estuaries, and coastal waters. The WFD is transposed and implemented within England through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. Chapter 8: Water and Sediment Quality also makes reference to the WFD in assessment of the offshore water environment.

24.5.9 The Groundwater Directive (2006/118/EC, including amendments to Annex II detailed under Directive 2014/80/EU) (the GWD) is designed to combat groundwater pollution and sets out procedures for assessing quality of groundwater. Aspects of the GWD are transposed and implemented through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, the Environmental Permitting (England and Wales) Regulations 2016 and the Groundwater (England and Wales) Regulations 2009.

24.5.10 The Floods Directive (2007/60/EC) which requires assessment of all watercourses and coastlines to determine risk of flooding and action to take adequate and coordinated measures to reduce this flood risk. The Flood Risk Regulations 2009 transpose the EU Floods Directive into law in England and Wales.

NATIONAL LEGISLATION

24.5.11 The objectives of the directives discussed above that are relevant to this assessment are met through the following UK legislation, relevant to the protection of the water environment:

- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 transposes the WFD and aspects of the GWD into UK legislation;
- The Groundwater (England and Wales) Regulations 2009 implements in England and Wales Article 6 of the GWD which details measures to prevent or limit inputs of pollutants into groundwater;
- The Environmental Permitting (England and Wales) Regulations 2016 consolidate and replace the Environmental Permitting (England and Wales) Regulations 2010, which have been amended 15 times to date. The 2010 Regulations are still in force and are the main implementing regulations for the environmental permitting regime;
- The Flood Risk Regulations 2009 transposes the EU Floods Directive into UK legislation and sets out requirements of the Environment Agency and local authorities in preparing assessments and mapping of flood risk for each river basin district in England and Wales;
- Flood and Water Management Act 2010 includes provisions for the management of risk in connection with flooding and sets out requirements for Lead Local Flood Authorities (LLFA) in preparing strategies for local flood risk management;
- The Water Resources Act 1991 and amendment (England and Wales) Regulations 2009. The Act regulates water resources, water quality and flood defence. The amendment Regulations make changes to the powers for carrying out anti-pollution works and serving notices;
- The Land Drainage Act 1991 and 1994 sets out requirements for maintenance of watercourses by riparian owners;
- The Environment Act 1995 sets out roles and responsibilities for the Environment Agency;
- The Private Water Supplies (England) Regulations 2016 and The Private Water Supplies (England) (amendment) Regulations 2018 transpose requirements of European Law on the quality of water intended for human consumption from private abstractions; and
- Town and Country Planning (Environmental Impact Assessment (EIA)) Regulations 2017 set out the key stages in the assessment process, including review and monitoring.

NATIONAL AND LOCAL PLANNING POLICY AND STRATEGY

24.5.12 The following national and local policy and guidance is considered relevant for the VE EIA in relation to the water environment:

- National Planning Policy Framework
  - The National Planning Policy Framework (NPPF), prepared by the Department for Communities and Local Government was published in March 2012 and revised in July 2021. Chapter 14 of the NPPF, Meeting the challenge of climate change, flooding and coastal change, along with the National Planning Practice Guidance (PPG) which expands on policies contained in the NPPF, recommends a proactive strategy to mitigate and adapt to climate change and requires that flood risk, sustainability and water quality are considered. In addition, the NPPF requires that account is taken of the potential for pollution arising from previous use of the land when determining suitability for a proposed use. NPPF (2012) informs section 5.7

Flood Risk of the Overarching National Planning Policy Statement for Energy (EN-1).

- Tendring District Local Plan 2013-2033 and Beyond Publication Draft, Tendring District Council, July 2017. Emerging Local Plan:
  - Policy PPL 1: Development and Flood Risk;
  - Policy PPL 5: Water conservation, drainage and sewerage; and
  - Policy PPL 13: Ardleigh Reservoir catchment area.
- North Essex Catchment Flood Management Plan, Environment Agency, December 2009:
  - The Catchment Flood Management Plan (CFMP) provides guidance on understanding the scale and extent of flooding across the region and sets policies for managing flood risk within the catchment. The search area falls largely within the “Coastal Streams” sub-area, governed by Policy 2. A small portion of the search area surrounding Little Clacton falls within the “Clacton-on-Sea” sub-area, governed by Policy 3 (Areas of low to moderate flood risk where we are generally managing existing flood risk effectively).
- Tendring District Council Strategic Flood Risk Assessment, Tendring District Council, March 2009:
  - Flood Risk;
  - Sustainable Drainage Systems;
  - Area Specific Strategies;
  - Flood Mitigation; and
  - Water Environment.
- Shoreline Management Plan 8, Essex County Council:
  - The Shoreline Management Plan (SMP) outlines strategy for managing flood and erosion risk along the coastline, over short, medium and long-term periods. SMP8 covers the Essex and South Suffolk coastline from Landguard Point to Two Tree Island. The study area is contained within Management Unit C, Tendring Peninsula, and the Policy Development Zones for Holland-on-Sea (PDZ C2) and Clacton-on-Sea (PDZ C3).

OTHER RELEVANT GUIDANCE

24.5.13 Relevant UK guidance on good practice for construction projects that will be referenced during assessment is detailed in the following documents:

- Control of Water Pollution from Construction Sites (C532), Construction Industry Research and Information Association, (CIRIA) 2001;
- Environmental Good Practice on Site (C741), CIRIA 2015;
- Control of water pollution from linear construction projects, CIRIA 2006;
- The Environment Agency's approach to groundwater protection, version 1.2, February 2018; and
- The SuDS Manual (C753), CIRIA 2015.

24.5.14 The CIRIA guidance provides help on environmental good practice for the control of water pollution arising from construction activities. It focuses on the potential sources of water pollution from within construction sites and the effective methods of preventing its occurrence.

24.5.15 The Environment Agency guidance is part of a wider suite of documents and guidance relating to groundwater protection which sets out principles for assessing risk, protecting groundwater, and permitting of abstractions and discharges from groundwater. The full suite of documents relating to groundwater can be found on the GOV.UK website at https://www.gov.uk/government/collections/groundwater-protection.

24.5.16 The SuDS Manual incorporates the latest research, industry practice, and guidance for design, delivery, and maintenance of Sustainable Drainage Systems (SuDS).

POTENTIAL PROJECT IMPACTS

24.5.17 A range of potential impacts on hydrology, hydrogeology and flood risk have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 24.3, together with a description of any proposed additional data collection (e.g., site-specific surveys) and/ or supporting analyses to enable an assessment of the impact.

24.5.18 Based on the baseline environment information currently available and the project description (outlined in Chapter 3: Project Description) a number of impacts are proposed to be scoped out of the EIA for hydrology, hydrogeology and flood risk. These impacts are outlined in Table 24.4, together with a justification for scoping them out.

24.5.19 It is acknowledged that detailed design and permitting of any watercourse or flood defence crossing will need to be agreed by licence, with the appropriate agency and this process will be separate to the DCO application process.

24.5.20 Any work on:

- Main Rivers (including associated flood defences) or on coastal sea defences will require an Environmental Permit from the Environment Agency; and
- Ordinary Watercourses will require Land Drainage Consent from Essex County Council.

Table 24.3 – Impacts proposed to be scoped in to the assessment for onshore hydrology, hydrogeology, and flood risk

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
24.1	Generation of turbid runoff which could enter the water environment.	Construction activities potentially including clearance of surface vegetation and topsoil at the landfall location, along the onshore cable route and at the substation location; stockpiling of removed materials; excavation for cable trenches; management of spoil from directional drilling; dewatering of excavations; and reinstatement of land following works.	VE landfall, onshore cable route and substation location: Existing data from the British Geological Survey for superficial and bedrock geology and soil information from Cranfield Soil and Agrifood Institute will be used to describe the baseline geological environment (this is detailed further under Chapter 26: Geology and Ground Conditions, of this Scoping Report). Site visits will be undertaken of key points along the onshore cable route (landfall point, substation location, watercourse crossing points, etc.), once the location for the onshore cable route and associated OnSS are known, to review any particular sensitivities with respect to the water environment. Typical sensitivities will include: > Surface watercourses; > Water abstraction points; > Water dependent habitat; and > Coastal environment.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			Measures described in Environment Agency pollution prevention guidance, and CIRIA guidance will be formalised within the Code of Construction Practice (CoCP), including consideration of HDD drilling fluids / bentonite. This will define principles for management of surface water runoff on areas of construction, handling and stockpiling of soils and stripped surface cover and control of vehicle movements. Existing water quality as documented by the Environment Agency will be reviewed in order to develop an understanding of baseline characteristics for surface water and groundwater catchments. The anticipated potential for turbid runoff to enter the water environment will be localised and short term only.
24.2	Changes to surface water runoff patterns which could affect flood risk.	The following construction phase activities have the potential to affect flood risk: > Removal of surface vegetation; > Compacting of soils through vehicle movement; > Development of temporary compounds; > Cable trenching excavations; and > Dewatering of excavations.	Environment Agency flood map zoning will be used to inform a Flood Risk Assessment for proposed activities on site.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
24.3	Potential for damage to flood defence or surface water drainage infrastructure.	Onshore infrastructure may cross existing flood defence or surface water drainage infrastructure and construction could alter the operation effectiveness or structural integrity.	Environment Agency opensource data will be reviewed to determine the location of formal flood defence infrastructure. Consultation with stakeholders will be undertaken to confirm the location of key surface water drainage infrastructure once the location of proposed VE infrastructure is known. This data may include, raised earth embankments, hard engineered flood defence walls and surface water pumping stations. Design of the onshore cable route will include the option of HDD crossings of key sensitive infrastructure and larger watercourse crossings where practical.
24.4	Pollution or disruption of flow to groundwater through ground excavations or piling.	Any piling or deep excavation works have the potential for impacting groundwater resources and creating a pathway for pollutants.	Existing data from the British Geological Survey for superficial and bedrock geology and soil information from Cranfield Soil and Agrifood Institute will be used to describe the baseline geological environment. The location of VE infrastructure in the emerging design solutions will inform intrusive site investigations which will determine the need for any piling or deep excavations. If a risk is identified at this point, a Piling Risk Assessment and/ or Groundwater Risk Assessment will be required.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
OPERATION			
24.5	Changes to surface water drainage at the onshore substation location.	Development of the OnSS will alter the nature of land cover at the site of development and is likely to increase surface water runoff to the local surface water environment or drainage network.	Engagement with the Lead Local Flood Authority (LLFA) will determine the level of detail required in regard to design of the surface water drainage strategy to support the DCO application. An outline drainage strategy will be prepared as an appendix to the Flood Risk Assessment (FRA) which will set out the strategy for management of surface water runoff at the site of the substation. The drainage strategy will follow SuDS principles.
DECOMMISSIONING			
24.6	Generation of turbid runoff which could enter the water environment.	Earthworks will be required to demolish and remove from site all surface structures related to the landfall, onshore cable route and substation location.	The risks identified and mitigation recommendations made with regard to construction earthworks will apply however it is noted that works will likely be limited to removal of surface features only (e.g. underground cables will not be removed at decommissioning).

Table 24.4 – Impacts proposed to be scoped out of assessment for onshore hydrology, hydrogeology, and flood risk

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
24.7	Operation Phase: Any impact on WFD status for assessed surface water or groundwater bodies.	Land within the onshore cable route corridor and landfall will be fully reinstated following cable trenching and/ or HDD operations. There will be no significant change to surface land use, hydro-morphology, runoff regimes, hydrogeological recharge and no potential for entrainment of pollutants to the surface water or groundwater environment. Subject to agreement with stakeholders and feedback from the same on this Scoping Report, VE intends to scope this impact out of further consideration within the EIA.
24.8	All phases: Accidental spillages and leakages of oils, fuel and other polluting substances which could potentially enter the water environment.	The impact of pollution including accidental spills and contaminant releases associated with the construction or operation of infrastructure may lead to direct impact to the receiving water environment. Implementation of principles within the CoCP will ensure that all potential spills or leaks will be identified early and contained at source with limited potential for mobilisation of any significant pollution to the water environment. Subject to consultation with stakeholders and feedback received on this Scoping Report, VE intends to scope this impact out of further consideration within the EIA.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

24.5.21 As part of the design process for VE a number of designed-in measures are proposed to reduce the potential for impacts on hydrological, hydrogeological and flood risk receptors. These are presented below. These will evolve over the development process as the EIA progresses and in response to consultation.

24.5.22 VE OWFL are committed to implement these measures, and also various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/ out presented in Table 24.3 and Table 24.4.

24.5.23 Measures adopted as part of the project will include:

- Avoidance of impact through design by selecting an onshore cable route, landfall and substation options that avoid, where possible, sensitive water environments (e.g., environmentally designated sites, sources of water use/ abstraction) and minimises watercourse crossing points;
- Avoidance of impact as far as feasible, through cable installation methodology (e.g., HDD at sensitive points, in particular flood defences or significant watercourse crossings);
- Development of, and adherence to, a CoCP which will set out principles for storage and handling of oils, fuel or any other potentially polluting substance, management of surface water and soil management; and
- Development of, and adherence to, a Decommissioning Plan.

24.5.24 The requirement and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

POTENTIAL CUMULATIVE IMPACTS

24.5.25 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For hydrology, hydrogeology and flood risk, cumulative interactions may occur with other planned projects and developments in the study area.

24.5.26 The impacts proposed to be scoped into the cumulative impact assessment are construction and decommissioning impacts for the onshore cable route and all pahses of development for the OnSS. Any potential for cumulative impact will be dependent on phasing of the other major developments considered, this will be monitored throughout the stages of the ES and assessed when appropriate. Plans and programmes for other developments are unlikely to generate additional significant adverse cumulative effects, unless they:

- Impact Main Rivers or Ordinary watercourses;
- Significantly impact groundwaters in the vicinity of the onshore cable route, landfall or OnSS; or
- Adversely impact catchments within the study area.

24.5.27 Wherever possible, cumulative assessment will be quantitative, however the level of data available and the ease with which impacts can be combined across different developments is variable. Where quantitative assessment is not possible, a qualitative assessment will be undertaken.

POTENTIAL TRANSBOUNDARY IMPACTS

24.5.28 Chapter 4: Environmental Impact Assessment Approach and Methodology provides a description of how potential transboundary effects will be assessed. Due to the localised nature of any onshore hydrology, hydrogeology, and flood risk potential impacts, transboundary impacts will not occur and therefore this impact will be scoped out from further consideration within the EIA.

24.6 SUMMARY OF NEXT STEPS

24.6.1 This scoping assessment has been undertaken based on desk-based information. Further information and data will be required to identify the potential impacts upon the water environment in relation to the onshore study area. This will include a detailed review and assessment of the onshore cable route, landfall zone and OnSS site. The assessment will be refined following the selection of the preferred VE onshore infrastructure.

24.6.2 A site walkover survey will be undertaken to inform the EIA in relation to hydrology, hydrogeology and flood risk following the selection of the preferred location of VE onshore infrastructure. The locations to be inspected will include the landfall location, main rivers and other significant drainage infrastructure (e.g., ordinary watercourses, pumping stations) crossing points, flood defence crossing points, proposed HDD locations, any public or private water supply sources or other water abstraction points identified as potentially sensitive, and designated sites close to VE infrastructure to assess possible hydraulic connectivity.

24.7 FURTHER CONSIDERATIONS FOR CONSULTEES

> Do you agree that the data sources identified (Section24.3) are sufficient to inform the onshore hydrology, hydrogeology, and flood risk baseline for the VE PEIR and ES?
> Have all potential impacts resulting from VE been identified for water environment receptors?
> Do you agree that the impacts described in Table 24.4 can be scoped out?
> For those impacts scoped in (Table 24.3), do you agree that the methods described are sufficient to inform a robust impact assessment?
> Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of VE on hydrology, hydrogeology, and flood risk for onshore receptors?

25. GEOLOGY AND GROUND CONDITIONS

25.1 INTRODUCTION

25.1.1 This chapter of the Scoping Report identifies the geology, ground conditions and land quality receptors of relevance to the VE landfall, onshore cable corridor and substation activities and infrastructure. It describes the potential effects from the construction, operation and maintenance, and decommissioning of onshore aspects of VE on geology, ground conditions and land quality and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

25.2 STUDY AREA

25.2.1 No pathways which could affect geology, ground conditions and land quality receptors beyond the onshore AoS have been identified. Therefore, the study area for onshore ground conditions has been defined as the onshore AoS which encapsulates the landfall zone, and the search areas for the onshore cable corridor(s) and substation.

25.2.2 The study area will be reviewed and amended once the location of the National Grid substation has been confirmed and the preferred onshore VE ECR and OnSS has been identified through ongoing review of constraints (environmental and/ or engineering) and discussions with stakeholders through the Evidence Plan Process. This is expected to result in a significant reduction in the size of the study area as it is refined to more closely follow the route of the preferred onshore cable route and preferred locations for the landfall and OnSS when these are selected during 2022 (see Chapter 5: Site Selection and Alternatives).

25.3 BASELINE DATA

25.3.1 To describe the geological and land quality baseline across the study area this scoping report chapter, as a minimum, makes use of the following freely available data sources, listed in Table 25.1 and below. These sources will also be used to inform the PEIR/ES.

25.3.2 The data review completed as part of the PEIR. It will identify sites across the study area benefitting from protection (e.g., geological sites of special scientific interest) and those that have been subject to potentially contaminative activity and, therefore, have a greater likelihood of representing significant sources of ground contamination.

25.3.3 Once the proposed location of the preferred onshore cable corridor has been selected there may be a requirement to source additional third-party data (e.g. Groundsure environmental database reports, historical Ordnance Survey maps) for individual parcels of land identified as higher risk through the desktop review. This requirement will be reviewed upon completion of the desktop review of data listed below in this quality and discussed with relevant stakeholders through the EPP. Information requests regarding historic landfills and contamination events will be submitted to Essex County Council.

Table 25.1 Key Sources of information for geology, ground conditions and land quality

KEY SOURCES OF INFORMATION	SUMMARY	SPATIAL COVERAGE OF VE
Old-maps.co.uk for historical Ordnance Survey maps (where available). https://www.oldmapsonline.org/	Historical ordnance survey maps for the study area.	Partial coverage of the study area.
British Geological Survey (BGS) mapping https://www.bgs.ac.uk/geological-data/map-viewers/	Mapping for: > Solid and superficial geology; > Borehole logs; and > Historic mining areas.	This is a national dataset providing full coverage of the study area.
Google Earth	Mapping for details of current, and where available former, land use.	This is a national dataset providing full coverage of the study area.
The Coal Authority website interactive mapping https://mapapps2.bgs.ac.uk/coalauthority/home.html	Service to check whether any historic coal mining will impede development, including subsidence damage claims.	This is a national dataset providing full coverage of the study area.
Natural England website https://magic.defra.gov.uk/magicmap.aspx	> Historic and active landfill sites; > Groundwater Source Protection Zones (SPZ); and > Permitted industrial and commercial facilities.	This is a national dataset providing full coverage of the study area.
Department for Environment, Food and Rural Affairs (DEFRA) MAGIC website https://magic.defra.gov.uk/magicmap.aspx	Statutory and non-statutory environmental designations.	This is a national dataset providing full coverage of the study area.

KEY SOURCES OF INFORMATION	SUMMARY	SPATIAL COVERAGE OF VE
Essex.gov.uk website https://www.essex.gov.uk/land-searches https://www.essex.gov.uk/minerals-waste-planning-policy/waste-local-plan	Essex and Southend on Sea Waste Local Plan (adopted July 2017) and; Essex Minerals Local Plan (adopted July 2014).	This a local dataset covering the VE study area
GeoEssex records relating to Local Geological Sites (LoGs) formerly Regionally Important Geological/Geomorphological Sites (RIGS). http://www.geoessex.org.uk/	Database of local geological sites.	This is a national dataset providing full coverage of the study area.

25.4 BASELINE ENVIRONMENT

25.4.1 This section provides an overview of the baseline characterisation based on the data review undertaken to date. Once the proposed location of the preferred landfall, substation and onshore cable corridor have been selected there may be a requirement to source additional third-party data (e.g. Groundsure environmental database reports, historical Ordnance Survey maps) for individual parcels of land identified as higher risk through the desktop review. This requirement will be reviewed upon completion of the desktop review of data listed above in this section. This section gives a general overview of baseline conditions across the study area highlighting areas with a history of development (particularly for commercial and industrial use), former military installations, areas of quarrying that have subsequently been subject for landfilling and areas with an increased risk of UXO.

25.4.2 Bedrock geology is consistent across the search area; the entire study area is underlain by Thames Group, clay, silt, sand and gravels of Palaeogene age. The Thames Group are impermeable, deposits that have been classified as unproductive.

25.4.3 Superficial deposits differ across the area and are absent in many parts of the search area. Strata identified comprise quaternary age River Terrace Deposits of clays silts and sands, and some areas of glacial sands and gravels and glacial till deposits to the west. The superficial deposits are of low sensitivity, comprising Secondary (A) and Secondary (B) Aquifers and Unproductive Strata.

25.4.4 As part of the detailed baseline characterisation, a search via Essex County Council will be undertaken to establish mineral safeguarding areas.

25.4.5 Environment Agency designated Source Protection Zones (SPZ 3) appear to the western portion of the onshore AoS beyond Great Bentley with no sensitive zones (i.e. SPZ1 or 2) in the area.

25.4.6 A detailed and robust characterisation of the baseline environment will be presented in the PEIR. This characterisation will identify sites across the study area benefitting from protection (e.g., geological sites of special scientific interest) and those that have been subject to potentially contaminative activity and, therefore, have a greater likelihood of representing significant sources of ground contamination.

COMMERCIAL/INDUSTRIAL ACTIVITIES

25.4.7 Sites with a history of Industrial/commercial use located in the vicinity of urban settlements including Great Holland, Thorpe-le–Soken, Tendring, Weeley Heath, Little Clacton, Great Bentley, Little Bentley, Great Bromley and Little Bromley have the greatest potential to be impacted by contamination. Activities that are likely to be present in the study area could potentially comprise the following:

- Petrol filling stations (PFS);
- Vehicle repair/maintenance businesses and similar engineering works;
- Infilled gravel/clay pits;
- Railway land; and
- Former industrial activities (e.g. brick works).

25.4.8 Notwithstanding the above, it is considered that the final ECR is likely to be positioned to avoid significantly developed urban areas and as such the ECR is more likely to traverse agricultural land that is less likely to be impacted by contamination.

WASTE RECYCLING & DISPOSAL FACILITIES

25.4.9 Historical landfill facilities within the study area are listed in the following Table 25.2.

Table 25.2 – Historical Landfill Site Identified within the Onshore Area of Search for VE

SITE	DATES OF OPERATION	WASTE ACCEPTED
TM 20190 19253 (former gravel pit)	Yet to be confirmed	Unknown
TM 19113 21542 (former gravel pit)	Yet to be confirmed	Unknown
TM 15223 22044 (former gravel pit)	Yet to be confirmed	Unknown
TM 13831 21248 (former gravel pit)	Yet to be confirmed	Unknown
TM 14563 22689 (former gravel pit)	Yet to be confirmed	Unknown
TM 15972 18011 (former gravel pit)	Yet to be confirmed	Unknown
TM 22055 22679 (former clay pit)	Yet to be confirmed	Unknown

25.4.10 Other waste facilities that may be located within the study area include the following:

- Yet unidentified current and historical landfill sites;
- Waste recycling, transfer and treatment sites, at Holland on sea, Great Bentley, Thorpe-le-Soker, Great Bromley and Little Bromley;
- End of life vehicle processing facilities (i.e. scrapyards); and
- Sewage works.

MINING AREAS

25.4.11 Map Information obtained from the Coal Authority website[83] does not identify any areas that have been impacted by mining within the study area.

UNEXPLODED ORDNANCE (UXO)

25.4.12 Historical industrial/commercial areas located in coastal towns such as Clacton on Sea may have been subject to bombing during World War Two and could therefore be impacted by UXO. However, much of the area is classified as Low Risk apart from Little Bentley which was subject to Luftwaffe attacks (V1 Flying bombs) as the area was used for troop camps during the war. The coast also had World War 2 defences located along the coast.

DESIGNATED SITES

25.4.13 Map information obtained from the Department for Environment, Food & Rural Affairs (DEFRA) MAGIC website identified limited designations, such as Sites of Special Scientific Interest (SSSI), no Special Areas of Conservation (SAC) and no RAMSAR sites, within the study area Designations. Geological designations within the study area are listed in Table 25.3.

Table 25.3 – Environmental designations with relevance to the onshore area of search for VE

SITE	CLOSEST DISTANCE TO VE OWF	FEATURES OR DESCRIPTION
NATIONAL/LOCAL		
Holland on Sea Cliff SSSI	Within study area boundary	Sea Cliff - geological
Dakings Pit (LoGs)	Within study area boundary	Gravel Pit with Palaeolithic remains

25.4.14 Additionally, a few undesignated small pits and ponds are located within the study area identified from screening aerial photography. The primary reason for designation is understood to be due to geological importance, primarily clay or gravel pits.

[83] https://mapapps2.bgs.ac.uk/coalauthority/home.html)

25.4.15 An initial data review identified there are two potentially sensitive surface water receptors. These comprise the Holland Brook and the North Sea. Further details of potentially sensitive controlled water receptors are presented in the Hydrology and Hydrogeology (Chapter 24).

25.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

25.5.1 A range of potential impacts on geology, land quality and ground conditions have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 25.2, together with a description of any proposed additional data collection (e.g., site-specific surveys) and/or supporting analyses (e.g., modelling) to enable an assessment of the impact.

25.5.2 Based on the baseline environment information currently available and the project description (outlined in Chapter 3: Project Description) a few impacts are proposed to be scoped out of the EIA for geology, land quality and ground conditions. These impacts are outlined in Table 25.2, together with a justification for scoping them out.

25.5.3 The following guidance documents have been referenced when devising the assessment methodology:

- A key item of guidance is the ‘Land contamination risk management (LCRM)’ guidance (Environment Agency, 2020), which indicates that a Conceptual Site Model (CSM) should identify those contamination sources, pathways and receptors which are “likely” to represent an “unacceptable” risk either to human health or the surrounding environment;
- Contaminated Land Statutory Guidance 2012 (ref: PB13735) is intended to explain how Local Authorities should implement the regime as detailed by EPA 1990, including how they should go about deciding whether land is contaminated land in the legal sense of the term;
- Construction Industry Research and Information Association (CIRIA) C552 (Contaminated Land Risk Assessment. A guide to good practice) examines the risk assessment of contaminated land and explains the key elements of risk assessment practices and procedures; and
- Environmental impact assessment guidance produced by CIRIA, Institute of Environmental Management and Assessment (IEMA) and the Highways Agency in the Design Manual for Roads and Bridges, Volume 11 Environmental Assessment[84].

PROPOSED ASSESSMENT METHODOLOGY

METHODOLOGY – LAND QUALITY ASSESSMENT

25.5.4 The normal procedure for assessing land dictates that potential contaminant Sources, Pathways and Receptors should be considered within the context of potential contaminant linkages (PCLs) and that an evaluation of the risks associated with each linkage should drive decisions regarding the status of the land as contaminated, unaffected by contamination or requiring further investigation.

[84] Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 3, Part 11, Geology and Soils (Highways Agency, 1993) and DMRB, Volume 11 Environmental Assessment, Section 2, Part 5, HA205/08 Assessment and Management of Environmental Effects Highways Agency (Highways Agency, 2008)

25.5.5 The first assessment, a land quality assessment, takes account of the development proposals which introduces humans and property to this site. The individual risk assessments consider the potential for existing ground conditions to harm site users, damage property/buildings and pollute the wider environment.

25.5.6 The methods to be followed in the assessment of land quality are detailed in various guidance documents. The overarching guidance document is LCRM guidance (Environment Agency, 2020). The Model Procedures are intended to assist all those involved in dealing with land contamination, including landowners, developers, professional advisors, regulatory bodies and financial providers.

25.5.7 The Model Procedures are split into three stages: risk assessment, options appraisal and remediation.

25.5.8 The first stage, risk assessment, is an essential component in achieving effective management of the risks from land contamination. The ES will rely on information and risk assessments presented as appendices, and these are likely to comprise detailed desk studies supported, where necessary, by targeted ground investigations and quantitative risk assessments, to address the likely sources, potential pathways and any likely receptors.

25.5.9 If needed, mitigatory measures will form part of a remediation strategy and implementation plan.

UNEXPLODED ORDNANCE

25.5.10 It should be noted that for the purposes of the chapter UXO will be assessed alongside other geohazards such as ground-based contaminants, hazardous gases, etc. In effect, UXO will be treated as a “Source” of hazard in a risk-based approach. This is judged appropriate as, whilst there is no legislation specifically dealing with UXO, health and safety legislation such as the CDM Regulations and Health and Safety at Work Act effectively place obligations to ensure appropriate assessment and mitigation measures, if required.

METHODOLOGY – DEVELOPMENT IMPACT ASSESSMENT

25.5.11 The second assessment, the Development Impact Assessment, will discuss the potential impacts of VE on soils and near surface geological deposits via physical-movement and pollution. The assessment will consider impacts during construction and operation of the development. Appropriate mitigation measures will be identified where predicted impacts during construction and operation are significant. It will not be possible to quantify these effects, and so qualitative assessments will be carried out based on available knowledge and professional judgement.

25.5.12 The methodology to be used draws on environmental impact assessment guidance produced by CIRIA, IEMA and the Highways Agency in the Design Manual for Roads and Bridges, Volume 11 Environmental Assessment.

25.5.13 The Environmental Statement will also likely rely on some form of Agricultural Land Classification and Soil Resources report.

POTENTIAL PROJECT IMPACTS

25.5.14 A range of potential impacts on ground conditions, human, environmental and built receptors have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the VE EIA are outlined in Table 25.2 above, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) to enable an assessment of the impact.

25.5.15 Following the method laid out above, the PEIR will present various risk assessments and consider the potential for existing ground conditions and UXO to harm future site users, damage future buildings, pollute water or the wider environment including plants. In this case, the risk assessments will show that baseline conditions across most of the site will comprise undeveloped agricultural land and that the site can be made sui for its new use.

25.5.16 An initial assessment of risk and associated impacts is presented in Table 25.4. It should be noted however that this initial assessment is based upon identified land uses and contaminative activities identified across the wider study area, and subsequent project refinement it may be possible to discount their presence and therefore the associated potential impacts.

25.5.17 Based on the information currently available, the supplied study area and the project description, a few impacts are proposed to be scoped out of the EIA for this topic. These impacts are described in Table 25.5, together with a justification for scoping them out.

Table 25.4 – Impacts proposed to be scoped into the assessment for onshore cable corridor and substation

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT)
CONSTRUCTION			
25.1	Short term risks to construction workers during development of landfall, onshore substation and onshore cable routes	Site workers could be exposed to contaminated soils and groundwater during the construction phase via the direct contact, ingestion and dust inhalation exposure pathways.	The presence of significant contamination along the large majority of the ECR is deemed unlikely as the final route is most likely to avoid significantly developed areas and traverse open farmland. However, the presence of localised sources of contamination cannot be ruled out at this initial stage. Once the infrastructure for the ECR and substation is finalised it will be necessary to carry out a detailed desk-based assessment supported by purchased environmental database and historical map information. In accordance with current guidance, this information will then be used to prepare a Conceptual Site Model (CSM) that will explore the relationships between sources, pathways and receptors of contamination. Any complete pollutant linkages identified by the CSM will represent a potential risk that may warrant further investigation. This could include site investigation, the recovery of soil and
25.2	Risks to offsite human receptors, such as occupants of residential properties bordering landfall, onshore substation and onshore cable routes.	Dusts generated during the construction phase could pose a risk to offsite human receptors via the inhalation exposure pathway. Such risks will be particularly pertinent if asbestos were identified in soils.	
25.3	Risks posed to sensitive surface water and groundwater resources.	Ground disturbance or the removal of hardstanding could increase the potential for leaching and the mobilisation of soluble contaminants.	

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT)
			water samples for chemical analysis and the provision of an interpretative quantitative risk assessment. These findings will be used to establish the likely magnitude of potential effects (i.e. whether they are long, medium or short-term; or whether the effect is temporary/reversible or permanent) as well as the sensitively of the receptor that could be impacted. The receptor importance/sensitivity and subsequent magnitude of change will be assessed as a function of one another to determine the significance of each effect. Any identified sources of contamination that could pose a risk to human receptors via the dust inhalation pathway, such as soils potentially impacted by asbestos, will be used to inform the Air Quality Chapter 23 and the mitigation measures required.
25.4		Leaks and/or spills of contaminants, such as fuels and oils, used and stored during the construction phase.	Bulk storage of potential contaminants judged to be unlikely during construction phase. Risks will be ameliorated by implementing a Code of Construction Practice and adopting good working procedures and control measures i.e.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT)
			appropriate storage facilities, spill response plans etc.
25.5	Construction phase impacts upon soil/land quality	Compaction, erosion and reduction of structural properties due to disaggregation. Localised excavation and loss of soil resources	Potential impacts could arise if poor working practices are adopted during the construction phase. Plant and vehicle movements should be carefully managed to ensure that the structural properties of soils, and their effectiveness as a growth medium for plants, are not significantly impacted. Exposure of soils after vegetation clearance, particularly on any sloping areas, should be avoided to prevent significant erosion. The complete loss of soil resources along limited sections of the ECR where intrusive construction works are more prominent cannot be completely ruled out. The receptor importance/sensitivity and subsequent magnitude of change will be assessed as a function of one another to determine the significance of each effect.
25.6	Sterilisation of mineral deposits	Construction of the ECR upon deposits of minerals safeguarded by local policy	Where possible, the ECR and substation should be positioned to avoid potentially sensitive mineral deposits as detailed by the Essex local minerals plan.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT)
25.7	Risk from Unexploded Ordnance to construction workers and nearby residents	Undertake a preliminary UXO desk based assessment and if required more detailed surveys should risk areas be identified near the corridor.	Where possible, the ECR should be positioned to avoid potential risk areas from UXO.
OPERATION			
25.8	Ingress and accumulation of hazardous ground gases	Ground gases generated by deposits of fill could accumulate in confined spaces, such as structures and deep excavations, resulting in the accumulation of poor air quality and a risk of asphyxiation and explosion.	Risks will only be applicable if the ECR was located on or near significant deposits of fill with the potential to generate ground gases such as methane and carbon dioxide. Such sources could be identified via detailed desk-based research of purchased environmental database information. The risks will only be applicable if any structures of infrastructure associated with the ECR included confined spaces in which ground gases could accumulate.
25.9	Structures and services laid in direct contact with contaminated soils and groundwater	Certain contaminants can have a long-term impact on the integrity of subsurface materials such as buried concrete and plastic service pipes.	Potential sources for contamination will be referenced during the design phase ensuring selection of appropriate materials that provide adequate protection from contaminated soils and/or groundwater.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT)
DECOMMISSIONING			
25.11	Short term risks to construction workers during decommissioning of ECR and associated infrastructure	Site workers could be exposed to contaminated soils and groundwater during the decommissioning phase via the direct contact, ingestion and dust inhalation exposure pathways.	Any significant risks posed by contaminated soils or groundwater are likely to be established during the construction phase and as such appropriate control measures could be implemented during decommissioning.
25.12	Risks to offsite human receptors, such as occupants of residential properties bordering the associated infrastructure with the project.	Dusts generated during the decommissioning phase could pose a risk to offsite human receptors via the inhalation exposure pathway.	Any identified sources of contamination that could pose a risk to human receptors via the dust inhalation pathway, such as soils potentially impacted by asbestos, will be used to inform the Air Quality chapter and the mitigation measures required.
25.13	Risks posed to sensitive surface water and groundwater resources.	Leaks and/or spills of contaminants, such as fuels and oils, during the decommissioning phase.	Bulk storage of potential contaminants judged to be unlikely during decommissioning phase. Risks will be ameliorated by adopting good working procedures and control measures i.e. appropriate storage facilities, spill response plans etc.

Table 25.5 – Impacts proposed to be scoped out of the assessment for onshore geology and ground conditions

IMPACT NO	IMPACT	JUSTIFICATION FOR SCOPING OUT
25.14	Operational impacts on geology/ground conditions and associated longer term risks to human and environmental receptors	Significant ground disturbance is considered unlikely during the operation phase. Furthermore, contractors appointed to carry out repair/maintenance activities will be informed of any issues relating to ground contamination identified during the construction phase and will therefore adopt appropriate working methods and control measures to ameliorate any potential risks and associated impacts.
25.15	Loss of agricultural land from operation of underground cables	The construction of the ECR will be carried out in controlled and considered manor so as not have any long-term impact upon agricultural land. Furthermore, the final ECR is likely to be positioned to avoid potentially sensitive land uses where possible.
25.16	Routine maintenance effects on sterilisation of minerals and loss of agricultural land.	Large scale works maintenance works are judged to be unlikely during the operation phase. Localised activities will be subject to control measures to ameliorate and small-scale risks and impacts.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

25.5.18 As part of the design process for VE a few designed-in measures are proposed to reduce the potential for impacts on ground conditions and the resulting impacts upon potentially sensitive human, environmental and built receptors. These are presented below, and these will continue to evolve over the development process as the EIA progresses and in response to consultation.

25.5.19 VE OWFL are committed to implement these measures, and various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/out presented in Table 25.4 and Table 25.5.

25.5.20 Measures adopted as part of the project will include:

- Construction and maintenance workers should develop task specific method statements and risk assessments that specifically reference any potentially significant sources of ground contamination identified by the desk and site-based assessments carried out to support the preparation of the final ES chapter;
- Selection and use of appropriate robust personal protective equipment (PPE) by all site workers;
- Use of appropriate dust suppression measures, particularly during periods of dry weather when dust generation is most likely;
- Provision of appropriate spill kits on all site plant and in areas where fuels or other potentially contaminative liquids/chemicals are both used and stored;
- Management of stockpiles, including placement on impermeable surfaces and the provision of covering, to avoid leaching of any contaminants;
- Management of plant and vehicles including the use of covered wagons to transport soils and provision of wheel wash facilities;
- Management of plant and vehicle movements to prevent significant compaction of soils and a reduction in their structural properties essential for plant growth;
- Prevent long term exposure of soils during construction, particularly within any sloping areas, to reduce the risk of wind and water erosion and the resulting impacts upon soil quality;
- Implement a Code of Construction Practice and adopt appropriate safe working practices that consider the potential for hazardous ground gases ingress and accumulation in confined spaces. The use of gas protection measures, such as impermeable membranes and ventilation, may be required if any permanent structures are to be in proximity to identified sources of ground gases such as a landfill site; and
- Development of, and adherence to, a Decommissioning Plan.

25.5.21 The requirement and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

POTENTIAL CUMULATIVE IMPACTS

25.5.22 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For onshore geology and ground conditions, cumulative interactions may occur with other planned projects and developments in the study area. Potential cumulative impacts with other projects and activities will be considered for each of the impacts considered in Table 25.4.

25.5.23 The risks posed to human receptors, including site workers and occupants/users of adjacent sites, could potentially be exacerbated if the landfall, cable corridor or substation were to border any other significant proposed developments. Risks to controlled water receptors could be increased if significant works adjoining the development areas also resulted in activities such as soil stockpiling and the removal of hardstanding, as this could have a cumulative impact upon the leaching of soluble contaminants. A concentration of plant and machinery will also increase the risk of an escape from fuel and chemical storage facilities.

25.5.24 Any plans, projects or activities that could result in a cumulative impact on onshore geology and ground conditions will be identified in the short listing process (see Chapter 4). Of particular note is the North Falls Offshore Wind Farm and the National Grid East Anglia Coastal Substation.

POTENTIAL TRANSBOUNDARY IMPACTS

25.5.25 Based upon the nature of the site, and the anticipated baseline ground conditions as identified by this initial assessment, it is considered that any impacts, if present, will be localised. It is therefore judged that there will not be any transboundary impacts relating to geology and ground conditions. Therefore, it is suggested that this impact will be scoped out from further consideration within the EIA.

25.6 SUMMARY OF NEXT STEPS

25.6.1 In accordance with current guidance and best practice, the assessment of potentially contaminated sites should commence with a desk-based assessment.

25.6.2 Once the landfall, cable corridor and substation are refined the initial stage of assessment will comprise a review of available desktop information This assessment will highlight any potentially contaminative sites that will warrant further, more robust assessment. The distance of the assessment from the landfall, cable corridor and substation will be devised based upon the significance of the identified sources of contamination, the sensitivity of the identified receptor and the likelihood of an exposure pathway existing that could link the two.

25.6.3 Areas identified as being more likely to be impacted by contamination could subsequently be subject to a more detailed desk-based assessment akin to a Phase I Primary Land Quality Risk Assessment (PLQRA). These assessments will be based upon a review of purchased environmental database and historical map records and, where necessary, site walkover surveys. The purpose of any such targeted qualitative risk assessments will be to provide a more comprehensive understanding of potential sources, pathways and receptors of contamination and their likely relationships. These will be presented in a Conceptual Site Model that will identify potentially pollutant linkages by which a sensitive receptor could be linked to source of contamination by an exposure pathway.

25.6.4 If/where potentially significant pollutant linkages are established this is likely to trigger further phases of assessment that could comprise intrusive ground investigation, the recovery of soil and water samples for laboratory chemical analysis and the provision of a quantitative risk assessment.

25.6.5 The findings of qualitative and quantitative risk assessments will be used to establish the likely magnitude of potential effects (i.e. whether they are long, medium or short-term; or whether the effect is temporary/reversible or permanent) as well as the sensitively of the receptor that could be impacted. The receptor importance/sensitivity and subsequent magnitude of change will be assessed as a function of one another to determine the significance of each effect.

25.6.6 The size of the area(s) requiring investigation will be devised with reference to the likely significance of the identified sources of contamination and the sensitivity of the constructions works and environmental setting of each defined study area.

25.6.7 The findings of the initial phases of assessment, and the nature and extend of any identified contamination, could then be used to inform working practices and the design of the final ECR. Where the risks cannot be ameliorated through the adoption of control measures consideration may need to be given to localised remediation.

25.7 FURTHER CONSIDERATIONS FOR CONSULTEES

25.7.1 The further consideration for consultees regarding potential impacts upon geology and ground conditions are as follows:

> Do you agree that the risks and impacts associated with contaminated land are unlikely to be significant across the large majority of any landfall, cable corridor and substation, and that any subsequent, more detailed assessments are most likely to target localised impacts?

> Do you agree that the proposed phased approach to the assessment of risk and associated impacts are sufficient to inform the onshore baseline ground conditions for the VE ES?

> Are there any potentially significant sources of ground contamination/contaminative activities within the UAOS that have not been identified by the initial data review?

> Have all potentially sensitive receptors within the wider UAOS been identified?

> Do you agree that the impacts described in Table 25.5 can be scoped out?

> For those impacts scoped in Table 25.4, do you agree that the methods described are sufficient to inform a robust impact assessment?

26. LANDSCAPE AND VISUAL

26.1 INTRODUCTION

26.1.1 This section of the Scoping Report identifies the landscape and visual receptors which are of relevance to the VE onshore AoS. It considers the potential landscape and visual impacts from the construction, operation and maintenance, and decommissioning of the onshore components of VE. It defines the proposed scope of the landscape and visual impact assessment (LVIA) for the onshore components of VE.

26.1.2 The LVIA for the onshore AoS will cover all terrestrial elements of VE from the cable landfall, the onshore export cable and the onshore substation. All seaward components of VE from the cable landfall point are covered by the Chapter 16: Seascape, landscape and visual impact assessment for the offshore environment. Consideration of the SLVIA in the Onshore LVIA will be assessed in the PEIR.

26.2 STUDY AREA

26.2.1 For the purpose of the EIA in respect of LVIA, the study area comprises the onshore AoS and a precautionary buffer of 5 km around the onshore AoS (Figure 26.1) (referred to as the LVIA study area). The LVIA study area takes account of the uncertainty around the final location of the VE substation and the ongoing connection to the National Grid EACS and has been identified as an appropriate maximum zone of influence for identifying sensitive LVIA receptors that could be impacted by the presence of the VE onshore infrastructure. This 5km buffer area around the onshore AoS incorporates a 1 km buffer around areas where the onshore export cable and landfall could be located within the onshore AoS. For reference Figure 26.1 to Figure 26.4 presents the LVIA study area and a 1 km buffer around the onshore AoS in respect of relevant sensitive landscape and visual receptors to a potential onshore export cable route at the outer extent of the AoS.

26.2.2 The review of the LVIA study area may also be influenced by the identification of additional constraints (environmental and / or engineering) and feedback through the scoping opinion and Evidence Plan process. The LVIA study area will also be refined to more closely follow the route of the preferred VE onshore export cable route to the final VE and EACS substation locations from the landfall location when these are selected (See Chapter 5: Site Selection and Alternatives for more information). This is expected to result in a significant reduction in the size of the final study area that will be considered in the PEIR and ES as there will only be a 1km buffer area around the preferred onshore export cable route and landfall and a 5km buffer area around the preferred VE substation location. Once a preferred cable route, substation and landfall has been identified further stakeholder consultation will be undertaken if required on any appropriate refinement of the LVIA study area through the Evidence Plan process.

26.3 BASELINE DATA

26.3.1 The data used for the purposes of scoping are as follows:

Table 26.1 - Key sources of information for Landscape and Visual Impact

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
Ordnance Survey (OS)	> OS 1:50,000, 1: 25,000 and Terrain 50 and Terrain 5 DTM data	This is a national mapping coverage
Ordnance Survey (OS) Open Data	> National landscape planning designations. > Settlements, roads, railways and public rights of way; and > National Trails.	This is national OS data able to provide designations for the specific area
Essex County Council	> Essex Landscape Assessment (Chris Blandford Associates for Essex County Council 2003); and > The Landscape Character Assessment of the Essex Coast (October 2005). > Local Landscape Designations including: Citations and descriptions relating to historic parks and gardens & Local Council Planning Portals and Development Plans	Local area coverage of landscape designations
Tendering District Council	> Tendring District Landscape Character Assessment, Volumes One and Two, LCA and Landscape Guidelines (November 2001, Land Use Consultants);	District level coverage of landscape character assessments in Tendering District.
Magic.gov	> There are two National Landscape Designations within the onshore AoS located at Haven Country Park and Thorpe Hall Registered Park and Garden. The Dedham Vale Area of Outstanding Natural Beauty (AONB) abuts onshore AoS but does not overlap	National landscape designations specific to the area
Essex County Council	> Identification of PROW, footpaths cycleways and bridleway networks will be assessed using Essex County Council's Highway's Information Map.	Local level coverage of PROWs within Essex
Suffolk County Council	> East of England Landscape Framework; > Suffolk Landscape Assessment, Suffolk County Council (2011, updated 2018);	Local area coverage of landscape designations within LVIA buffers.

SOURCE	SUMMARY	SPATIAL COVERAGE OF VE
	> Touching the Tide Landscape Character Assessment (Alison Farmer Associates for the Touching the Tide Partnership, August 2012); > Suffolk Coastal Landscape Character Assessment (Alison Farmer Associates for Suffolk Coastal District Council, July 2018);	
Suffolk County Council	> Suffolk Coast and Heaths AONB Management Plan 2018-2023; > Suffolk Coast and Heaths AONB – Natural Beauty and Special Qualities Indicators (LDA Design for Suffolk Coast and Heaths AONB Partnership, Suffolk County Council and EDF Energy, V1.8, November 2016); > The Suffolk Coast and Heaths – Landscape Guidelines (Suffolk Coast and Heaths Partnership, 2001); > Development in the setting of the Suffolk Coast and Heaths AONB (Suffolk Coast and Heaths AONB Partnership, December 2015); > Citations and descriptions relating to historic parks and gardens; and > Local Council Planning Portals/ Development Plans.	Landscape planning context and designations within LVIA buffers
Mid Suffolk District Council Colchester Borough Council	> the Joint Babergh and Mid Suffolk District Council Landscape Guidance, August 2015; and > the Colchester Borough Landscape Character Assessment, Colchester Borough Council, November 2005.	Landscape planning context and designations within LVIA buffers

26.4 BASELINE ENVIRONMENT

26.4.1 This section provides a high-level summary of landscape and visual receptors that form part of the existing environment within the LVIA study area.

LANDSCAPE CHARACTER

26.4.2 Landscape character within the LVIA study area includes a number of national and local landscape character types and areas. The National Character Areas for England (Natural England, 2014/2015) provide a broad description of the landscape. The number of overlapping published character assessment documents has the potential to create a degree of complexity in the LVIA. Therefore, it is proposed that the LVIA is predominately based on the Tendring District Landscape Character Assessment Volumes One and Two Landscape Character Assessment and Landscape Guidelines prepared by Land Use Consultants (November 2001), the Joint Babergh and Mid Suffolk District Council Landscape Guidance, August 2015 and the Colchester Borough Landscape Character Assessment, Colchester Borough Council, November 2005.

26.4.3 The other published document listed above will still be used in the LVIA to ensure a comprehensive analysis of the baseline context is undertaken.

- The onshore AoS lies within two National Character Areas (NCA) as shown in Figure 26.1
- NCA 81 Greater Thames Estuary, and
- NCA 111 Northern Thames Basin;

26.4.4 The wider LVIA study area lies within the following two additional National Character Areas (NCA) as shown in Table 26.1 and Figure 26.1:

- NCA 86 South Suffolk and North Essex Clayland; and
- NCA 82 Suffolk Coast and Heaths.

26.4.5 The Tendring District Landscape Character Assessment separates the landscape into landscape types, which are sub-divided into character areas. This local character assessment will form a good basis for the baseline landscape assessment for within the onshore AoS. It also covers some of the wider LVIA study area. The following landscape types and character areas lie within the LVIA study area as shown in Figure 26.1

- 1 Open Estuarine/ Coastal Marsh:
    - 1A Brightlingsea Creek Marshes;
    - 1B Colne Estuary Marshes;
    - 1C Colne Point Marshes;
    - 1D Hamford Water Marshes; and
    - 1E Stour Estuary Marshes.
- 2 Drained Estuarine/ Coastal Marsh:
    - 2A Brightlingsea Drained Marshes;
    - 2B St Osyth Drained Marshes;

- 2C Holland Haven; and
- 2D Hamford Drained Marshes and Islands.
- 3 Coastal Slopes:
  - 3A Hamford Coastal Slopes; and;
  - 3B Brightlingsea Coastal Slopes;
  - 3C St Osyth Coastal Slopes; and
  - 3D Holland Coastal Slopes.
- 4 Coastal Ridges and Peninsulas:
  - 4A The Oakley Ridge;
  - 4C Brightlingsea Peninsula; and
  - 4D St Osyth Coastal Ridge.
- 5 River Floodplains:
  - 5C Cattawade Marshes.
  - 6 Clay Valley:
  - 6A Stour Valley System;
  - 6B Ardleigh Valley System;
  - 6C Airesford Valley System; and
  - 6D Holland Valley System.
- 7 Heathland Plateau (landscape type):
  - 7A Bromley Heaths; and
  - 7B St Osyth / Great Bentley Heaths.
- 8 Clay Plateau (landscape type):
  - 8A Tendring and Wix Clay Plateau; and
  - 8B Clacton and the Sokens Clay Plateau.

26.4.6 The landscape within the onshore AoS (and also parts of the wider LVIA study area) is located on the Tendring Peninsula at the edge of the London Basin. It is drained by numerous rivulets flowing to the sea. The area comprises a mosaic of intensive farmland and pasture, small woodland plantations (including some areas of nationally important ancient broadleaf woodland), heathland, drained estuaries, clay valleys and associated rivers and coastline with sandy beaches and a string of popular tourist resorts. It is a predominately lowland plateau landscape falling towards the east. The coastline is largely drained coastal marsh protected by seawalls with long views over the landscape from the sea wall and Great Holland.

26.4.7 There is a range of cultural heritage assets in the landscape, including Saxon burial mounds. Military features are also a key feature of the landscape (Second World War pillboxes).

26.4.8 Settlement pattern is relatively sparse inland but larger settled areas are present on the coast at Clacton and Frinton. Typically, inland settlement comprises dispersed farmsteads together with small villages such as Bromley, Little Bromley, Tendring, Weeley, Thorpe-le-Soken, Landemere and Great Holland.

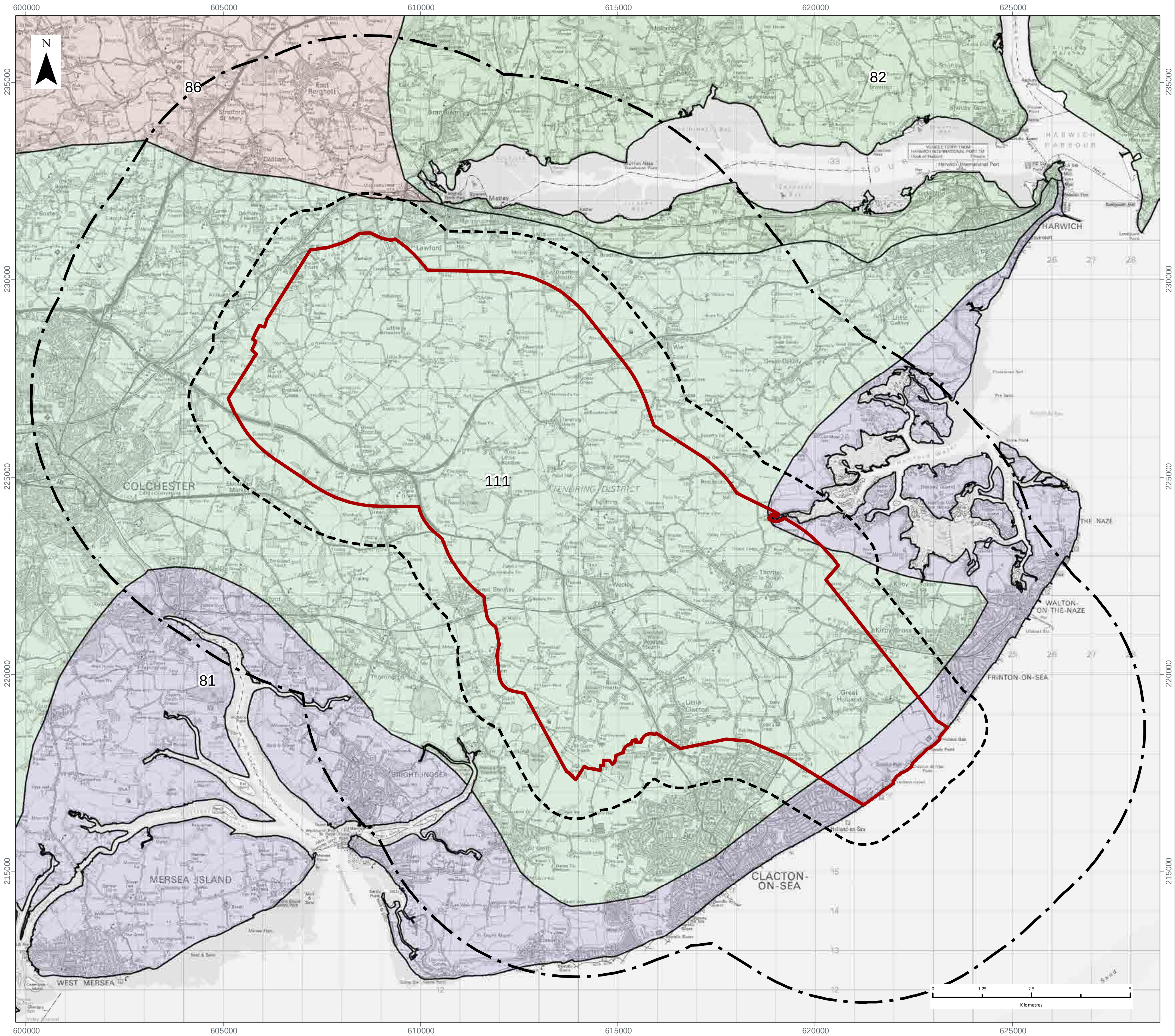
26.4.9 The Joint Babergh and Mid Suffolk District Council Landscape Guidance, August 2015 separates the landscape into landscape typologies. This local character assessment has used the Landscape Character Assessment areas as defined by Suffolk County Council and then includes information and detail to ensure each Landscape Character is clearly relating to Babergh District. This will form the baseline landscape assessment for the LVIA study area as it covers this area with an appropriate level of detail. The following landscape character areas lie within the LVIA study area as shown in Figure 26.2

- 11 Plateau Estate Farmlands;
- 12 Plateau Farmlands;
- 15 Rolling Estate Farmlands;
- 18 Rolling Valley Farmlands;
- 26 Valley Meadowlands;
- Navigable Inland Waters; and
- Saltmarsh and Intertidal Flats.

26.4.10 The landscape character within the LVIA study area is largely characterised by distinct large regular fields located to the north of the River Stour. It contains part of the designated Dedham Vale AONB consisting of plateaux that are flat or gently rolling with areas of 'ancient' countryside with old, sinuous hedge lines. Valley sides of deep loams, with parklands plantations and Ancient woodlands line the saltmarsh and intertidal flats with areas of rolling valley farmlands further inland. To the west of the River Stour lie areas of valley meadowland. The Colchester Borough Landscape Character Assessment (Colchester Borough Council produced by Chris Blandford Associates, November 2005) separates the landscape into landscape types, which are sub-divided into character areas. This local character assessment will form the baseline landscape assessment for the LVIA study area as it covers these areas an appropriate level of detail. The following landscape types and character areas lie within the LVIA study area as shown in Figure 26.2:

- A River Valley:
  - A2 Roman Wooded Valley;
  - A5 Colne River Valley Slopes;
  - A6 Ardley River Valley;
  - A7 Stour River Valley Slopes;
  - A7b Stour River Valley Slopes; and
  - A8 Stour River Valley Floor.
- B Farmland Plateau:
  - B3 Southern Colchester Farmland Plateau;

- B7 Langham Farmland Plateau; and
- B8 Wivenhoe Farmland Plateau.
- C Estuarine Marsh/ Mudflats;
  - C1 Fingringhoe Estuarine Marsh/ Mudflats.
- D Drained Estuarine Marsh:
  - D3 Colne Drained Estuarine Marsh; and
  - D4 Pyefleet Drained Estuarine Marsh.
- E Coastal Farmland:
  - E3 Langerhoe Coastal Farmland.
- G Principal Urban Areas:
  - G3 Wivenhoe Urban Landscape; and
  - G4 Colchester Urban Landscape.



LEGEND

- Onshore Area of Search
- Onshore Area of Search plus 1km Buffer
- LVIA Study Area

National Landscape Character Areas

- 81: Greater Thames Estuary
- 82: Suffolk Coast and Heaths
- 86: South Suffolk and North Essex Clayland
- 111: Northern Thames Basin

Data Source:
© Crown copyright [and database rights] (2021) 0100031673 OS OpenData.
© Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right 2021.

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

National Landscape Character Areas

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	JRS	SF

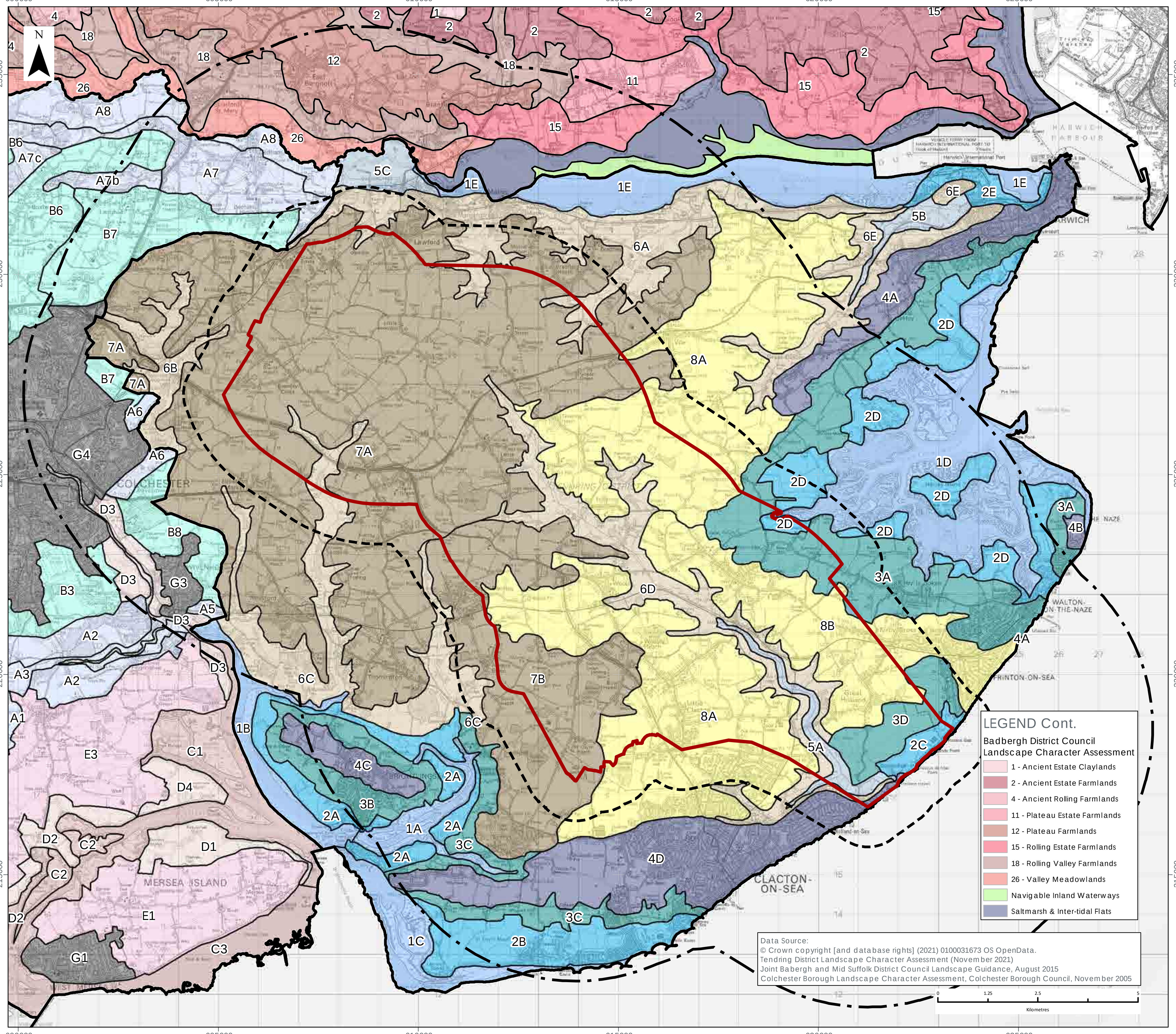
DRAWING NUMBER:

26.1

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:100,000	A3	ODN	British National Grid

FIVE ESTUARIES OFFSHORE WIND FARM

P:\05356 - GoBe Consultants Ltd\00010 Five Estuaries\Tech\GIS\Dwgs\Wking\2021 07 Scoping\Landscape\05356.00010.0006.2 Landscape Characters.mxd



LEGEND

Onshore Area of Search
District Borough Boundary
Onshore Area of Search plus 1km Buffer
LVIA Study Area

Tendring Landscape Character Assessment

1: Open Estuarine / Coastal Marsh
- 1A: Brightlingsea Creek Marshes
- 1B: Colne Estuary Marshes
- 1C: Colne Point Marshes
- 1D: Hamford Water Marshes
- 1E: Stour Estuary Marshes

2: Drained Estuarine / Coastal Marsh
- 2A: Brightlingsea Drained Marshes
- 2B: St Osyth Drained Marshes
- 2C: Holland Haven
- 2D: Hamford Drained Marshes and Islands
- 2E: Parkeston Drained Marshes

3: Coastal Slopes
- 3A: Hamford Coastal Slopes
- 3B: Brightlingsea Coastal Slopes
- 3C: St Osyth Coastal Slopes
- 3D: Holland Coastal Slopes

4: Coastal Ridges and Peninsulas
- 4A: The Oakley Ridge
- 4B: The Naze Peninsula
- 4C: Brightlingsea Peninsula
- 4D: St Osyth Coastal Ridge

5: River Floodplains
- 5A: Holland Brook
- 5B: Ramsey Creek
- 5C: Cattawade Marshes

6: Clay Valleys
- 6A: Stour Valley System
- 6B: Ardleigh Valley System
- 6C: Alfresford Valley System
- 6D: Holland Valley System
- 6E: Ramsey Valley System

7: Heathland Plateaux
- 7A: Bromley Heaths
- 7B: St Osyth / Great Bentley Heaths

8: Clay Plateaux
- 8A: Tendring and Wix Clay Plateau
- 8B: Clacton and the Sokens Clay Plateau

Colchester Borough Council Landscape Character Assessment

A - River Valley
- A1 - Abberton Flooded River Valley
- A2 - Wooded Roman River Valley
- A3 - Roman River Valley Floor
- A5 - Colne River Valley Slopes
- A6 - Ardleigh River Valley
- A7 - Stour River Valley Slopes
- A7b - Stour River Valley Slopes
- A7c - Stour River Valley Slopes
- A8 - Stour River Valley Floor

B - Farmland Plateau
- B3 - Southern Colchester Farmland Plateau
- B6 - Great Horkelsley Farmland Plateau
- B7 - Langham Farmland Plateau
- B8 - Wivenhoe Farmland Plateau

C - Estuarine Marsh/Mudflats
- C1 - Fingringhoe Estuarine Marsh/Mudflats
- C2 - Strood & Salcott Estuarine Marsh/Mudflats
- C3 - West Mersea Estuarine Marsh/Mudflats

D - Drained Estuarine Marsh
- D1 - Mersea Drained Estuarine Marsh
- D2 - Feldy Drained Estuarine Marsh
- D3 - Colne Drained Estuarine Marsh
- D4 - Pyefleet Drained Estuarine Marsh

E - Coastal Farmland
- E1 - Mersea Island Coastal Farmland
- E3 - Langenhoe Coastal Farmland

G - Principal Urban Areas
- G1 - West Mersea Urban Landscape
- G3 - Wivenhoe Urban Landscape
- G4 - Colchester Urban Landscape

LEGEND Cont.

Badbergh District Council Landscape Character Assessment

- 1 - Ancient Estate Claylands
- 2 - Ancient Estate Farmlands
- 4 - Ancient Rolling Farmlands
- 11 - Plateau Estate Farmlands
- 12 - Plateau Farmlands
- 15 - Rolling Estate Farmlands
- 18 - Rolling Valley Farmlands
- 26 - Valley Meadowlands
- Navigable Inland Waterways
- Saltmarsh & Inter-tidal Flats

Data Source:

Tendring District Landscape Character Assessment (November 2021)
Joint Babergh and Mid Suffolk District Council Landscape Guidance, August 2015
Colchester Borough Landscape Character Assessment, Colchester Borough Council, November 2005

0 1.25 2.5 5
Kilometres

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

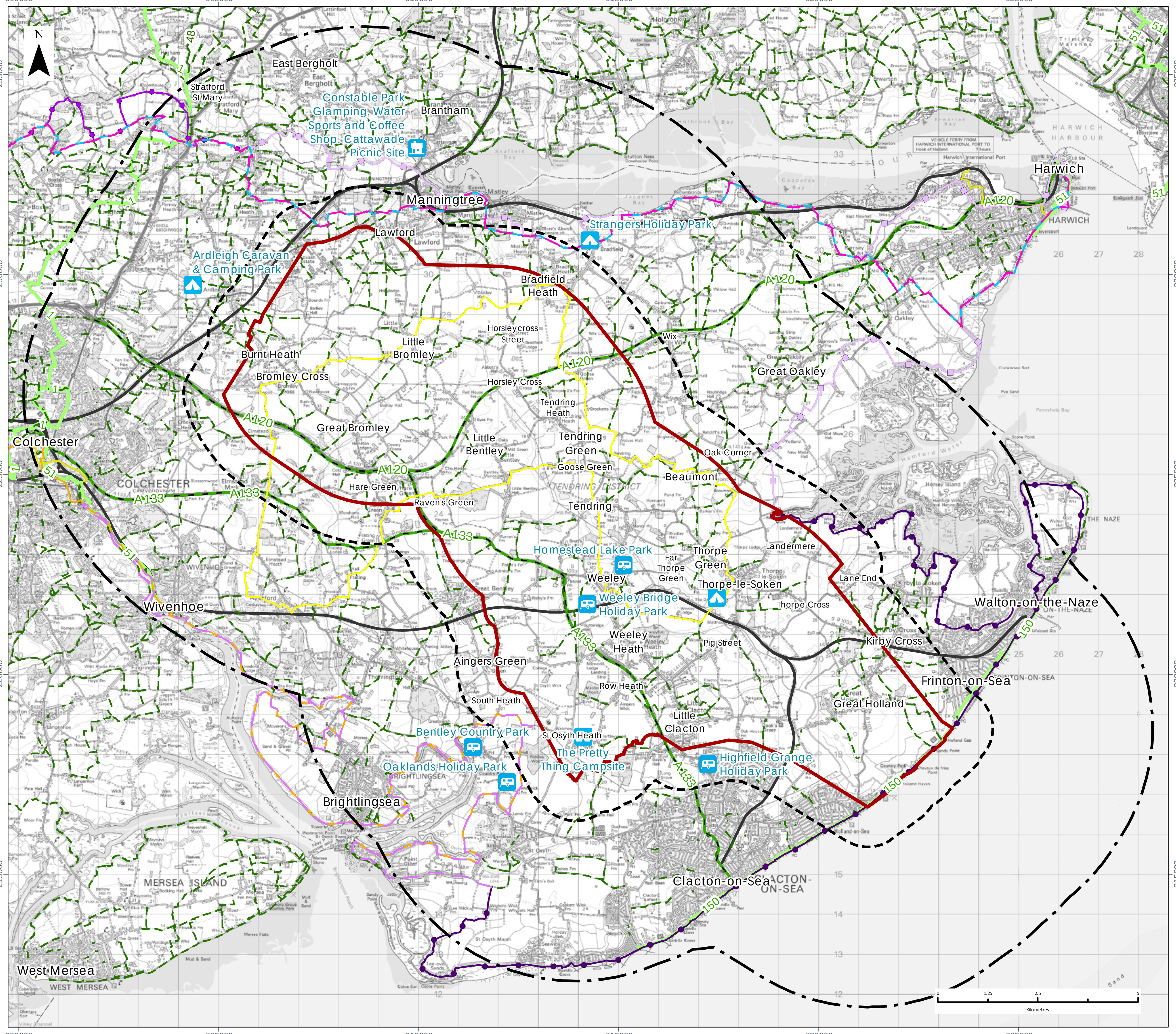
Detailed Landscape Character Areas

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	JRS	SF

DRAWING NUMBER: 26.2

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:100,000	A3	ODN	British National Grid

FIVE ESTUARIES OFFSHORE WIND FARM



LEGEND

- Onshore Area of Search
- Onshore Area of Search plus 1km Buffer
- LVIA Study Area
- Campsite
- Caravan Park
- Glamping Site
- Public Right of Way
- A Road Network
- Railway Line

Long Distance Walking Routes

- Essex Way
- Lasso Essex - Sparkling Estuary (07)
- Lasso Essex - Sunny Sandy Strands (08)
- Lasso Essex - Mastodon Echo (09)
- Lasso Essex - Sparkling Estuary (10)
- Nelson Way
- Tendering Hundred Hinterland
- Walks in Colne Zolne

Cycle Routes

- National Cycle Route
- National Cycle Route Link
- Regional Cycle Route

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

VISUAL RECEPTORS

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	JRS	SF

DRAWING NUMBER:

26.3

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:100,000	A3	ODN	British National Grid

FIVE ESTUARIES OFFSHORE WIND FARM

P:\05356 - GoBe Consultants Ltd\00010 Five Estuaries\Tech\GIS\Dwgs\Wking\2021 07 Scoping\Landscape\05356.00010.0008.2 Visual Receptors.mxd

VISUAL RECEPTORS

26.4.11 The diversity and scale of the LVIA study area means it includes a wide range of visual receptors, which are illustrated by Figure 26.3

26.4.12 Key considerations in the context of this analysis include:

- Residents;
- Leisure users, including people using Public Rights of Way, Open Access Land, promoted walking and cycling routes and visiting local features/attractions, beaches and also including areas valued for natural and cultural heritage qualities that contribute to the sense of place; and
- Users of transport routes, including the road and rail networks.

RESIDENTS

26.4.13 Settlement pattern within the onshore AoS is generally relatively dispersed with numerous individual or clusters of residential properties and farmsteads. In addition, there are several villages and larger settlements, such as Bromley, Little Bromley, Little Bentley, Tendring, Weeley, Beaumont-cum-Maze, Thorpe-le-Soker, Wesley Heath, Little Clacton, Landermere, Kirby Cross and Great Holland. Several of these settlements also form popular tourist destinations, particularly those along the coastline nestled between Frinton-on-Sea to the south east of the Clacton-on-Sea to the south west of the onshore AoS.

26.4.14 Settlement patterns within the LVIA study area are similar in nature to that of the onshore AoS comprising numerous individual or clusters of residential properties and farmsteads especially towards the coastal areas. Village settlements within the LVIA study area include Lawford, Bradfield Heath, Oak Corner, Lane End, Kirby Cross, Great Oakley, Wix, Seawick, Thorrington, Dedham Heath, Strafford St Mary, East Bergholt and Brantham. Larger settlements and towns within the LVIA study area include Manningtree, Walton-on-the-Naze, Brightlingsea, Wivenhoe and Colchester.

LEISURE AND RECREATION

26.4.15 There are numerous footpaths and bridleways (including promoted routes), areas of Open Access Land and promoted cycling routes that provide access to the countryside and coastlines.

26.4.16 Two Long distance promoted routes overlap with the onshore AoS. These include Lasso Essex – Sunny Sands Stands and the Tendring Hundred Hinterland. Beyond the onshore AoS within the LVIA study area there are further routes at the Essex Way, Lasso Essex Way (various sections), Nelson Way and Walks in Colne Zolne. There are several locally promoted routes, Public Rights of Way, bridleways and byways.

26.4.17 There is one National Cycle Route within the onshore AoS. National Cycle Route 150 runs along the coast between Frinton-on-Sea and Clacton-on- Sea. An on-road route not on the National Cycle Network cuts across the onshore AoS between Raven's Green in the west towards Stones Green to the east. National Cycle Routes 1 and National Cycle Route 51 lie within the LVIA study area. Figure 26.3).

26.4.18 There are other opportunities for leisure and recreation throughout the LVIA study area predominantly located on the coast between Frinton and Clacton and beyond. There is a caravan park at Homestead Lake Park and Weeley Bridge Holiday Park and a camping site at Grange Farm within the onshore AoS. Within the LVIA study area lie a number of further caravan and camping sites including Ardleigh Caravan and Camping Site Constable Park, Glamping Water, Cattawade Picnic site, Strangers Holiday Park, Highfield Grange Holiday Park, The Pretty Thing Campsite, Oakland Holiday Park and Bentley Country Park. (Figure 26.3).

26.4.19 Other opportunities for leisure and recreation include visitor locations notable for their ecological and scenic interest are present within the LVIA study area. Relevant designations within the onshore AoS include the following designations:

- The Holland Haven Marshes SSSI and the Holland Haven Country Park between Clacton-on-Sea and Frinton-on-Sea; and,
- Various pockets of Nationally important ancient broadleaf woodland

26.4.20 In addition, the following designations fall within the LVIA study area:

- The Hamford Water SPA, SAC and Ramsar.
- Dedham Vale AONB;
- Stour and Orwell SPA and Ramsar;
- The Colne Estuary (Mid-Essex Coast Phase 2) Ramsar and SPA;
- the Suffolk Coast and Heaths AONB; and
- Highwoods Country Park.

26.4.21 It is not proposed to specifically consider any offshore leisure based visual receptors as part of the LVIA for terrestrial elements of VE.

TRANSPORT ROUTES

26.4.22 There are multiple transport routes within the LVIA study area. The A120 Harwich Road crosses into the northern part of the onshore AoS near Great Bromley and Thorley Cross and forms the Wix Bypass. The A133 Colchester Road leads south from the A120 travelling south to Clacton-Sea through the western section of the onshore AoS. There are multiple secondary and minor roads throughout the onshore AoS and LVIA study area, providing connections between the settlements (Figure 26.3).

26.4.23 There is one passenger railway line entering the western edge of the onshore AoS near Great Betley towards Great Holland where it forks into two lines towards Frinton in the east and Clacton in the west. (Figure 26.4). A further passenger railway line lies within the LVIA study area connecting Colchester in the west to Manningtree and beyond in the north.

26.4.24 It is not proposed to specifically consider any offshore transport (e.g. ferry routes) visual receptors as part of the LVIA for terrestrial elements of VE.

DESIGNATED SITES

26.4.25 Table 26.2 below provides an overview of designated sites within the LVIA study area. There are two Landscape Designations that overlap the onshore AoS. Dedham Vale AONB abuts the onshore AoS boundary to the north and the Suffolk Coast and Heaths AONB is located a short distance beyond the onshore AoS to the north; both are within the LVIA study area. For the sake of thoroughness Registered Common Land Areas are also included. Figure 26.4 shows the location and extent of the designations in relation to the onshore AoS and the LVIA study area.

26.4.26 Local landscape designations are also included. There is one Registered Park and Garden located at Thorpe Hall within the onshore AoS and a further five Registered Parks and Gardens within the LVIA study area located at Clacton Seafront Gardens, St Osyths Priory, Beth Chatto Gardens, Wivenhoe Park and Colchester Castle Park.

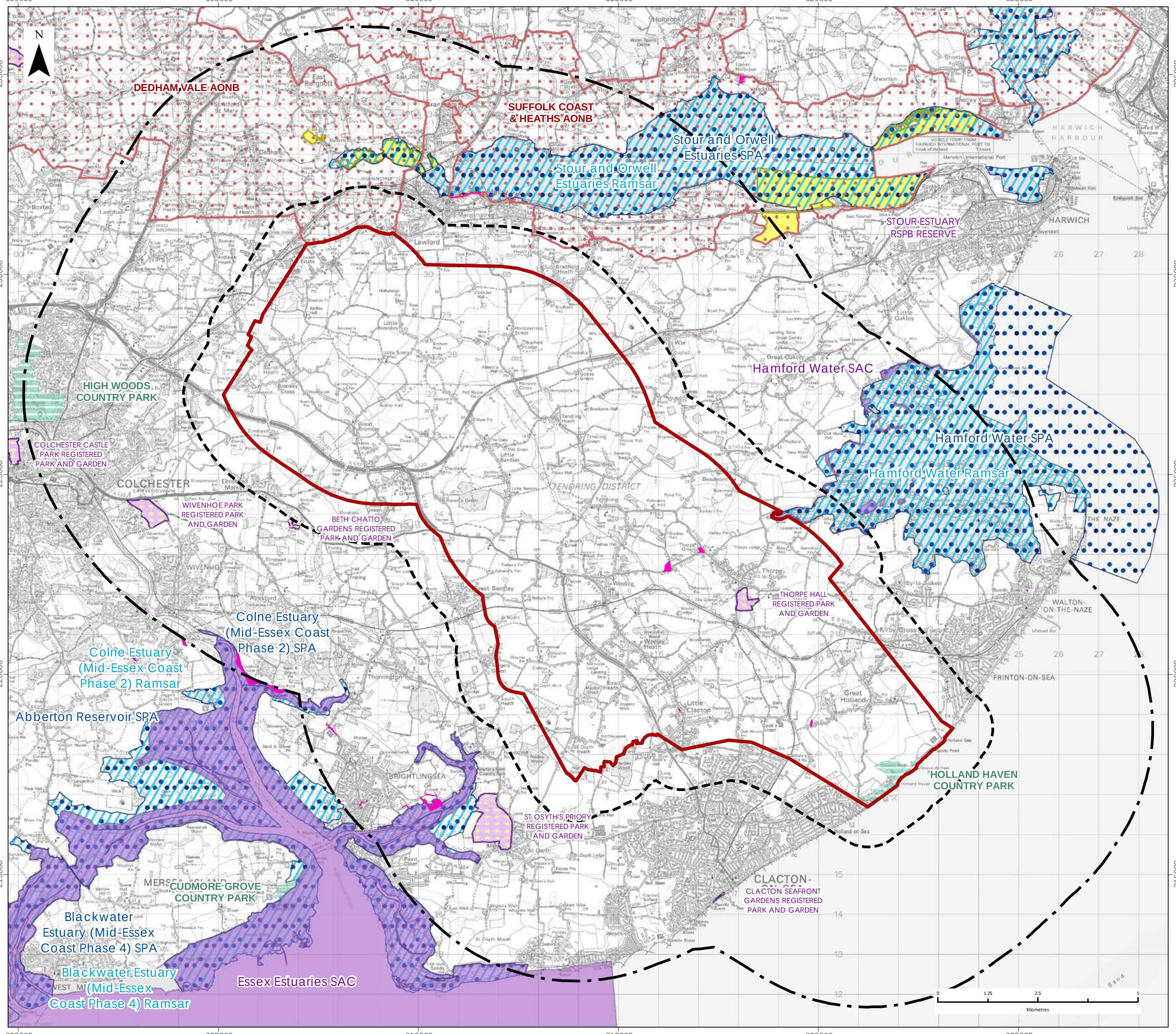
26.4.27 Holland Haven Country Park lies within the onshore AoS and a further Country Park is located within the LVIA study area at High Woods Country Park.

26.4.28 SPAs, Ramsar sites, Special Areas for Conservation (SAC) and RPSB Reserves within the study area are also included on Figure 26.4 as they are considered to be tourist destinations/ visual receptors due to their ecological interest.

Table 26.2 – Landscape designations with relevance to VE

SITE	CLOSEST DISTANCE TO VE ONSHORE AOS	FEATURES OR DESCRIPTION
NATIONAL		
Dedham Vale AONB	> Adjacent to the onshore AoS and overlaps the LVIA study area.	The Dedham Vale AONB covers an area of 90 km^2. It comprises picturesque villages, rolling farmland, rivers, meadows, ancient woodlands.
Suffolk Coast and Heaths AONB	> Out with onshore AoS at a distance of approximately 1km to its nearest point. Overlaps the LVIA study area buffer.	The Suffolk Coast and Heaths AONB covers an area of 403 km^2. It comprises a gently rolling landscape on the eastern edge of Suffolk. It comprises coastline, with shingle beaches, estuaries with salt marsh and mudflats, grazing marshes, heathland, forestry and farmland.
Holland Haven Country Park	> Located within the onshore AoS	Holland Haven Country Park is situated on the coast between Clacton-on-Sea and Frinton-on-Sea and is managed to conserve landscape, coastal grazing marsh and wildlife whilst providing for the quiet enjoyment of visitors.
Highwoods Country Park	> Located within the LVIA study area at a distance of approximately 4.5km from the onshore AoS.	Highwoods Country Park is located to the northern edge of Colchester set within the urban context.
Registered Common Land Areas	> Located within the onshore AoS > Located within the LVIA study area buffer	There are two registered common land areas at Thorpe Green and Far Thorpe Green. There are four registered common land areas at Brightlingsea and two along the River Colne to the south east of Wivenhoe.
Registered Parks and Gardens	> Thorpe Hall Registered Park and Garden is located within the Onshore AoS. > Clacton Seafront Gardens Registered Park and Garden is located within the LVIA study area at a distance of approximately 3.5km from the boundary of the onshore AoS.	Restored 17th century gardens open to the public. Grade II Park and Garden including 20th century shrub and water gardens. Located within the urban settlement Grade II seafront gardens dating back to 1921 consisting of Marine gardens, bedding, war memorial and sunken rose garden.

SITE	CLOSEST DISTANCE TO VE ONSHORE AOS	FEATURES OR DESCRIPTION
	> St Osyth's Priory Registered Park and Garden located within the LVIA study area at a distance of approximately 2km from the boundary of the onshore AoS. > Beth Chatto Registered Park and Garden located within the LVIA study area at a distance of approximately 1.2km from the boundary of the onshore AoS. > Wivenhoe Park Registered Park and Garden located within the LVIA study area buffer at a distance of approximately 3km from the boundary of the onshore AoS. > Colchester Castle Park Registered Park and Garden located within the LVIA study area buffer at a distance of approximately 4.9km from the boundary of the onshore AoS.	Grade II mid to late 18th century kitchen gardens. Grade II series of informal gardens of 7 acres developed from 1960 onwards – s structured series of linked gardens with terraces and water features. Grade II old deer park and landscaped park of 34hectares associated with Wivenhoe House. With relatively flat parkland, parkland trees and lakes. Grade II late 19th century public park incorporating a mid-18th century house and it's grounds set around the remains of a Norman Castle in an urban setting.



LEGEND

- Onshore Area of Search
- Onshore Area of Search plus 1km Buffer
- LVIA Study Area
- Area of Outstanding Natural Beauty (AONB)
- Country Park
- Registered Common Land
- Special Protection Area (SPA)
- Ramsar
- Special Area of Conservation (SAC)
- RSPB Reserve
- Registered Park and Garden

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Landscape Designations

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	JRS	SF

DRAWING NUMBER:

26.4

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:100,000	A3	ODN	British National Grid

FIVE ESTUARIES
OFFSHORE WIND FARM

P:\05356 - GoBe Consultants Ltd\00010 Five Estuaries\Tech\GIS\Dwgs\Wking\2021-07_Scoping\Landscape\05356.00010.0007.2 Landscape Designations.mxd

26.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

26.5.1 The assessment will be based on recognised guidelines, principally the 3rd edition of the Guidelines for Landscape and Visual Impact Assessment (GLVIA 3) (Landscape Institute and Institute of Environmental Management and Assessment, 2013). The process followed will conform with the recommendations of GLVIA 3 as well as our own professional experience, focussing on likely significant impacts, rather than assessing all potential impacts. This will allow determination of the key residual impacts resulting from VE. Photomontages and visualisations will be based on SNH's Visual Representation of Wind Farms (February 2017) and the Landscape Institute's Visual Representation of Development Proposals (September 2019).

26.5.2 This section describes the broad principles and approach that will be applied. The key assessment stages will be:

- Confirming the scope of the assessment, in terms of the final LVIA study area extent, key viewpoints and LVIA content, including cumulative considerations;
- An iterative approach to the mitigation of potentially significant adverse impacts through the assessment process;
- Preparation of the LVIA and accompanying drawings and visualisations; and
- The LVIA will include judgements in relation to the susceptibility, value and sensitivity of landscape and visual receptors, the predicted magnitude of change and the predict level of impacts/impacts and whether these will be significant.

LANDSCAPE

26.5.3 The assessment of potential landscape effects will concentrate on the refined study area for the LVIA once the landfall, export cable route and substation location have been confirmed and will be based on the criteria given in Section 26.2. A character assessment will establish the baseline landscape conditions and examine the sensitivity of the LVIA receptors within the relevant study areas to the potential changes associated with the VE onshore infrastructure.

26.5.4 The assessment will require a combination of desk study and fieldwork. The desk study and baseline assessment will include analysis of published information on landscape character and landscape designations. This will inform judgements in relation to the value, susceptibility and sensitivity of landscape receptors.

26.5.5 The landscape assessment will use the published landscape character assessments, refined through fieldwork, to establish the existing baseline landscape character of the LVIA study area and identify distinct landscape character types. The location, use, landscape elements, scale, nature of views and landscape quality of character areas/types will be described. Landscape character will be assessed, and potential impacts identified based on the principles set out in GLVIA 3. A review of published information has identified several key documents that inform this. The LVIA will take into consideration the potential impacts of the proposal on relevant landscape designations.

26.5.6 The assessment will identify key characteristics of the landscape and visual context that may inform the design of VE and any required mitigation measures. The emphasis of the baseline study will be the recording and describing of existing features that are important in the local context and their contribution to character.

26.5.7 The significance of the potential landscape impacts will be determined using professional judgement and a robust method in accordance with GLVIA 3 and best practice. The evaluation of potential impacts will focus on impacts on landscape features and elements, and the perception of landscape character.

VISUAL

26.5.8 Potentially sensitive visual receptors are located across the landscape within the refined LVIA study area. These include residents, users of PROW, road users and tourists/visitors to the coast and surrounding landscape. The visual assessment will be based on the confirmed locations of VE and:

- The analysis of the ZTV for VE;
- Field survey to review potential visibility and the changes that will occur; and
- Views from agreed viewpoints representing sensitive visual receptors within the LVIA study area at a range of distances and directions from the location of the onshore VE infrastructure.

26.5.9 The viewpoint assessment will be carried out to determine the potential impacts of VE on specific receptors and viewpoints within the refined LVIA study area. However, important viewpoints beyond this will also be considered if appropriate. Viewpoints proposed for inclusion in the assessment will be agreed through consultation with relevant consultees. The viewpoints will allow an assessment of the key elements of VE to be made from a range of locations within the refined LVIA study area. It is also expected that viewpoints will be selected to support the assessment of impacts on the cultural heritage assets, these may be specific to the cultural heritage assessment or used in both this and the LVIA.

26.5.10 The existing and predicted view of the onshore infrastructure associated with VE will be described and illustrated using photography. A 35mm equivalent camera (i.e. a full frame digital single lens reflex camera) with a 50mm lens is the chosen format for recording the viewpoint photography, which is endorsed as the most suitable camera combination/focal length for landscape and visual impact assessment work. For each viewpoint, the photography will be presented showing the existing view, together with visualisations (e.g. wireline and photomontage as appropriate) to illustrate the predicted view of VE. The visualisations will be prepared in accordance with relevant good-practice guidance e.g. SNH's Visual Representation of Wind Farms (February 2017) and the Landscape Institute's Visual Representation of Development Proposals (September 2019). It may be appropriate to consider the need for photography that reflects views seen in different seasons at certain locations and the need for this will be agreed with key consultees as part of the viewpoint selection process. It is currently proposed that baseline photography will be taken in Spring 2022, before vegetation is in leaf and so illustrating the 'worse case' view.

26.5.11 As with the assessment of landscape impacts, the significance of the potential visual impacts will be determined using professional judgement and a robust method in accordance with GLVIA 3. The evaluation of potential impacts will focus on how changes resulting from VE are predicted to affect visual amenity within the LVIA study area.

26.6 POTENTIAL PROJECT IMPACTS

26.6.1 A range of potential impacts on landscape and visual receptors have been identified, which may occur during the construction, operation and maintenance, and decommissioning of the onshore components of VE. The potential impacts that have been scoped into the VE EIA are outlined in Table 26.3, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. predicted visibility modelling) to enable an assessment of the potential impacts.

26.6.2 Based on the information currently available and the current project description, a number of potential impacts are proposed to be scoped out of the EIA for this topic. These impacts are described in Table 26.4, together with a justification for scoping them out. A key reason for proposing to scope out certain impacts is to ensure the LVIA remains focused on the likely significant impacts rather than every impact that might occur. Table 26.4 includes those impacts that are considered appropriate to scope out based on expert judgement and professional experience from similar developments.

Table 26.3 - Impacts proposed to be scoped into the assessment for onshore landscape and visual

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
26.1	Direct temporary loss/disturbance of landscape features and elements, and potential impacts on the perception of landscape character.	The impact of construction activities such as vegetation removal and soil stripping within the onshore VE substation and infrastructure will directly affect features and elements of the landscape, with associated effects on the perception of landscape character.	The LVIA will consider the potential impacts of the construction phase on landscape receptors. This will include desk based and field survey work for the onshore VE substation and infrastructure. ZTV will be prepared to inform evaluation of the extent of potential effects on the perception of landscape character. Viewpoint photography will be undertaken at agreed locations to record the baseline and inform the prediction of potential effects. Whilst the viewpoints are more specifically linked with the assessment of effects on visual receptors they will also help inform and illustrate the landscape impact assessment work.
26.2	Impacts of the construction phase on visual amenity.	The impact of construction activities such as vegetation removal and soil stripping within the onshore substation and infrastructure will	The LVIA will consider the potential impacts of the construction phase on visual receptors. This will include desk based and field survey work around both the VE substation and infrastructure. ZTV will be prepared to inform evaluation of the extent of potential effects on visual amenity. Viewpoint photography will be undertaken at agreed locations to record the baseline and inform the prediction of potential visual effects.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
		affect visual receptors, with the LVIA focused on those receptors within the LVIA study area (where significant effects are more likely to occur).	
OPERATION			
26.3	Potential effects on the perception of landscape character resulting from the operational substation.	The presence of the operational substation will result in potential effects on landscape character.	The LVIA will consider the potential effects of the operational phase on landscape receptors. It is anticipated that assessment will be focused on the 5km area surrounding the substation site. This will include desk based and field survey work, which will overlap with similar work undertaken for the substation in relation to the construction phase. A ZTV will be prepared to inform evaluation of the extent of potential effects on landscape character. Viewpoint photography (expected to be consistent with those used for the construction phase) will be undertaken at agreed locations, expected to be consistent with the construction phase work, to record the baseline and inform the prediction of potential effects. Again, whilst the viewpoints are more specifically linked with the assessment of effects on visual receptors they will also help inform and illustrate the landscape impact assessment work.

Table 26.4 - Impacts proposed to be scoped out of the assessment onshore landscape and visual

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
CONSTRUCTION		
26.1	Landscape and visual effects resulting from construction traffic	Construction traffic will be comparable with traffic flows that form part of the baseline environment, as noted within Chapter 22: Traffic and Transport. On this basis there is no risk of significant landscape and visual effects on sensitive visual receptors.
OPERATION		
26.2	Effects on landscape and visual receptors resulting from the VE cable infrastructure during the operational phase.	The key landscape and visual effects will occur during the construction phase. Once the land is restored any potential landscape and visual effects associated with this phase are unlikely to be significant.
26.3	Effects on landscape and visual receptors resulting from maintenance activities at the VE substation.	Whilst the presence of the operational VE substation will be a key component of the LVIA specific maintenance activities are likely to be short in duration and any associated landscape and visual effects are unlikely to be significant.
26.4	Night time landscape and visual effect	Depending on the final location and design, there may be a presence of some limited permanent artificial light sources at the VE substation and the access road. There may also be temporary short-term construction or maintenance activities, or to support security measures. However, these are unlikely to result in significant landscape and

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
		visual effects. Embedded mitigation will include sensor activated lights or infrared cameras to avoid the need for continuous security lighting.
DECOMISSIONING		
26.5	Effects on landscape and visual effects resulting from decommissioning	Effects on landscape and visual receptors resulting from the decommissioning will be comparable with, but less than the construction phase. The underground ducting will be left in situ following the operational phase, reducing the potential for loss or disturbance to landscape features and elements.
26.6	Residential visual amenity resulting from VE infrastructure route	The potential for visual effects along the VE infrastructure route are unlikely to be overbearing or overwhelming due to the short term and temporary nature of this phase.

26.7 MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

26.7.1 As part of the design process for the onshore elements of VE a number of designed-in measures are proposed to reduce the potential for impacts on landscape and visual receptors. These are presented below and will evolve over the development process as the EIA progresses and in response to consultation.

26.7.2 VE OWFL are committed to implement these measures and various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgements as to which impacts can be scoped in/out presented in Table 26.3and Table 26.4.

26.7.3 Key designed-in mitigation for the export cable route relate to the route and site selection process. This will include the micro-siting of the route to avoid important landscape features or elements, e.g. important hedgerows, trees and areas of woodland where possible. The avoidance of relevant landscape designations e.g. SLAs, historic parks and gardens and historic landscapes is anticipated and so will reduce potential landscape effects, if required.

26.7.4 Measures adopted as part of the project will include:

> Development of, and adherence to, a Code of Construction Practice (CoCP);

> Reinstatement and restoration of the landfall, onshore export cable route and construction compounds following the construction phase;

> Careful consideration of fencing such as materials, colouring and placement in relation to any screen planting;

> Careful consideration of lighting. Permanent artificial lighting may be required in limited form at the VE substation and access road. However, until the actual VE substation location and any associated access has been identified any permanent lighting requirements will be unknown. Potential mitigation is also highlighted in Table 26.4;

> Permanent security lighting requirements will be avoided where possible by the use of sensor activated lights or infrared cameras;

> Consideration of screening options such as planting and earthworks, this could include offsite works if considered necessary; and

> Development of, and adherence to, a Decommissioning Programme.

26.7.5 The requirement and feasibility of any mitigation measures will evolve and be consulted upon with statutory consultees throughout the EIA process. It will be important that any measures proposed recognise other related issues and balance the potential for any adverse impacts. For instance, new landscape proposals could have adverse impacts on heritage assets as a result of disturbance or root damage. Where possible mitigation proposals should also recognise and seek to reinforce historic landscape pattern and character.

26.8 POTENTIAL CUMULATIVE IMPACTS

26.8.1 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For LVIA, cumulative interactions may occur with other planned projects and developments in the study area. Potential cumulative impacts with other projects and activities will be considered for each of the impacts considered in Table 26.3.

26.8.2 At this stage it is anticipated that the key developments that will be included in the cumulative assessment include the National Grid EACS, North Falls Offshore Wind Farm's onshore infrastructure. Cumulative decommissioning impacts will be scoped out as listed in Table 26.4 as the likelihood that there will be a cumulative impact is low.

26.8.3 Other onshore activities that could potentially have a cumulative impact on onshore landscape and visual receptors in the context of the onshore export cables and substation are:

> Other proposed large-scale infrastructure projects;
> Other proposed linear developments such roads, pipelines and electricity transmission networks; and
> Major leisure/tourism and residential developments.

26.9 POTENTIAL TRANSBOUNDARY IMPACTS

26.9.1 Due to the relatively localised nature of any potential landscape and visual impacts associated with the onshore components of VE, transboundary impacts will not occur and therefore it is proposed that this impact be scoped out from further consideration within the EIA.

26.10 SUMMARY OF NEXT STEPS

26.10.1 The next steps and key discussion points will be as follows:

> Confirmation of the study area for inclusion in the LVIA once the locations of the VE onshore infrastructure and substation are known.
> Agreement on the viewpoints to be included in the LVIA, together with any seasonal requirements; and
> Agreement on the scope of any required cumulative assessment following review of current applications for adjacent projects and consultation with Essex County Council (and through the Evidence Plan process).

26.11 FURTHER CONSIDERATIONS FOR CONSULTEES

> Do you agree that the data sources identified are sufficient to inform the onshore LVIA baseline for the VE PEIR and ES?
> Do you agree that all the relevant designated sites and areas have been identified?
> Have the key potential impacts resulting from the onshore components of VE been identified for landscape and visual receptors?
> Do you agree that the impacts described in Table 26.4 can be scoped out?
> For those impacts scoped in (Table 26.3), do you agree that the method outlined is sufficient to inform a robust impact assessment?
> Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of the onshore components of VE on landscape and visual receptors?

27. SOCIOECONOMICS AND TOURISM

27.1 INTRODUCTION

27.1.1 This chapter of the Scoping Report identifies the socio-economic and tourism receptors of relevance to all proposed onshore and offshore infrastructure and activities associated with the VE. It describes the potential effects from the construction, operation and maintenance, and decommissioning of VE on socio-economic, tourism and recreational receptors and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

27.1.2 This chapter should be read alongside the following chapters of this Scoping Report:

- Chapter 14: Shipping and Navigation;
- Chapter 16: Seascape, Landscape, Visual Impact Assessment;
- Chapter 18: Infrastructure and other marine users;
- Chapter 21: Airborne Noise and Vibration;
- Chapter 22: Traffic and Transport;
- Chapter 23: Air Quality; and
- Chapter 26: Landscape and Visual.

27.1.3 The assessments in relation to the above technical topics that will be undertaken as part of the EIA will be used to inform potential socioeconomic effects within the socioeconomic impact assessment.

27.2 STUDY AREA

27.2.1 The onshore AoS is located within a part of Essex that is removed from some of the more popular tourist destinations and includes a quieter section of coast together with inland rural communities. The tourist destinations of Clacton-on-Sea, Frinton-on-Sea and Colchester are nearby but outwith the onshore AoS.

27.2.2 The nature of the effects to be considered by the socio-economic, tourism and recreation assessment apply at a range of spatial levels. It is therefore proposed to adopt a two-tier approach to baseline characterisation, identification of potential receptors and the assessment of effects. The two spatial levels and associated relevant receptors are defined below. The study areas will be refined and reduced in size as the project evolves following further development of VE onshore and offshore infrastructure.

LOCAL AREA OF INFLUENCE

27.2.3 The Local Area of Influence (LAI) forms the focus for assessment of both direct and indirect effects on those receptors that are likely to experience effects at a more local level, specifically tourism and recreation assets. It includes the onshore AoS and extends beyond it to include an offset of 5 km. Receptors include businesses and attractions associated with the local visitor economy such as tourist attractions, as well as community facilities and services. Where a receptor is located close to the LAI boundary (for example, where a village straddles the boundary of the 5 km offset) this has been accounted for and the offset distance extended accordingly. It is anticipated that the LAI will be refined significantly at the point when the preferred landfall, onshore cable route and onshore substation (OnSS) are identified (see Chapter 5: Site Selection and Alternatives).

WIDER STUDY AREA

27.2.4 The Wider Study Area (WSA) is intended to encompass the area within which significant effects on employment and the local economy, both onshore and offshore, could occur due to construction, operation and maintenance and decommissioning of VE. The WSA also takes account of the potential for effects on the tourism economy as a result of the visual impact of the presence of the WTGs. A preliminary WSA of 60 km from the array areas is proposed to be consistent with the Zone of Theoretical Influence (ZTV) of the WTGs; this may be refined at EIA stage depending on the findings of the SLVIA assessment (see Chapter 16). The relevant receptors for the WSA are employment and the local economy, with particular reference to the tourism economy. The WSA is provisionally set at the boundary of Essex and Suffolk County Council areas, within which the majority of the local supply chain and labour market effects that could occur will be experienced.

27.2.5 Both study areas will be reviewed and may be amended for the PEIR in response to preliminary assessment, stakeholder engagement, the refinement of the onshore and offshore AoSs, the use of ports for offshore construction, the use of an O&M base (see Chapter 3), further detail of businesses that may be affected by both onshore and offshore activities associated with VE and the identification of additional constraints (environmental and/ or engineering). As the development of VE progresses, and the study area is refined, this will be discussed with relevant stakeholders through the Evidence Plan Process.

27.3 BASELINE DATA

27.3.1 The data used for the purposes of scoping are set out in Table 27.1. Data relating to the baseline situation with regard to shipping and other marine users are detailed in the relevant marine chapters (Chapters 14 and 18 respectively).

Table 27.1 - Key sources of information for socio-economics, tourism and recreation

SOURCE	SUMMARY	SPATIAL COVERAGE
Office of National Statistics (ONS) including the ONS labour market data service NOMIS and other governmental published sources including Census data	> Demographic and labour market characteristics; > Employment, economic activity and unemployment trends; > Commuting and travel to work relationships; and > Business demography: the number, size profile and sectoral representation of the business base.	National dataset covering the whole of the WSA
Essex Open Data	Skills and employment data.	Essex
Open Data Suffolk	Skills and employment data.	Suffolk
OS postcode data	Location of businesses, tourism attractions and community services.	National dataset covering the whole of the WSA
England Coast Path / SUSTRANS / Long Distance Walkers Association	Long distance routes	Partial coverage of the socio-economic, tourism and recreation study areas.
Local Plan policies and land allocations for Tendring District Council and Essex County Council	Development allocations and minerals and waste safeguarding areas	Coverage of the whole of the WSA
Essex Sunshine Coast (Tendring District Council)	Visitor Information provided by Tendring District Council.	Coverage of the whole of the WSA
Visit Essex	Economic Impact of Tourism (2019) annual report; A Recovery Plan for the Essex Tourism and Hospitality Industry.	Coverage of the whole of the WSA
Destination Management Organisation	Suffolk Coast Tourism Strategy 2013-2023; The Energy Coast 2019.	Partial coverage of WSA
Definitive Maps	PROW network.	Coverage of the whole of the WSA
Galloper Offshore Wind Farm Environmental Statement	ES for Galloper Offshore Wind Farm, in particular the socio-economic, tourism and recreation assessment.	Partial coverage of WSA

27.3.2 It is not proposed to undertake any bespoke data collection or surveys.

27.3.3 A literature review will be undertaken of published studies of the effects on the tourism economy arising from the presence of wind farms. Relevant studies include:

- Regeneris Consulting, September 2016 The Economic Impacts of Galloper Wind Farm;
- Biggar Economics 2016 Windfarms and tourism trends in Scotland;
- National Grid, 2014 A Study into the Effect of National Grid Major Infrastructure Projects on Socio-economic Factors; and
- Lilley, M., Firestone, J. and Kempton, W., 2010 The Effect of Wind Power Installations on Coastal Tourism.

27.4 BASELINE ENVIRONMENT

WIDER STUDY AREA

27.4.1 The baseline environment for the assessment of socio-economic effects will provide an overview of the population and employment profile of the WSA, comprising the county authorities of Essex and Suffolk. The WSA will be characterised on the basis of the following:

- Population profile;
- Working age population;
- Employment and economic activity rates;
- Earnings;
- Employment sectors; and
- Gross Value Added (GVA).

27.4.1 Relevant economic strategies for the WSA will be referenced in the baseline section. The southern part of the WSA is covered by an economic strategic partnership of public and private bodies, the Haven Gateway Partnership, which includes Tendring District Council, East Suffolk Council, Essex County Council, and other bodies. The partnership was set up to cover the area of North Essex and South Suffolk in order to promote the area as a distinct economic sub-region based upon its strong links with the Haven Ports of Felixstowe and Harwich, and has the stated[85] aim of providing:

> *"a framework through which partner organisations can work together to promote economic opportunities and secure the future prosperity of this major gateway to the East of England"*

27.4.2 Part of the WSA also falls within the area covered by the New Anglia Local Enterprise Partnership.

27.4.3 With regards to offshore receptors, such as marine users, for whom VE may result in socio-economic impacts, the baseline characterisation presented in Chapter 18 (Infrastructure and other marine users) has been used to inform this scoping assessment.

[85] https://www.haven-gateway.org/about-us/

LOCAL AREA OF INFLUENCE

27.4.4 The onshore AoS for the onshore works is located within the northern coastal area of Essex in Tendring District, which refers to this area of coast as the Essex Sunshine Coast (2021). Figure 27.1 identifies the extent of the LAI relative to the onshore Area of Search.

27.4.5 Visit Essex (2021) does not include any attractions within the onshore AoS, although there are a number of attractions within or close to the LAI including:

> Seaside resorts and beaches at Walton on the Naze, Frinton-on-Sea and Clacton-on-Sea;
> Frinton Golf Course;
> Gunfleet Boating Club and Clacton Sailing Club;
> Beth Chatto's Gardens;
> Green Island Gardens;
> Martello Towers;
> Mistley Towers;
> Long distance routes including England Coast Path (under development) and the Essex Way; and
> National Cycle Network (NCN) National Route 51 between Colchester and Harwich.

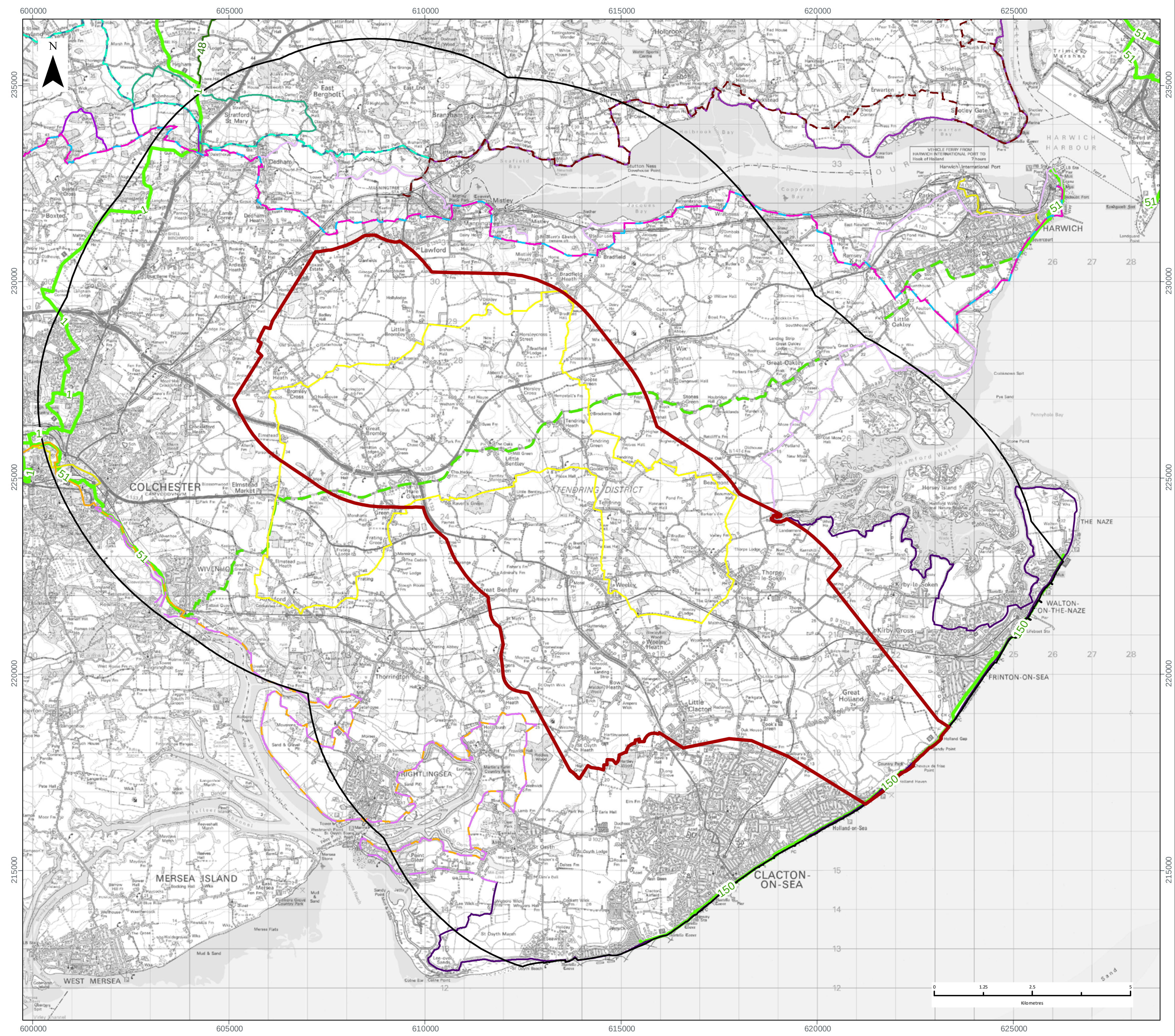
27.4.6 Holiday accommodation within the LAI includes Haven Hendre Park Holiday Village and individual holiday accommodation properties including self-catering, B&B and camping / glamping. A number of other businesses in the LAI are likely to focus primarily, or partly, on the visitor economy.

27.4.7 The LAI is crossed at various points by long distance walking and cycling routes together with the local PROW network. The location of the long distance routes crossing the LAI is shown on Figure 27.1.

27.4.8 The statutory definitive map is available to view at Essex County Council offices (County Hall) and an interactive map is for general purposes is available online at:

https://www.essexhighways.org/getting-around/public-rights-of-way/prow-interactive-map.

27.4.9 In addition to locations of interest, the assessment of effects on socio-economic, tourism or recreational assets will also address potential impacts on key local events such as Clacton Airshow and the Tendring Show.



LEGEND

Onshore Area of Search

Local Study Area Boundary

Long Distance Walking Routes

- Essex Way
- Lasso Essex - Sparkling Estuary (07)
- Lasso Essex - Sunny Sandy Strands (08)
- Lasso Essex - Mastodon Echo (09)
- Lasso Essex - Sparkling Estuary (10)
- Nelson Way
- St Edmund Way
- Stour and Orwell Walk
- Stour Valley Path
- Suffolk Coast Walk
- Suffolk Way
- Tendering Hundred Hinterland
- Walks in Colne Zolne

Cycle Routes

- National Cycle Route
- National Cycle Route Link
- Regional Cycle Route
- On-road Route not on the National Cycle Network

Data Source:

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Socio-economic, Tourism and Recreation Scoping

VER	DATE	REMARKS	Drawn	Checked
1	29/09/2021	For Issue	JRS	AD

DRAWING NUMBER:

27.1

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:100,000	A3	ODN	British National Grid

FIVE ESTUARIES
OFFSHORE WIND FARM

P:\05356 - GoBe Consultants Ltd\00010 Five Estuaries\Tech\GIS\Dwgs\Wking\2021 07 Scoping\SocioEconomic\05356.00010.0013.1 Socio-economic Tourism and Recreation.mxd

DESIGNATED SITES

27.4.10 There are no national designations for socio-economic, tourism or recreational assets. Certain sites that may be designated for other reasons, such as landscape, cultural heritage or nature conservation, may also fulfill a recreational and tourism role and so attract visitors to the area. Holland Haven Country Park is managed to conserve the landscape, coastal grazing marsh and wildlife quality of the area whilst providing for the quiet enjoyment of visitors and is based on the special wildlife character of the Holland haven marshes SSSI. Dedham Vale AONB is a nationally important landscape that was designated to conserve and enhance the habitats and biodiversity of the area, but at the same time encourages sustainable visiting86.

27.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

PROPOSED ASSESSMENT METHODOLOGY

27.5.1 There is no industry standard guidance for this assessment, although Overarching National Policy Statement for Energy (NPS) EN-1 describes the approach to be taken where a project is likely to have socio-economic impacts at local or regional levels. Paragraph 5.12.3 requires applicants to consider all socio-economic impacts, which may include:

- *"The creation of jobs and training opportunities;*
- *The provision of additional local services and improvements to local infrastructure, including the provision of educational and visitor facilities;*
- *Effects on tourism;*
- *The impact of a changing influx of workers during the different construction, operation and decommissioning phases of the energy infrastructure. This could change the local population dynamics and could alter the demand for services and facilities in the settlements nearest to the construction work (including community facilities and physical infrastructure such as energy, water, transport and waste). There could also be effects on social cohesion depending on how populations and service provision change as a result of the development; and*
- *Cumulative effects – if development consent were to be granted to for a number of projects within a region and these were developed in a similar timeframe, there could be some short-term negative effects, for example a potential shortage of construction workers to meet the needs of other industries and major projects within the region".*

27.5.2 EN-1 also requires consideration of how the development's socio-economic impacts correlate with local planning policies. Paragraph 5.12.5 states that socio-economic impacts may be linked to other impacts, for example the visual impact of a development, as this may also have an impact on tourism and local businesses.

[86] https://www.dedhamvalestourvalley.org

27.5.3 NPS for Electricity Networks Infrastructure (NPS EN-5) sets out additional technology-specific considerations for electricity networks beyond those described in NPS EN-1. None of these elaborate further on the socio-economic, tourism or recreation considerations set out in NPS EN-1.

27.5.4 Chapter 1 of this Scoping Report refers to the recent consultation on relevant NPS and how this will be considered for the ongoing VE assessment.

27.5.5 While not specific to electricity infrastructure, the Design Manual for Roads and Bridges (DMRB) provides useful context for the socio-economic, tourism and recreation assessment. The document includes guidance for assessing impacts on land use and for assessing the community impacts of linear infrastructure.

27.5.6 The proposed method for assessment, based on experience on similar projects, is detailed below and will take into consideration any matters raised in the Scoping Opinion. The assessment will:

- Consider the social and economic policy context at the local, regional and national level;
- Review socio-economic, tourism and recreation baseline conditions within the relevant study areas;
- Assess the likely scale, scope, permanence and significance of identified effects, taking account of any embedded environmental or social measures proposed within VE;
- Recommend mitigation measures, where appropriate; and
- Assess cumulative effects of the scheme with other proposed schemes.

27.5.7 Receptors will be identified for each of the two study areas. Receptor sensitivity will be based on its importance or scale and the ability of the baseline to absorb or be influenced by the identified impacts. For example, a receptor (such as the local construction supply chain or a long distance route) is considered less sensitive if there are alternatives with capacity within the relevant study area. Chapter 4: Environmental Impact Assessment Approach and Methodology sets out how significance will be assessed.

POTENTIAL PROJECT IMPACTS

27.5.8 A range of potential socio-economic, tourism and recreation impacts have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE. The impacts that have been scoped into the EIA are outlined in Table 27.2, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) to enable an assessment of the impact. Impacts that are proposed to be scoped out are outlined in Table 27.3, and a justification provided.

Table 27.2 - Impacts proposed to be scoped in to the assessment for Socio-Economic, Tourism and Recreation

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION			
27.1	Economy (labour market and GVA) within the WSA including local supply chain	Impacts on the local labour market, GVA and supply chain within the WSA are likely to be experienced during the construction phase; the impacts may be beneficial due to the creation of direct, indirect and induced jobs for local people.	Quantitative modelling will be undertaken of the effects of increased spending in the local economy due to the construction of VE. The modelling will take account of expenditure within the WSA arising from direct investment in goods and services, and the multiplier effects arising from increased spending. Inputs into the economic model will make use of estimates of expenditure from VE OWFL based on experience elsewhere within the UK, and published data from standard sources such as the ONS.
27.2	Disruption to community and tourism receptors within the LAI	Impacts due to construction of the onshore infrastructure on community and tourism receptors may occur due to severance of access routes, noise and vibration, and visual impact.	The assessment will consider the characteristics of any potential disruptive activities that occur adjacent to, or along the access routes to, sensitive community and tourism receptors. The assessment will make use of published data, web-based searches and data gathered for other topics such as Traffic & Transport and Noise. Information from these chapters will be used to inform the consideration of socioeconomic effects resulting from VE. It should be noted that a significant effect for another impact, such as visual, does not necessarily mean there will be a significant socio-economic effect. No requirement for new data is envisaged.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
27.3	Displacement of tourism visitors within the WSA	There is potential for an influx of workers during the construction period to create a demand for local accommodation that may lead to competition for accommodation with tourist visitors. This is most likely to occur during the peak summer season.	Estimates will be provided of the number of construction workers who are likely to commute to work, and those who are likely to require accommodation locally. Data will be gathered on accommodation levels (bed spaces) and occupancy rates for both serviced and non-serviced accommodation, and analysis undertaken to identify any potential hotspots. No requirement for new data is envisaged.
27.4	Demand for healthcare services within the WSA	There is potential for an influx of workers during the construction phase to create a demand for local health care services that may lead to undue pressure on the system.	Demand for healthcare services may arise in relation to workers who are not resident in the WSA but are staying in temporary accommodation during the week, or even for periods of months at a time. It is currently uncertain as to what the proposed scale of this demand is likely to be, and further work will be undertaken prior to EIA assessment to understand whether the scale of the influx will be sufficient to result in a significant effect. If a significant effect is not predicted the issue will be scoped out of the EIA. If it appears likely that the level of demand could be substantial, then the assessment will consider the capacity within the local health care system, including GP practices and hospitals, to accommodate the increased demand. The study will make use of online data sources and consultation with stakeholders such as NHS England.
27.5	Impact on tourism	There may be an impact on the visitor economy if the	The assessment will take account of findings from SLVIA with regard to impacts from key coastal visitor viewpoints including

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
	receptors and tourism economy within the WSA	visual impact of the construction of the WTG were to deter potential visitors.	such landmarks as Naze Tower, Orford Ness and seaside resorts, as well as the England Coast Path. A review will be undertaken of relevant published studies, especially those where wind farms have been built, or are proposed, in an area where the tourism sector makes an important contribution to the local economy. Where possible, consideration will be given to feedback from local businesses with regard to existing wind farms.
27.6	Impact of offshore construction activities on businesses, ports and maritime users	Impact on ports and related businesses both beneficial and potentially adverse (disturbance and delays).	A review will be undertaken of the likely beneficial effects arising from the concentration of jobs and services supplying the offshore construction activities. It is likely that both UK and international ports will support the construction of VE (see Chapter 3). Consideration will also be given to the potential for economic impacts resulting from disruption to existing businesses and maritime users as a result of construction activities.
27.7	Users of PROW and other walking and cycling routes	Construction activities may cause disruption to users	PROW (and other walking and cycling routes) are an important recreational resource although the ‘sensitivity’ of individual PROWs in EIA terms is dependent on the extent to which they contribute to the wider PROW network or provide access to key viewpoints or visitor locations. Upon confirmation of the preferred onshore cable route and OnSS location, all PROW directly affected will be identified using the definitive map. This will take account of access roads and haul roads where these cross PROW, and any that connect to those and therefore indirectly impacted. Impacts on other walking and cycling routes will also be identified using mapped data from online sources.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			A qualitative assessment of the impacts of construction works taking account of embedded mitigation will be undertaken. The assessment within Chapter 22: Traffic and Transport will be used to inform any socioeconomic impacts resulting from effects on changes to traffic and transport. If significant effects are identified then bespoke mitigation measures for each PROW and other walking and cycling routes will be identified and secured.
OPERATION			
27.8	Economy (labour market and GVA) including local supply chain within the WSA	Impacts on the local labour market, GVA, and supply chain within the WSA are likely to be experienced during the operational phase; the impacts may be beneficial due to the creation of direct, indirect and induced jobs for local people.	Quantitative modelling will be undertaken of the effects of increased spending in the local economy due to the operation of VE. The modelling will take account of expenditure within the WSA arising from direct investment in goods and services, and the multiplier effects arising from increased spending. Inputs into the economic model will make use of estimates of expenditure provided by the applicant based on its experience elsewhere within the UK, and published data from standard sources such as the ONS.
27.9	Long term impact on tourism receptors and tourism economy within the WSA	There may be an impact on the visitor economy if the visual impact of the WTG were to deter potential visitors.	The assessment will take account of findings from the LVIA with regard to impacts from key coastal visitor viewpoints including such landmarks as Naze Tower, Orford Ness and seaside resorts in Essex and Suffolk, as well as the England Coast Path. A review will be undertaken of relevant published studies, especially those where wind farms have been built, or are proposed, in an area where the tourism sector makes an important

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
			contribution to the local economy. Where possible, consideration will be given to feedback from local businesses with regard to existing wind farms.
27.10	Impact of offshore O&M activities on businesses and maritime users	Impact on ports and related businesses both beneficial and potentially adverse (disturbance and delays).	A review will be undertaken of the likely beneficial effects arising from the concentration of jobs and services supplying the O&M base for the operational wind farm. Consideration will also be given to the potential for disruption to existing businesses and marine users.

Table 27.3 - Impacts proposed to be scoped out of the assessment for Socio-Economic, Tourism and Recreation

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
27.11	Impact of construction on demand for housing and schools	The construction and decommissioning phases of the VE are expected to be relatively short-term activities that will not lead workers to relocate to the area with their families. There is therefore not expected to be an influx of workers seeking housing and schools' services in the WSA.
27.12	Impact of construction, operation or decommissioning on indoor recreational facilities such as gyms	It is not expected that the construction, operation or decommissioning of the VE will have an impact on indoor recreational facilities over and above potential traffic impacts that will be addressed in Chapter 22: Traffic and Transport of the ES.
27.13	Impact on LAI due to presence of onshore infrastructure during operational phase.	The above-ground presence of the onshore infrastructure during the Operational phase will be restricted to the OnSS, which will have a limited sphere of visual influence that will be further reduced by proposed mitigation measures that will be addressed fully in the Landscape and Visual chapter of the ES.
27.14	Socioeconomic and tourism impacts during decommissioning including: > Economy (labour market and GVA) within the WSA including local supply chain; > Disruption to community and tourism receptors within the LAI; > Displacement of tourism visitors within the WSA; > Demand for healthcare services within the WSA;	Socio-economic and tourism effects arising from decommissioning works are likely to be of a similar nature, but of smaller scale and geographical extent, to effects experienced during the construction phase.

IMPACT NUMBER	IMPACT	JUSTIFICATION FOR SCOPING OUT
	> Impact on tourism receptors and tourism economy within the WSA; > Impact of offshore construction activities on businesses, ports and maritime users; and > Users of PROW and other walking and cycling routes.	

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

27.5.9 As part of the design process for VE a number of designed-in or embedded measures are proposed to reduce the potential for impacts on sensitive receptors such as tourism assets and community facilities. These will include development of, and adherence to, the following measures during the construction and decommissioning phases:

- Code of Construction Practice.
- Construction Traffic Management Plan; and
- PROW Management Plan.

27.5.10 The requirement for and feasibility of any bespoke mitigation measures over and above the proposed embedded measures will be consulted upon with statutory consultees throughout the EIA process.

POTENTIAL CUMULATIVE IMPACTS

27.5.11 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For socio-economics and tourism, cumulative interactions may occur with other planned projects and developments in the study area. The socio-economic, tourism and recreation assessment will consider cumulative effects arising from the following:

- Disruption caused to tourism assets and community facilities within the LAI arising from concurrent construction of VE and any other major infrastructure projects, such as the North Falls Offshore Wind Farm and National Grid East Anglia Coastal Substation;
- Effects on the labour supply within the WSA arising from concurrent construction of VE and any other major infrastructure projects: affects could be adverse due to excessive competition for resources or beneficial due to enhanced training and skills development; and
- Effects on the tourism economy in the longer term within the WSA arising from the presence of the WTG in combination with other major infrastructure projects.

27.5.12 The assessment will consider how cumulative effects, from other projects, may be expected to impact on the local labour market: whether adverse due to shortage of skills, or beneficial due to skills development which allows more work to be retained locally thereby benefitting the local labour market in the longer term. It should be noted that there may be beneficial cumulative effects if projects overlap as it may mean skills can be transferred from one project to another and thus keep people employed for longer.

POTENTIAL TRANSBOUNDARY IMPACTS

27.5.13 Chapter 4: Environmental Impact Assessment Approach and Methodology provides details of the approach that will be taken for assessing the transboundary impacts, which is not expected to be relevant for the onshore elements of VE as socio-economics, tourism and recreation effects arising as a result of VE will be localised and will not be experienced across international boundaries.

27.6 SUMMARY OF NEXT STEPS

27.6.1 The next steps will be as follows:

- Refine the study areas following selection of the exact landfall location, preferred route corridor and sub-station location;
- Undertake a comprehensive review of baseline data from published sources supplemented by direct communication with stakeholders such as Visit Essex, Essex County Council, Suffolk County Council, Visit Suffolk and Tendring District Council;
- Assemble VE specific data and/ or assumptions regarding likely investment and procurement strategy as basis for economic modelling;
- Assemble VE specific data and/ or assumptions regarding influx of workers to allow assessment of impact on community services and accommodation; and
- Engage with other specialist EIA teams such as traffic & transport, SLVIA and LVIA to understand likely impacts on tourism, recreation and community receptors.

27.7 FURTHER CONSIDERATIONS FOR CONSULTEES

27.7.1 Comments on the scope of the socio-economic, tourism and recreation section will be welcomed; the questions below make some suggestions as to specific areas where input from consultees will be appreciated:

- Do you agree that the data sources identified are sufficient to inform the onshore socio-economic and tourism baseline for the VE PEIR and ES?
- Have all potential socio-economic and tourism impacts resulting from VE been identified for onshore socio-economic and tourism receptors?
- Do you agree that the impacts described in Table 27.3 can be scoped out?
- For those impacts scoped in (Table 27.2), do you agree that the methods described are sufficient to inform a robust impact assessment?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential onshore effects of VE on onshore socio-economic and tourism receptors?
- Do you have any specific requirements for the economic modelling methodology?

28. HEALTH

28.1 INTRODUCTION

28.1.1 This section of the Scoping Report identifies the public health receptors of relevance to the VE. It considers the potential effects from the construction, operation and maintenance, and decommissioning of VE on public health receptors and sets out the proposed scope of the EIA. The proposed methods for the EIA are also presented.

28.1.2 Public health is an inherent part of a number of technical areas assessed within the EIA, including flood risk, air quality, noise and vibration, traffic and transport, landscape and visual impact assessment, tourism and recreation. This chapter provides a summary of the conclusions for each relevant EIA Scoping chapter's assessment, which are referenced below, and provides a further assessment of the potential effects arising from electromagnetic fields (EMF), as these effects are not considered in any other chapters in the context of public health.

28.1.3 This public health assessment should be read alongside the following chapters of this Scoping Report, which are referred to where relevant throughout this chapter:

- Chapter 21: Airbourne Noise and Vibration.
- Chapter 22: Traffic and Transport;
- Chapter 23: Air Quality;
- Chapter 24: Hydrology and flood risk;
- Chapter 25: Geology and Ground conditions;
- Chapter 26: Onshore Landscape and Visual Impact Assessment; and
- Chapter 27: Socio-Economics and tourism.

28.2 STUDY AREA

28.2.1 For each of the effects considered (see Section 28.5) the study area will be drawn from the relevant technical assessments (Chapters 0 to 27 of this Scoping Report).

28.2.2 Within this Scoping Report the study area considered for the EMF effects will be synonymous with the onshore AoS (see Figure 1.2).

28.3 BASELINE DATA

28.3.1 The baseline environment data for each potential health impact (excluding EMF) is provided in Chapters 0 to 27 of this Scoping Report. This chapter has not sought to duplicate that information and instead focusses on providing a description of the existing data with regard to EMF only.

28.4 BASELINE ENVIRONMENT

28.4.1 The baseline environment for each potential health impact (excluding EMF) is described in Chapters 0 to 27 of this Scoping Report. This chapter has not sought to duplicate that information and instead focuses on providing a description of the existing environment with regards to EMF.

28.4.2 EMFs are produced both naturally and as a result of certain human activities. The earth has a magnetic field produced by currents deep inside the core of the planet; the earth is also subject to electric fields produced by electrical activity in the atmosphere such as thunderstorms. The direction of the Earth's magnetic field is normally constant, varying in size only slowly over time, and is referred to as a static or "DC" field. The Earth's magnetic field is approximately 50 µT (microteslas) in the UK. Other fields that alternate in their intensity more frequently over time are referred to as alternating or "AC" fields. EMFs are inevitable wherever electricity is produced, distributed, and used, including electrical substations, power lines and from household electrical equipment.

28.4.3 Electric fields are produced by voltage. Voltage is the pressure behind the flow of electricity. Electricity inside UK homes is at 230 volts (V), whereas electrical distribution systems in the UK utilise much higher voltages generally from 11,000 to 400,000 volts (11 kV to 400 kV). The higher the voltage the greater the electric field, which is measured in volts per metre (V/m). Electric fields are eliminated when electrical cables are buried due to the effect of the ground and protective sheath surrounding the cable.

28.4.4 Magnetic fields are produced by current, which is a measure of the flow of electricity. Generally, the higher the current (measured in amperes or amps) the greater the magnetic field. Magnetic fields are measured in (µT).

28.4.5 Onshore export cables are proposed to be buried within the onshore AoS – see Chapter Project Description.

DESIGNATIONS

28.4.6 All designations of relevance have been outlined within Chapters 0 to 27 of this Scoping Report.

28.5 PROPOSED APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED ASSESSMENT METHODOLOGY

28.5.1 The assessment of the EMF presented in this Scoping Report is based on the most up to date published literature and guidance. It is proposed that the health assessment of the EIA will be a signposting chapter, which highlights the key information and findings in the relevant EIA chapters and provides an assessment of the significance of EMF effects. Further details are provided in Section 28.6. Feedback will be sought from consultees on potential health impacts, with particular reference to the Health and Safety Executive and Public Health England (PHE).

PLANNING POLICY

28.5.2 Planning policy relating to health, which is of relevance to VE, is provided by the NPSs. These provide the primary basis for the recommendations made by the Examining Authority (the Planning Inspectorate) to the Secretary of State for Business Energy and Industrial Strategy on applications for development consent for nationally significant renewable energy projects. Overarching guidance on nationally significant energy projects is provided in National Policy Statement for Energy (NPS EN-1) (DECC, 2011a).

28.5.3 The National Policy Statement for Energy (EN-1) states that where the proposed project has an effect on human beings, the ES should assess these effects for each element of the project, identifying any adverse health impacts, and identifying measures to avoid, reduce or compensate for these impacts as appropriate.

28.5.4 EN-1 indicates that direct impacts on health may include:

> Increased traffic;
> Air or water pollution;
> Dust;
> Odour;
> Hazardous waste and substances;
> Noise;
> Exposure to radiation; and
> Increases in pests.

28.5.5 Guidance specifically relating to onshore grid connections is provided in EN-5 National Policy Statement for electricity networks infrastructure (DECC, 2011b). This policy focuses on guidance primarily in relation to overhead lines which is not applicable to VE as all export transmission cables from the offshore array, through to the landfall location (when defined) and onward to the substation will be buried. Whilst it is noted that works will be required at the EACS substation these will not pose a risk to public health as they will be undertaken on a secure (National Grid) site with restricted access.

28.5.6 The EIA and DCO application will take account of the requirements of any revised NPS when formally adopted within the meaning of section 104 of the Planning Act 2008.

GUIDELINES

28.5.7 There are no statutory regulations in the UK with regard to exposure to EMF. However, in 2004 the Government adopted guidelines published in 1998 by the International Commission on Non-Ionizing Radiation Protection (ICNIRP, 1998) in accordance with the terms of the 1999 EU Council recommendation on limiting public exposure to EMF (EU, 1999). The criteria establish acceptable limits for exposure of the public to EMF that adopt a precautionary approach taking into account various scenarios and potentially more vulnerable groups (such as infants).

28.5.8 The ICNIRP 'reference levels' for the public are:

> 100 µT for magnetic fields; and
> 5 kilovolts (kV) per metre for electric fields.
> While the ICNIRP 'basic restriction' for levels of public exposure are higher at:
> 360 µT for magnetic fields; and
> 9 kV per metre for electric fields.

28.5.9 In the ICNIRP guidelines and the EU Recommendation, the actual limit is the basic restriction. The reference levels are not limiting but are guides to when detailed investigation of compliance with the actual limit, the basic restriction, is required. If the reference level is not exceeded, the basic restriction cannot be exceeded, and no further investigation is needed. If the reference level is exceeded, the basic restriction may or may not be exceeded.

28.5.10 If the fields produced by an item of equipment are lower than 9 kV/m and 360 µT, the fields corresponding to the ICNIRP basic restriction, it is compliant with the ICNIRP guidelines and hence with PHE recommendations and Government policy. If the fields are greater than these values, it is still compliant with Government policy if the land use falls outside the residential and other uses specified in the Code of Practice (DECC, 2012a) and it may still be compliant if the fields are non-uniform.

POTENTIAL PROJECT IMPACTS

28.5.11 A range of potential impacts on public health have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of VE OWF. The impacts that are proposed to be scoped into the VE EIA are outlined in Table 28.1, together with a description of any proposed additional data collection (e.g. site-specific surveys) and/or supporting analyses to enable an assessment of the impact.

28.5.12 Based on the baseline information currently available and the project description (see Chapter 3), several impacts are proposed to be scoped out of the EIA for this topic. These impacts are described in Table 28.2, together with a justification for scoping them out.

Table 28.1 - Impacts proposed to be scoped in to the assessment for public health

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
CONSTRUCTION AND DECOMMISSIONG			
28.1	Impact on health due to air emissions including dust	The generation of dust and particulates (e.g. from excavation or movement of dry materials) could potentially have an adverse impact on human health. Exhaust emissions from construction traffic have the potential to contribute to local ambient concentrations of nitrogen dioxide (NO_2), and particulate matter (PM10 and PM2.5), resulting in potential effects on human health.	For information on the proposed approach see Table 23.2 presented in Chapter 23: Air Quality.
28.2	Impacts on health due to water emissions	Construction activities such as clearance of surface vegetation, could result in run-off of materials into the local water sources.	For information on the proposed approach see Table 24.3 presented in Chapter 24: Hydrology and flood risk.
28.3	Impacts on health due to soil emissions (including hazardous	Ground disturbance or the removal of hardstanding could increase the potential for leaching and the	For information on the proposed approach see Table 25.4 presented in Chapter 25: Geology and Ground conditions.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
	waste and substances)	mobilisation of soluble contaminants. In addition, leaks and/or spills of contaminants, such as fuels and oils, used and stored during the construction phase could occur.	
28.4	Impacts on health due to noise and vibration disturbance	The impact of noise and vibration from construction activities due to the onshore landfall, cable route installation and substation construction could result in disturbance of local residence and commercial properties.	For information on the proposed approach see Table 21.1 presented in Chapter 21: Airbourne Noise and Vibration.
28.5	Disruption to local road network	The potential delays to existing routes and the potential severance of routes which could reduce the access to services (such as GPs and hospitals) and amenities (as recreational activities).	For information on the proposed approach see Table 22.3 presented in Chapter 22: Traffic and Transport.

IMPACT NUMBER	IMPACT	DESCRIPTION	PROPOSED APPROACH TO ASSESSMENT
OPERATION			
28.6	Impacts on health due to noise disturbance from the onshore substation	Residential and commercial properties could be affected by the operational noise associated with the onshore substation (and associated infrastructure)	For information on the proposed approach see Table 21.1 presented in Chapter 21: Airbourne Noise and Vibration.
28.7	Improvement of air quality relative to alternative fuel sources such as coal and gas power stations	The health benefits of moving to OWF may be notable, particularly for regions that rely more heavily on coal to generate electricity. Replacing coal and oil with OWF will reduce emissions of air pollutants like fine particulate matter, nitrogen oxide and sulphur dioxide. These pollutants can form smog, soot and ozone. When people downwind are exposed to them, they can develop incapacitating and deadly diseases (Buonocore, 2018).	Evidence based on a literature review will be presented within the chapter to identify key beneficial effects on health from VE OWF relative to alternative forms of energy generation.

Table 28.2 - Impacts proposed to be scoped out of assessment for public health

IMPACT NO	IMPACT	JUSTIFICATION FOR SCOPING OUT
OPERATIONS AND MAINTENANCE		
28.13	Impact on health due to air emissions including dust and emissions	The operational phase is expected to give rise to only limited and intermittent traffic movements and other maintenance activity that will result in negligible air quality effects. No planned activities during the operation phase, such as excavation, are anticipated and so dust generation is not anticipated. Therefore, subject to feedback received on this Scoping Report, it is intended to scope this impact out of further consideration within the EIA.
28.14	Impacts on health due to water emissions	No planned activities during the operation phase are anticipated which could result in notable additional run-off into the water environment. Therefore, subject to feedback received on this Scoping Report, it is intended to scope this impact out of further consideration within the EIA.
28.15	Impacts on health due to soil emissions (including hazardous waste and substances)	No planned activities during the operation phase are anticipated which could result in the mobilisation of contaminants and hazardous substances. Therefore, subject to feedback received on this Scoping Report, it is intended to scope this impact out of further consideration within the EIA.
28.16	Disruption to local road network (reduced access to services and amenities)	The notable disruptions are anticipated due to the low numbers of vehicles anticipated to be required during the O&M phase. Therefore, subject to feedback received on this Scoping Report, it is intended to scope this impact out of further consideration within the EIA.
ALL PROJECT PHASES		
28.17	Impacts from major disasters	The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations 2017) require significant risks to the receiving communities and environment, for example through major accidents or

IMPACT NO	IMPACT	JUSTIFICATION FOR SCOPING OUT
		disasters, to be considered. Similarly, significant effects arising from the vulnerability of VE OWF to major accidents or disasters should be considered. Relevant risks will be covered in the topic chapters within this PEIR/ ES. A major accident, as defined in the Control of Major Accident Hazards (COMAH) Regulations 2015 (as amended), means "an occurrence (including in particular, a major emission, fire or explosion) resulting from uncontrolled developments in the course of the operation of any establishment and leading to serious danger to human health or the environment, immediate or delayed, inside or outside the establishment and involving one or more dangerous substances". Offshore wind developments have an intrinsically low risk of causing major accidents. The turbines, blades towers and foundation bases of offshore wind farms have an excellent safety record with a very low failure rate and are positioned many kilometres offshore away from populated areas and the public. On the rare occasion that offshore turbine blades have been lost into the sea or damage has been caused to a turbine by a fire within the nacelle, this has not resulted in injury. The performance of each turbine is constantly monitored through the Supervisory Control and Data Acquisition (SCADA) system sending performance data through to a central, partly automated monitoring and control centre. As a result a problem can be quickly detected and pre-prepared safety management action plans rapidly enacted. Whilst exposed power cables on the seabed can pose a snagging risk to shipping and fishing vessels, the projects export and array cables will be buried where possible to protect the cables and remove the snagging risk. This will be discussed in detail in the shipping and navigation EIA assessment, which also discusses the risk that the increased vessel movements to and from the site may pose to navigational safety during construction and operational phases.

IMPACT NO	IMPACT	JUSTIFICATION FOR SCOPING OUT
		The buried cables onshore and offshore pose very little risk to the public as they are designed to 'trip out' automatically should any failure in insulation along the cable be detected. The onshore project substation will be located away from populated areas where possible. The risk of substation fires is historically low; however, substation fires can impact the supply of electricity and create a localised fire hazard. The highest appropriate levels of fire protection and resilience will be specified for the onshore project substation to minimise fire risks. The small quantities of lubricants, fuel and cleaning equipment required within the project will be stored in suitable facilities designed to the relevant regulations and policy design guidance. The offshore wind industry strives for the highest possible health and safety standards across the supply chain. However, there have been incidents including a small number of worker fatalities during the construction and operation of offshore wind farms. Risks to the public onshore and sea users offshore during construction have been minimised through the use of controlled construction sites onshore and vessel safety zones offshore. Safety zones are temporary exclusion zones enacted during construction, allowing VE OWFL and its contractors to control vessel movement to enable safe construction and certain maintenance, works to proceed. Onshore, controlled or closed construction sites will be operated where construction works are ongoing and access will be strictly controlled . VE OWFL recognises the importance of the highest performance levels of health and safety to be incorporated into the project. There is a commitment to adhere to a high level of process safety, from design to operations and for all staff, contractors and suppliers to have a high level of safety awareness and

IMPACT NO	IMPACT	JUSTIFICATION FOR SCOPING OUT
		knowledge of safety and safe behaviour. VE OWFL will enact a Code of Conduct for suppliers, contractors and subcontractors. They must all comply with the Code as well as health and safety legislation. VE OWFL will ensure that employees have undergone necessary health and safety training. With a commitment to the highest health and safety standards in design and working practises enacted, none of the anticipated construction works or operational procedures are expected to pose an appreciable risk of major accidents or disasters. In conclusion, the risk of 'major accidents and/or disasters' occurring associated with any aspect of the project, during the construction, operation and decommissioning phases is anticipated to be negligible. Therefore, subject to feedback received on this Scoping Report, it is intended to scope this impact out of further consideration within the EIA.
29.18	Impacts on health due to exposure to EMFs	All electrical infrastructure will have to comply with ICNIRP guidelines (as outlined above) by being designed to comply with current guidelines on levels of public exposure and design of electrical infrastructure. As such the impact will be of negligible magnitude and as explained in Chapter 4 this will not result in significant effects in EIA terms. Therefore, subject to feedback received on this Scoping Report, it is intended to scope this impact out of further consideration within the EIA.
29.19	Impacts on health due to pests	No pathways are anticipated to result in the increase of pests. Therefore, subject to feedback received on this Scoping Report, it is intended to scope this impact out of further consideration within the EIA.
29.20	Impacts on health due to odours	No notable odours are anticipated during any of the phases of the project. Therefore, subject to feedback received on this Scoping Report, it is intended to scope this impact out of further consideration within the EIA.

MITIGATION MEASURES ADOPTED AS PART OF THE PROJECT

28.5.13 As part of the design process for VE a number of designed-in measures are proposed to reduce the potential for impacts on public health receptors. These are presented within the relevant chapters which inform the health assessment (Chapters 0 to 27 of this Scoping Report). These will evolve over the development process as the EIA progresses and in response to consultation.

28.5.14 VE OWFL are committed to implement these measures, and also various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of VE and hence have been considered in the judgments as to which impacts can be scoped in/out presented in Table 28.1 and Table 28.2.

28.5.15 It should be noted that the onshore cables will be buried which will significantly reduce the exposure to electromagnetic radiation. The onshore substation will be adequately secured and accessed only by authorised personnel with appropriate training and safety equipment. As well as this, all infrastructure built will comply with the government guidelines on electromagnetic radiation emission (ICNIRP, 1998; DECC, 2012a; DECC, 2012b; ENA, 2017).

28.5.16 The additional measures adopted as part of the project will also include:

- Development of, and adherence to, a CoCP (onshore);
- Development of, and adherence to, an appropriate PEMP (offshore); and
- Development of, and adherence to, a Decommissioning Programme.

28.5.17 The requirement and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

POTENTIAL CUMULATIVE EFFECTS

NON-RADIATIVE EFFECTS

28.5.18 Chapter 4: Environmental Impact Assessment approach and methodology sets out how potential cumulative effects will be assessed through the CIA. For Public health, cumulative interactions may occur with other planned projects and developments in the study area.

28.5.19 However, it is anticipated that due to the localised nature of any potential impacts, cumulative impacts are unlikely to occur unless there is overlap with the working areas. It is therefore proposed that cumulative impacts will be considered following the creation of the shortlisting process. If agreed as appropriate, VE OWFL will seek to scope out cumulative impacts with the relevant consultees (such as PHE) under the Evidence Plan process.

EMF IMPACTS (CUMULATIVE EFFECTS)

28.5.20 There is potential for cumulative exposure to electromagnetic radiation as a result of operational power production facilities and transmission infrastructure around the onshore cable route. However, as noted above all electrical infrastructure will have to comply with ICNIRP guidelines by being designed to comply with current guidelines on levels of public exposure and design of electrical infrastructure. As such, cumulative EMF effects are not anticipated. Therefore, it is suggested that this impact will be scoped out from further consideration within the EIA for public health.

POTENTIAL TRANSBOUNDARY IMPACTS

28.5.21 Due to the localised nature of any potential impacts, transboundary impacts are not anticipated to occur. Therefore, it is suggested that this impact will be scoped out from further consideration within the EIA for public health.

28.6 SUMMARY OF NEXT STEPS

28.6.1 The proposed approach to the assessment for public health PEIR chapter will first include the definition of the worst-case scenarios on which the assessments will be based.

28.6.2 The assessment will include the identification and review of the potential public health impacts during construction, operation and decommissioning. It is proposed that the EIA assessment will be a signposting chapter, which highlights the key information and findings in the relevant EIA chapters and indicates where further information is provided in the PEIR/ ES.

28.7 FURTHER CONSIDERATIONS FOR CONSULTEES

- Have all potential impacts resulting from VE been identified for public health receptors?
- Do you agree that the impacts described in Table 28.2 can be scoped out?
- Do you agree that the cumulative impacts can be scoped out?
- Do you agree that the transboundary impacts can be scoped out?
- For those impacts scoped in (Table 28.1), do you agree that the methods described are sufficient to inform a robust impact assessment?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of VE OWF on EMF receptors (please note proposed mitigation measures to address other impacts which may affect health are dealt with in the other relevant chapters)?
- Do you agree that providing a sign-posting chapter is a proportionate and adequate assessment of public health?

29. PROPOSED STRUCTURE OF THE EIA

29.1.1 The structure of the ES will enable robust and consistent consideration of the significance of effects, including cumulative impacts, as set out in Chapter 4, above.

29.1.2 The technical chapters for inclusion in the ES will be informed by the Scoping Opinion that will be provided by The Planning Inspectorate in response to this Scoping Report. The matters that VE OWFL and its project team considers are suitable to be included in the ES as well as those matters that are considered appropriate to scope out, are summarised within each of the technical chapters above.

29.1.3 Technical supporting information and principal drawings will be provided as appendices to the main ES. A non-technical summary will also accompany the main technical element of the ES. The approach to the ES will be in accordance with good practice guidance provided by recognised bodies such as IEMA, as set out in Chapter 4. The structure of the ES that will be prepared for VE is set out in Table 29.1.

29.1.4 The assessment of each technical topic will form a separate chapter within the ES. For each topic chapter, the following aspects will be addressed:

- Statutory and policy context:
  - Will provide a summary of the relevant legislation and national policy that have been taken into account in assessing each individual topic.
- Consultation:
  - Will provide a summary of the consultation responses received to date from statutory consultees and outcomes of the Scoping process, PEIR and the ongoing Evidence Plan process.
- Scope and methodology
  - Will provide detail confirming the extent of the study area, describing baseline data sources and survey methodology and topic specific detail on the approach to the impact assessment.
- Description of the existing and likely evolving future environment;
- Key parameters for assessment:
  - Will provide a summary of the key parameters of proposed activities and/ or infrastructure and justifies the maximum adverse scenario assessed for each potential effect;
- Embedded mitigation:
  - Will provide detail on any mitigation measures that have been identified and adopted as part of the evolution of the project design (i.e. embedded into the project design) of relevance to the topic.
- Environmental assessment:
  - Will present an assessment of the significance of any identified effects and the magnitude of the potential impacts that may arise during the construction, O&M and decommissioning of the development.

    - Will take account of any embedded mitigation and identify any further relevant mitigation measures required to avoid, reduce and if possible, remedy any adverse effects.
    - Will present an assessment of the confidence of any assessments of effect.
- Identification of residual impacts (taking into account embedded and further mitigation, where relevant);
- Inter-relationships:
    - Will provide an assessment of the potential for, and significance of, any effects on the topic area from multiple impacts arising from VE (for example direct impacts of noise from piling plus indirect impacts from potential sediment plumes changing the nature of feeding or spawning grounds on fish and shellfish together could have an effect significance greater than either impact assessed individually);
- Cumulative impacts:
    - Will provide an assessment of any cumulative impacts arising from interaction with other projects, plans or activities (onshore and in UK territorial waters) where these impacts have not been scoped out for further consideration.
- Transboundary impacts (offshore only) assessment of any impacts from VE on the environment of other European Economic Zones where these impacts have not been scoped out for further consideration; and
- Identification of any further monitoring required and, where relevant, in principle monitoring plans will be drafted to accompany the DCO application.

Table 29.1 - Proposed structure of Environmental Statement for VE

CHAPTER TITLE
Non-technical summary
Introduction
Policy and Legislation
Environmental Impact Assessment Approach and Methodology
Site selection and alternatives
Offshore Assessments: > Physical Processes (see Chapter 7 of this Scoping Report); > Water and Sediment Quality (see Chapter 8 of this Scoping Report); > Benthic and Intertidal Ecology (see Chapter 9 of this Scoping Report); > Fish and Shellfish Ecology (see Chapter 10 of this Scoping Report); > Marine Mammals (see Chapter 11 of this Scoping Report); > Offshore Ornithology (see Chapter 12 of this Scoping Report); > Commercial Fisheries (see Chapter 13 of this Scoping Report); > Shipping and Navigation (see Chapter 14 of this Scoping Report); > Military and Civil Aviation (see Chapter 15 of this Scoping Report); > Seascape, Landscape and Visual Impact Assessment (see Chapter 16 of this Scoping Report); > Archaeology and Cultural Heritage (see Chapter 17 of this Scoping Report); and > Other Marine Users and Activities (see Chapter 18 of this Scoping Report).
Onshore Assessments: > Terrestrial Ecology and Nature Conservation (see Chapter 19 of this Scoping Report); > Archaeology and Cultural Heritage (see Chapter 20 of this Scoping Report); > Airbourne Noise and Vibration (see Chapter 21 of this Scoping Report); > Traffic and Transport (see Chapter 22 of this Scoping Report); > Air Quality (see Chapter 23 of this Scoping Report); > Hydrology and Flood Risk (see Chapter 24 of this Scoping Report); > Geology and Ground Conditions (see Chapter 25 of this Scoping Report); > Landscape and Visual (see Chapter 26 of this Scoping Report); > Socioeconomics[87] (see Chapter 27 of this Scoping Report); > Tourism and recreation (see Chapter 18 and 27 of this Scoping Report); and

[87] Covering the potential impacts from both onshore and offshore activities and infrastructure.

CHAPTER TITLE
> Health (see Chapter 28 of this Scoping Report).
Annexes to support technical chapters, including but not limited to: > Scoping Opinion; > Site specific survey reports; > Navigational Risk Assessment; > Project specific noise modelling report(s); > Marine Conservation Zone Assessments; > Flood Risk Assessment; and > Water Framework Directive Assessment.

30. REFERENCES

Aarts, G., S. Brasseur, and R. Kirkwood. 2018. Behavioural response of grey seals to pile-driving. Wageningen Marine Research report C006/18.

ABPmer & HR Wallingford (2009), 'Coastal Process Modelling for Offshore Wind farm Environmental Impact Assessment: Best Practice Guide'. For COWRIE. [http://www.offshorewindfarms.co.uk];

ABPmer and METOC, (2002), 'Potential effects of offshore wind developments on coastal processes'.

ABPmer, Cefas and HR Wallingford (2007), 'Review of Round 1 Sediment process monitoring data - lessons learnt. (Sed01)'.

ABPmer, HR Wallingford & Cefas (2010), 'Further review of sediment monitoring data'. (COWRIE ScourSed-09).

ABPmer, Met Office and POL (2008a), 'Atlas of UK Marine Renewable Energy Resources: Atlas Pages'. A Strategic Environmental Assessment Report, March 2008. Produced for BERR. Report and associated GIS layers available at: http://www.renewables-atlas.info/.

ABPmer, Met Office and SeaRoc UK Ltd (2008b), 'Guidelines in the use of metocean data through the lifecycle of a marine renewables development'.

AQTAG09 (Air Quality Technical Advisory Group 09), Guidance on the effects of industrial noise on wildlife

Balmer, D., Gillings, S., Caffrey, B., Swann, B., Downie, I. and Fuller, R (2013), 'Bird Atlas 2007-11: The Breeding and Wintering Birds of Britain and Ireland' (Thetford: BTO Books).

Band, W. (2012), 'Using a collision risk model to assess bird collision risks for offshore wind farms'. https://www.bto.org/sites/default/files/u28/downloads/Projects/Final_Report_SOSS02_Band1ModelGuidance.pdf [Accessed: July 2021].

Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidson, N.C. and Buck, A.L. (1998), 'Coasts and seas of the United Kingdom. Region 7 South-east England: Lowestoft to Dungeness', Joint Nature Conservation Committee, (Coastal Directories Series).

BEIS (2013), 'Offshore wind industrial strategy: business and government action', https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/243987/bis-13-1092-offshore-wind-industrial-strategy.pdf [June 2021]

BEIS (2020) 'Press release - New plans to make UK world leader in green energy' Available online: https://www.gov.uk/government/news/new-plans-to-make-uk-world-leader-in-green-energy [Accessed June 2021]

BEIS (2020), 'UK electricity generation, trade, consumption, July to September 2019', https://www.gov.uk/government/statistics/electricity-section-5-energy-trends [Accessed June 2021]

Benhemma-Le Gall, A., P. Thompson, I. Graham, and N. Merchant. 2020. Lessons learned: harbour porpoises respond to vessel activities during offshore windfarm construction.in Environmental Interactions of Marine Renewables 2020, Online.

BERR, (2008), 'Review of Cabling Techniques and Environmental Effects applicable to the Offshore Wind farm Industry'. Department for Business Enterprise and Regulatory Reform in association with Defra.

Biggar Economics (2016) 'Windfarms and tourism trends in Scotland'.

Biggs J, Ewald N, Valentini A, Gaboriaud C, Griffiths RA, Foster J, Wilkinson J, Arnett A, Williams P and Dunn F. (2014). Analytical and methodological development for improved surveillance of the Great Crested Newt. Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (Triturus cristatus) environmental DNA. Freshwater Habitats Trust, Oxford.
BirdLife International (2004), 'Birds in Europe: population estimates, trends and conservation status', Birdlife Conservation Series No. 12, BirdLife, Cambridge.
Blue Marine Foundation. (2018). Management recommendations for English non-quota
Bradbury G, Trinder M, Furness B, Banks AN, Caldow RWG, et al. (2014), 'Mapping Seabird Sensitivity to Offshore Wind farms', PLoS ONE 9(9): e106366.
Brandt, M. J., A.-C. Dragon, A. Diederichs, M. A. Bellmann, V. Wahl, W. Piper, J. Nabe-Nielsen, and G. Nehls. 2018. Disturbance of harbour porpoises during construction of the first seven offshore wind farms in Germany. Marine Ecology Progress Series 596:213-232.
Brasseur, S. M., and R. Kirkwood. 2015. Seal monitoring and evaluation for the Gemini offshore windpark: Pre-construction, T0-2014 report. IMARES.
Brasseur, S., A. de Groot, G. Aarts, E. Dijkman, and R. Kirkwood. 2015a. Pupping habitat of grey seals in the Dutch Wadden Sea. IMARES Wageningen UR.
Brasseur, S., G. Aarts, E. Meesters, T. van Polanen Petel, E. Dijkman, J. Cremer, and P. Reijnders. 2012. Habitat preference of harbour seals in the Dutch coastal area: analysis and estimate of efects of offshore wind farms.
Brasseur, S., R. Kirkwood, and G. Aarts. 2015b. Seal monitoring and evaluation for the Gemini offshore windfarm: construction - 2015 report. Wageningen University & Research Report C004/18.
Bridgland, D.R. (1994), 'Quaternary of the Thames, Geological Conservation Review Series, No. 7' (London, Chapman and Hall)
Bright P, Morris P and Mitchell-Jones T. (2006) The Dormouse Conservation Handbook (2nd Edition). Natural England, Peterborough.
British Standard 7445:1991 'Description and measurement of environmental noise Part 2: Guide to the acquisition of data pertinent to land use'
British Standard BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'
Brown & May Marine Limited (2021). Confidential, in draft. Five Estuaries Offshore Wind Farm: Scouting Survey Report June 2021.
Brown, A. and Grice, P. (2005), 'Birds in England', T and AD Poyser (London:Bloomsbury Publishing).
BS5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise
BS5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration
BSI (2015). Environmental impact assessment for offshore renewable energy projects. Standard number PD 6900:2015
BSI, (2015) 'Environmental impact assessment for offshore renewable energy projects'
Buckley, J. and Willis, E. (1969), 'Isotope's radiocarbon measurements VII', Radiocarbon, 11(1): 53-105.
Buonocore, J. (2018), 'The public health benefits of adding offshore wind to the grid' Available from: https://phys.org/news/2018-06-health-benefits-adding-offshore-grid.html (Accessed July 2021)

Bynoe, R. (2018), ‘The submerged archaeology of the North Sea: Enhancing the Lower Palaeolithic record of northwest Europe’, Quaternary Science Reviews, 191: 1-14.
CAA (2016) CAP 764 Policy and Guidelines on Wind Turbines.
CAA (2018) CAP 437 Standards for Offshore Helicopter Landing Areas.
CAA (2019) CAP 168 Licensing of Aerodromes.
CAA (2019a) CAP 393 The Air Navigation Order 2016 and Regulations.
CAA (2019b) CAP 670 Air Traffic Services Safety Requirements.
CAA (2020) Visual Flight Rules Chart – Southern England.
Carr, A. and Baker, R. (1968), ‘Orford, Suffolk: evidence for the evolution of the area during the Quaternary’, Transactions of the Institute of British Geographers, 45: 107-123.
Carter, M., L. Boehme, C. Duck, W. Grecian, G. Hastie, B. McConnell, D. Miller, C. Morris, S. Moss, D. Thompson, P. Thompson, and D. Russell. 2020. Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles. Sea Mammal Research Unit, University of St Andrews, Report to BEIS, OESEA-16-76/OESEA-17-78.
CEBR, 2012. The macroeconomic benefits of investment in offshore wind A scenario-based assessment of the economic impacts on the UK of alternative realisations of offshore wind capacity
Cefas (2001). The impact of disposal of marine dredged material on the Thanet Coast and Sandwich Bay Candidate Special Areas of Conservation (cSACs). Cefas Contract ReportAA001.
Cefas (2004), ‘Offshore Windfarms: Guidance note for Environmental Impact Assessment in Respect of FEPA and CPA requirements’.
Cefas (2011), ‘Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects’.
Cefas (2016), ‘Suspended Sediment Climatologies around the UK. Produced for the UK Department for Business, Energy & Industrial Strategy offshore energy Strategic Environmental Assessment programme’.
Cefas (2004) Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of Food and Environment Protection Act 1985 and Coastal Protection Act 1949 requirements – Version 2.
Cefas (2012) Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects.
Cefas (2016). Suspended Sediment Climatologies around the UK. Report for the UK Department of Energy and Climate Change's offshore energy Strategic Environmental Assessment programme.
CEFAS. 2010. Strategic review of offshore wind farm monitoring data associated with FEPA licence conditions – annex 4: underwater noise., Cefas report ME1117.
Centre for Environment, Fisheries and Aquaculture Science (CEFAS) (2004), ‘Offshore Wind Farms: Guidance note for Environmental Impact Assessment In respect of FEPA and CPA requirements’. Version 2 - June 2004. Prepared by CEFAS on behalf of the Marine Consents and Environment Unit (MCEU)
Centre for Environment, Fisheries and Aquaculture Science (CEFAS) (2012), ‘Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects‘. CEFAS. Report reference: ME5403 – Module 15.
Centre for Environment, Fisheries and Aquaculture (Cefas). (2004), Guidance note for Environmental Impact Assessment in respect of FEPA (Food and Environment Protection Act 1985) and CPA (Coastal Protection Act 1949) requirements.

Centre for Marine and Coastal Studies (CMACS). (2005a), 'Greater Gabbard Offshore Wind Farm Environmental Impact Assessment. Benthic Ecology Technical Report'.
Centre for Marine and Coastal Studies (CMACS). (2005b), 'London Array Environmental Impact Assessment. Benthic Ecology Technical Report'.
Centre for Marine and Coastal Studies (CMACS). (2010), 'Galloper Offshore Wind Farm Benthic Survey Technical Report 2010', Prepared for OSIRIS PROJECTS (NRL and SSER).
Chanin P. (2003a) Ecology of the European Otter. Conserving Natura 2000 Rivers, Ecology Series No. 10. English Nature, Peterborough.
Chanin P. (2003b) Monitoring the Otter Lutra lutra. Conserving Natura 2000 Rivers Monitoring Series No 10. English Nature, Peterborough.
Chartered Institute for Archaeologists (CIfA) (2014a), 'Standard and guidance for the collection, documentation, conservation and research of archaeological materials. Reading'. 2014.
Chartered Institute for Archaeologists (CIfA) (2014b), 'Standard and guidance for commissioning work on, or providing consultancy advice on, archaeology and the historic environment'. Reading. 2014.
Chartered Institute of Ecology and Environmental Management (2018), 'Guidelines for Ecological Impact Assessment in the UK and Ireland' https://cieem.net/wp-content/uploads/2019/02/Combined-EcIA-guidelines-2018-compressed.pdf [Accessed September 2021]
CIEEM (2017) Guidelines for Preliminary Ecological Appraisal, 2nd editon. Chartered Institute of Ecology and Environmental Management, Winchester.
CIEEM (2018; updated 2019), 'Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1', Chartered Institute of Ecology and Environmental Management (Winchester).
CIEEM. 2019. Guidelines for ecological impact assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. September 2018 Version 1.1 - updated September 2019. Chartered Institute of Ecology and Environmental Management, Winchester.
CIRIA C552 (Contaminated Land Risk Assessment. A guide to good practice)[SM1]
Cohen, K.M., Westley, K., Erkens, G., Hijma, M.P. and Weerts, H.J.T. (2017), 'The North Sea', in N. C. Flemming, J. Harff, D. Moura, A. Burgess and G.N. Bailey (eds.), Submerged Landscapes of the European Continental Shelf: Quaternary Palaeoenvironments (Oxford: Wiley). 147-186.
Collaborative Offshore Wind Research into the Environment (2008), 'Establishing best practice for the documentation and dissemination of marine biological data', https://www.offshorewindfarms.co.uk/establishing-best-practice-for-the-documentation-and-dissemination-of-marine-biological-data/ [Accessed June 2021]
Collins J. (ed.) (2016) Bat Surveys for Professional Ecologists, Good Practice Guidelines. 3rd Edition. BCT
Committee on Climate Change (2011), 'The Renewable Energy Review' https://www.theccc.org.uk/publication/the-renewable-energy-review/ [Accessed: June 2021].
Connor, D.W., Allen, J.H., Golding, N., Howell, K.I., Lieberknecht, L.M., Northern, N. and Reker, J.B. (2004), 'The Marine Habitat Classification for Britain and Ireland Version 04.05', JNCC, Peterborough ISBN 1 861 07561 8. www.jncc.gov.uk/MarineHabitatClassification [Accessed SeptemberJuly 2021].
Construction Design and Management (CDM) Regulations 2015
Contaminated Land Statutory Guidance 2012 (ref: PB13735)

Cook, A.S.C.P., Humphries, E.M., Masden, E.A., and Burton, N.H.K. (2014), 'The avoidance rates of collision between birds and offshore turbines'. https://www.gov.scot/publications/scottish-marine-freshwater-science-volume-5-number-16-avoidance-rates/ [Accessed: July 2021].

Cook, A.S.C.P., Wright, L.J., and Burton, N.H.K. (2012), 'A review of flight heights and avoidance rates of birds in relation to offshore wind farms'. https://www.bto.org/sites/default/files/u28/downloads/Projects/Final_Report_SOSS02_BTOReview.pdf [Accessed: July 2021].

Cooper, K. and Barry, J. (2017). RSMP Baseline Dataset. Cefas, UK. V1. Available at: https://doi.org/10.14466/CefasDataHub.34 [Accessed SeptemberAugust 2021].

Cooper, K.M., Bolam, S.G., Downie, A-L. and Barry, J. (2019). Biological-based habitat classification approaches promote cost-efficient monitoring: An example using seabed assemblages. Journal of Applied Ecology, 56 (5), 1085–1098.

Copping, A. 2018. The State of Knowledge for Environmental Effects Driving Consenting/Permitting for the Marine Renewable Energy Industry. Prepared for Ocean Energy Systems On behalf of the Annex IV Member Nations, January 2018.

Coull, K. A., Johnstone, R. and Rogers, S. I. (1998), 'Fishery Sensitivity Maps in British Waters'. Published and distributed by UKOOA Ltd.

COWRIE (2007), 'Historic Environment Guidance for the Offshore Renewable Energy Sector', Wessex Archaeology.

COWRIE (2008), 'Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy'.

Cox, T. M., J. Barker, J. Bramley, J. Debney, A. Debney, D. Thompson, and A.-C. Cucknell. 2020. Population trends of harbour and grey seals in the Greater Thames Estuary. Mammal Communications 6:42-51.

Cramp S. and Simmons K.E.L. (Eds.) (1977 - 1994), 'The Birds of the Western Palearctic' (Oxford: Oxford University Press).

Czech-Damal, N. U., G. Dehnhardt, P. Manger, and W. Hanke. 2013. Passive electroreception in aquatic mammals. Journal of Comparative Physiology A-Neuroethology Sensory Neural and Behavioral Physiology 199:555-563.

DECC (2011) EN-1 Overarching NPS for Energy.

DECC (2011a) EN-3 National Policy Statement for Renewable Energy Infrastructure.

DECC, (2011a), 'Overarching National Policy Statement for Energy (EN-1)', Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf [Accessed July 2021]

DECC, (2011b), 'National Policy Statement for Renewable Energy Infrastructure (EN-3)', Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47856/1940-nps-renewable-energy-en3.pdf, [Accessed July 2021]

DEFRA (2009), 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites'

DEFRA (2010). Eel Management Plans for the United Kingdom: Thames River Basin District. [Online] https://webarchive.nationalarchives.gov.uk/ukgwa/20130402151656/http://archive.defra.gov.uk/foodfarm/fisheries/documents/fisheries/emp/thames.pdf

Defra (2012) Habitats Regulations: Evidence plans for Nationally Significant Infrastructure Projects

DEFRA (2021). 'Local air quality management technical guidance (TG16), April 2021'.

Del Hoyo, J., Elliott, A. and Sargatal, J. (Eds.) (1992 – 2011), 'Handbook of the Birds of the World' (Madrid: Lynx Editions).
Dellino-Musgrave, V. and Heamagi, C. (2010), 'Our Marine Historic Environment: Enhancing the National Monuments Record. Phase 1: Identifying the Scale of the Problem', English Heritage.
Department for Business, Enterprise and Regulatory Reform (BERR). (2008). Fisheries Liaison with Offshore Wind and Wet Renewables Group (FLOWW) Recommendations For Fisheries Liaison: Best Practice guidance for offshore renewable developers.
Department for Communities and Local Government (2017), 'Planning Practice Guidance'.
Department for Energy and Climate Change (2011a), 'Overarching National Policy Statement for Energy (EN-1)' (London: The Stationary Office).
Department for Energy and Climate Change (2011b), 'National Policy Statement for Renewable Energy Infrastructure (EN-3)' (London: The Stationary Office).
Department for Environment and Climate Change (DECC) (2009) The UK renewable energy strategy
Department for Environment and Climate Change (DECC) (2011a) Overarching National Policy Statement (NPS) for Energy (EN-1).
Department for Environment and Climate Change (DECC) (2011b) National Policy Statement for Renewable Energy Infrastructure (EN-3).
Department of Energy & Climate Change (DECC) (2011c). National Policy Statement for Electricity Networks Infrastructure (EN-5).
Department of Energy & Climate Change (2009), 'Aerial Surveys of Waterbirds in the UK: 2007/08, Final Report'.
Department of Energy and Climate Change (2009), 'Overarching National Policy Statement for Energy (EN-1)' https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf [Accessed: December 2019]
Department of Energy and Climate Change (2011), 'National Policy Statement for Renewable Energy Infrastructure (EN-3)' https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47856/1940-nps-renewable-energy-en3.pdf [Accessed: December 2019]
Department of Energy and Climate Change (DECC) (2011a), Overarching National Policy Statement for Energy (EN-1), https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf (July 2021).
Department of Energy and Climate Change (DECC) (2011b), 'National Policy Statement (NPS) for Electricity Network Infrastructure (EN-5)'.
Department of Energy and Climate Change (DECC) (2012a), 'Power Lines: Demonstrating compliance with EMF public exposure guidelines – a Voluntary Code of Practice (document dated March 2012 replacing document with the same title dated February 2011)'.
Department of Energy and Climate Change (DECC) (2012b), 'Optimum Phasing of high voltage double-circuit Power Lines – a Voluntary Code of Practice'.
Department of Energy and Climate Change (DECC), 2011d. The Carbon Plan - reducing greenhouse gas emissions
Department of Energy and Climate Change (DECC), 2011d. The Carbon Plan - reducing greenhouse gas emissions
Department of Energy and Climate Change (DECC), 2014. Updated energy and emissions projections

Department of Energy and Climate Change (DECC), 2016. Climate change explained

Department of Trade and Industry (2006), 'Aerial Surveys of Waterbirds in Strategic Windfarm Areas: 2004/05, Final Report. https://tethys.pnnl.gov/sites/default/files/publications/Aerial_Surveys_of_Waterbirds_in_Strategic_Wind_Farm_Areas.pdf [Accessed: July 2021].

Design Manual for Roads and Bridges (DMRB), (2020), LA111 Noise and Vibration Revision 2, May 2020

Design Manual for Roads and Bridges LA112 Population and Human Health, Highways England (2019

Diederichs, A., G. Nehls, M. Dähne, S. Adler, S. Koschinski, and U. Verfuß. 2008. Methodologies for measuring and assessing potential changes in marine mammal behaviour, abundance or distribution arising from the construction, operation and decommissioning of offshore windfarms.

Dierschke, V., Furness, R.W., Gray, C.E., Petersen, I.K., Schmutz, J., Zydelis, R. and Daunt, F. (2017), 'Possible behavioural, energetic and demographic effects of displacement of red-throated divers'. https://hub.jncc.gov.uk/assets/e9cb4b91-cf6d-440c-b9e3-c363bac51f86 [Accessed: July 2021].

Diesing and Stephens (2018). UK shelf and North Sea quantitative sediment composition predictions. Cefas, UK. https://data.gov.uk/dataset/6b2ad69b-b4b5-411d-a7d1-9958ad10d338/1990-2019-centre-for-environment-fisheries-aquaculture-science-cefas-quantitative-sediment-composition-predictions-for-the-north-west-european-continental-shelf [Accessed July 2021]

Donovan, C. (2018), 'Stochastic Band CRM – GUI User Manual Draft V1.0'.

Drewitt, A.L. and Langston, R.H.W. (2006), 'Assessing the impacts of wind farms on birds', Ibis, 148 (Suppl. 1): 4-7.

Dyer, K. R., Moffat, T. J. (1998). Fluxes of suspended matter in the East Anglian plume Southern North Sea. Continental Shelf Research, 18, 1311-1331.

Dyer, R. and Bailey, D. (2019). Thames Estuary Cockle Survey Report 2018. Kent and

Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015), 'Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man', British Birds 108: 708–746.

Economic Impact of Tourism (2019) 'Annual report; A Recovery Plan for the Essex Tourism and Hospitality Industry'.

EDF Energy, 2019. Sizewell C proposed Nuclear Development: Sizewell C EIA Scoping Report. Planning Inspectorate Ref: EN010012.

EDF Energy, Suffolk Coast and Heaths AONB Partnership, Suffolk County Council, Suffolk Coastal District Council and Waveney District Council (2016) Suffolk Coast and Heaths AONB - Natural Beauty and Special Qualities Indicators.

EIFCA. (2020a). Whelk Technical Summary Report – Review of whelk permit conditions

EIFCA. (2020b). Briefing Note: The Wash Cockle Fishery 2020.

Ellis, J.R., Milligan, S.P. Readdy, L. Taylor, N. and Brown, M.J. (2012), 'Spawning and nursery grounds of selected fish species in UK waters'. Cefas Scientific Series Technical Report 147.

EMU (2009), 'The Outer Thames Estuary Regional Environmental Characterisation (09/J/1/06/1305/0870)' London, GB. ALSF/MEPF (DEFRA).

EMU Limited (2008), 'Kentish Flats Offshore Wind Farm Turbine Foundation Faunal Colonisation Diving Survey'. https://tethys.pnnl.gov/publications/kentish-flats-

offshore-wind-farm-turbine-foundation-faunal-colonisation-diving-survey [Accessed: July 2021].
Energy Networks Association (ENA) (2017), EMFs The Facts. http://www.emfs.info/wp-content/uploads/2017/09/EMF_The_Facts_250917.pdf (Accessed July 2021)
English Heritage (2007), 'England's Historic Seascapes Marine HLC Pilot Study: Southwold to Clacton, Final Project Report', English Heritage and Oxford Archaeology.
English Nature (2001) Great crested newt mitigation guidelines. English Nature, Peterborough.
Environment Agency (2007), 'Coastal trends report: Suffolk (Lowestoft to Languard Point, Felixstowe)'. Report RP003/S/2007
Environment Agency (2010), 'SMP8: Landguard Point to Two Tree Island'. http://eacg.org.uk/smp8.asp [Accessed: July 2021].
Environment Agency (2015), 'Coastal processes study: East Lane, Bawdsey, Suffolk.'
Environment Agency (2020), 'Land contamination risk management (LCRM)', Available online: https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm [Accessed September 2021]
Environment Agency (2020). 'Update on bathing waters in England' Available online: https://environmentagency.blog.gov.uk/2020/12/16/update-on-bathing-waters-in-england/ [Accessed July 2021]
Environment Agency (2020b). Freshwater fish surveys (NFPD). [Online] https://environment.data.gov.uk/dataset/ce2618db-d507-4671-bafe-840b930d2297
Environment Agency (2021). 'WFD Cycle 2 Overall Classification', Available online: https://data.gov.uk/dataset/4d28e5c2-dc05-4945-9574-002fa71db22f/wfd-cycle-2-overall-classification [Accessed July 2021]
Environment Agency (2017). Water Framework Directive assessment: estuarine and coastal waters, Available online: https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters [Accessed July 2021]
Environment Agency (2020b). Freshwater fish surveys - salmonid age data (NFPD). [Online] https://environment.data.gov.uk/dataset/aefcad3c-2930-45c0-8539-77ba2471f7e4
Environmental Impact Assessment Practice, IEMA Lincoln.
Environmental Protection Act (EPA) 1990
Essex County Council (2003) Essex Landscape Character Assessment.
Essex Inshore Fisheries and Conservation Authority. 41 pp.
EU Data Collection Framework (EU DCF) database. (2021). Data by quarter-rectangle: Tables and maps of effort and landings by ICES statistical rectangles for 2012 to 2016.
EUMOFA. (2021). European Market Observatory for Fisheries and Aquaculture Products online database. Accessed at: https://www.eumofa.eu/en/web/eumofa/ad-hoc-query-first-sale-eu
European Commission Directive 2000/14/EC8
European Commission. 2010. Guidance Document: Wind Energy Developments and Natura 2000.
European Subsea Cable Association (ESCA). (2018). European Subsea Cable Association Statement on vessels operating in the vicinity of subsea cables.
European Union (1999), 'Council Recommendation on the limitation of exposure of the general public to electromagnetic fields (0 Hz – 300 GHz)'. Official Journal of the European Communities 1999/519/EC.

Fisheries Liaison with Offshore Wind and Wet Renewables group FLOWW (2015) FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds (FLOWW, 2015).
fisheries: Common whelk.
Fitch, S, Gaffney, V and Thomson, K, (2007), 'Heritage Management and the North Sea Palaeolandscapes Project', in Gaffney and Thomson with Fitch 2007, 105–26.
Flemming, N.C. (2002), 'The scope of Strategic Environmental Assessment of North Sea areas SEA3 and SEA2 in regard to prehistoric archaeological remains', Department of Trade and Industry.
FLOWW (2014) FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison. January 2014.
Froglife (1999). Reptile Survey: An Introduction to Planning, Conducting and Interpreting Surveys for Snakes and Lizard Conservation. Froglife Advice Sheet 10. Froglife, Halesworth.
Frost, T.M., Austin, G.E., Calbrade, N.A., Mellan, H.J., Hearn, R.D., Robinson, A.E., Stroud, D.A., Wotton, S.R. and Balmer, D.E. 2019, 'Waterbirds in the UK 2017/18: The Wetland Bird Survey' (Thetford: British Trust for Ornithology).
Fugro-Emu (2014), 'Review of environmental data associated with post-consent monitoring of licence conditions of offshore wind farms'. MMO Project No: 1031.
Furgo. (2018), 'Thanet Extension Offshore Wind Farm: Environmental Investigation Report Thanet Benthic Characterisation Report'.
Furness, R.W. (2015), 'Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS)'.http://publications.naturalengland.org.uk/publication/6427568802627584 [Accessed: July 2021].
Furness, R.W. and Wade, H. (2012), 'Vulnerability of Scottish seabirds to offshore wind turbines'. https://www.gov.scot/publications/vulnerability-scottish-seabirds-offshore-wind/ [Accessed: July 2021].
Furness, R.W., Wade, H.M. and Masden, E.A. (2013), 'Assessing vulnerability of marine bird populations to offshore wind farms', Journal of Environmental Management, 119: 56-66.
Galloper Wind Farm Project (2011), Environmental Statement – Chapter 15: Commercial fisheries.
Garthe, S and Hüppop, O. (2004), 'Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index', Journal of Applied Ecology, 41:724-734.
Gent T and Gibson S. (1998). Herpetofauna Workers' Manual. Joint Nature Conservation Committee, Peterborough.
Gilbert, G., Gibbons, D.W. & Evans, J. (1998) Bird Monitoring Methods: A Manual of Techniques for Key UK Species. RSPB, Sandy.
Gohin, F (2011). Annual cycles of chlorophyll-a, non-algal suspended particulate matter, and turbidity observed from space and in-situ in coastal waters. Ocean Sci., 7, 705-732. doi:10.5194/os-7-705-2011
Gray, M., Stromberg, P-L., Rodmell, D. (2016). 'Changes to fishing practices around the UK as a result of the development of offshore windfarms – Phase 1 (Revised).' The Crown Estate, 121 pages. ISBN: 978-1-906410-64-3
Greater Gabbard Offshore Wind Limited (GGOWL). (2005), 'Greater Gabbard Offshore Wind Farm Environmental Statement, October 2005'.

Guidance for Environmental Assessment of Road Traffic, Institute of Environmental Management and Assessment (2003)

Hammond, P., C. Lacey, A. Gilles, S. Viquerat, P. Börjesson, H. Herr, K. Macleod, V. Ridoux, M. Santos, M. Scheidat, J. Teilmann, J. Vingada, and N. Øie. 2021. Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys - revised June 2021.

Hazell, Z. (2008), 'Offshore and intertidal peat deposits, England — a resource assessment and development of a database', Environmental Archaeology, 13(2): 101-110.

Heinänen, S., and H. Skov. 2015. The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area. JNCC Report No. 544, JNCC, Peterborough.

Her Majesty's Government (2019), 'Industrial Strategy: Offshore Wind Sector Deal', Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/790950/BEIS_Offshore_Wind_Single_Pages_web_optimised.pdf [Accessed June 2021].

HiDef Aerial Surveying Ltd. 2020. Digital video aerial surveys of seabirds and marine mammals at Five Estuaries: Annual report for March 2019 to February 2020.

HiDef Aerial Surveying Ltd. 2021. Digital video aerial surveys of seabirds and marine mammals at Five Estuaries: Two-year report March 2019 to February 2021.

Highways Agency (1993), 'Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 3, Part 11, Geology and Soils'

Highways Agency (2008), 'Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 2, Part 5, HA205/08 Assessment and Management of Environmental Effects Highways Agency'

Highways England (2019), 'Design Manual for Roads and Bridges LA112 Population and Human Health'.

Highways England, Transport Scotland, Welsh Government and Department for Infrastructure (2019). 'Design Manual for Roads and Bridges LA105 Air Quality'.

HM Government (2016) Andrea Leadsom Speech to Utility Week Energy Summit. Available: https://www.gov.uk/government/speeches/andrea-leadsom-speech-to-utility-week-energy-summit [Accessed June 2021]

HM Government (2017) Building our Industry Strategy: Green Paper. Available: https://beisgovuk.citizenspace.com/strategy/industrial-strategy/supporting_documents/buildingourindustrialstrategygreenpaper.pdf [Accessed June 2021]

HM Government (2020) 'Offshore wind: Sector Deal' https://www.gov.uk/government/publications/offshore-wind-sector-deal [Accessed June 2021]

HM Government (2020) 'The Ten Point Plan for a Green Industrial Revolution' https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution/title [Accessed September 2021]

Hoffman, E., Astrup, J., Larsen, F, Munch-Petersen, S. and Støttrup, J. (2000). 'Effects of marine windfarms on the distribution of fish, shellfish and marine mammals in the Horns Rev area'. Report to ELSAMPROJEKT A/S, Danish Institute for Fisheries Research.

Holling, M. and the Rare Breeding Birds Panel. (2011), 'Rare breeding birds in the United Kingdom in 2009', British Birds, 104: 476–537.

Horswill, C., O'Brien, S.H. and Robinson, R.A. 2017, 'Density dependence and marine bird populations: are wind farm assessments precautionary?', Journal of Applied Ecology 54: 1406-1414.

HR Wallingford, (2002), 'Southern North Sea Sediment Transport Study, Phase 2, Sediment Transport Report' EX 4526 produced for Great Yarmouth Borough Council, 94pp.

HR Wallingford, ABPmer and Cefas (2007), 'Dynamics of scour pits and scour protection - Synthesis report and recommendations. (Sed02)'.

HSE, 2015, Control of Major Accident Hazards (COMAH) Regulations 2015, Available from: https://www.hse.gov.uk/pUbns/priced/l111.pdf (Accessed July 2021)

http://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/196490/OES_Aerial_Surveys_2007_08.pdf [Accessed: July 2021].

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716510/pb13298-code-of-practice-090910.pdf [Accessed: December 2019]

https://data.jncc.gov.uk/data/9aecb87c-80c5-4cfb-9102-39f0228dcc9a/Joint-SNCB-Interim-Displacement-AdviceNote-2017-web.pdf [Accessed: July 2021].

https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/05/Advice-note-9.-Rochdale-envelope-web.pdf [Accessed July 2021]

https://www.gov.scot/binaries/content/documents/govscot/publications/factsheet/2021/02/stochastic-collision-risk-model-for-seabirds-in-flight/documents/user-guide/user-guide/govscot%3Adocument/user%2Bguide.pdf [Accessed: July 2021].

IALA (2013). Recommendation O-139 the Marking of Man-Made Offshore Structures. Edition 2. Saint Germaine en Laye, France: IALA.

IAMMWG. 2021. Updated abundance estimates for cetacean Management Units in UK waters. JNCC Report No. 680, JNCC Peterborough, ISSN 0963-8091.

IAQM (2016). 'Guidance on the Assessment of Dust from Demolition and Construction'.

IAQM (2020). 'A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites'.

IAQM and EPUK (2017). 'Land-Use Planning & Development Control: Planning for Air Quality'.

ICAO (2018) Doc.8168 Ops/611 Procedures for Air Navigation Services Aircraft Operations.

ICES. (2021). Spatial data layers of fishing intensity/pressure for EU vessels operating within ICES defined Celtic Seas Ecoregion and Greater North Sea Ecoregion.

IEEM. 2010. Guidelines For Ecological Impact Assessment In Britain And Ireland Marine And Coastal Guidelines For Ecological Impact Assessment In The United Kingdom. Winchester: Chartered Institute of Ecology and Environmental Management.

IEMA (2004) Guidelines for Environmental Impact Assessment, IEMA Lincoln.

IEMA (2016) Guide to Shaping Quality Development, IEMA Lincoln.

IEMA (2017) Delivering Proportionate EIA - A Collaborative Strategy for Enhancing UK

IMO (1972/77). Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) – Annex 3. London: IMO.

IMO (1974). International Convention for the Safety of Life at Sea. London: IMO.

IMO (2018). Revised Guidelines for Formal Safety Assessment. London: IMO.

Institute of Acoustics (IoA) Good Practice Guide (GPG), A Good Practice Guide (GPG) to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, 2014

Institute of Ecology and Environmental Management (IEEM). (2010), 'Guidelines for ecological impact assessment in Britain and Ireland - Marine and Coastal'. Institute of Ecology and Environmental Management, Winchester Hampshire.

Institute of Environmental Management and Assessment (2003), ‘Guidance for Environmental Assessment of Road Traffic’.
International Cable Protection Committee. (2009). Fishing and Submarine Cables - Working Together.
International Commission on Non-Ionizing Radiation Protection (ICNIRP) (1998), ‘Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz)’. Health Phys, 74: 494-522.
Irwin, C., Scott, M., S., Humphries, G. & Webb, A. 2019, ‘Digital video aerial surveys of red-throated diver in the Outer Thames Estuary Special Protection Area 2018’. http://publications.naturalengland.org.uk/publication/4813740218515456 [Accessed: July 2021].
ISO 9613-2:1996-2 ‘Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation’
Jarrett, D., Cook, A.S.C.P., Woodward, I., Ross, K., Horswill, C., Dadam, D. and Humphreys, E.M. 2018, ‘Short-term behavioural responses of wintering waterbirds to marine activity’, Scottish Marine and Freshwater Science 9/7.
JNCC and Natural England (2011), ‘General advice on assessing potential impacts of and mitigation for human activities on Marine Conservation Zone (MCZ) features, using existing regulation and legislation'
JNCC, NE, SNH, and NRW. 2016. Joint Statutory Nature Conservation Bodies Position Statement: ORJIP Project 4, Stage1 of Phase 2 “The use of Acoustic Deterrents for the mitigation of injury to marine mammals during pile driving for offshore wind farm construction”.
JNCC. 2010. JNCC guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys.
JNCC. 2019a. European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018 Conservation status assessment for the species: S1351 - Harbour porpoise (Phocoena phocoena) UNITED KINGDOM.
JNCC/SNCBs (2017), ‘Joint SNCB Interim Displacement Advice Note 2017’. https://hub.jncc.gov.uk/assets/9aecb87c-80c5-4cfb-9102-39f0228dcc9a [Accessed: July 2021].
Johnston, A., Cook, A.S.C.P., Wright, L.J., Humphreys, E.M. and Burton, E.H.K. (2014a), ‘Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines’, Journal of Applied Ecology, 51: 31-41.
Johnston, A., Cook, A.S.C.P., Wright, L.J., Humphreys, E.M. and Burton, N.H.K. (2014b) corrigendum. Journal of Applied Ecology, 51, doi: 10.1111/1365-2664.12260.
Joint Nature Conservation Committee (JNCC). (2007), ‘UK Biodiversity Action Plan: List of UK BAP Priority Marine Species’. https://data.jncc.gov.uk/data/98fb6dab-13ae-470d-884b-7816afce42d4/UKBAP-priority-marine-species.pdf [Accessed September 2021].
Joint Nature Conservation Committee (JNCC). (2019), ‘Annex I Reefs and Sandbanks in the UK (Public)’. https://data.gov.uk/dataset/d19f631c-27c0-4c74-804f-d76a4632b702/annex-i-sandbanks-in-the-uk-v2-public [Accessed SeptemberJuly 2021].
Joint Nature Conservation Committee (JNCC). (2021), ‘Annex I Reefs in UK waters (Open Data)’. https://hub.jncc.gov.uk/assets/8f886e47-31d6-477e-9240-65ac42bee709 [Accessed September 2021].

Joint Nautical Archaeology Policy Committee (2006), 'JNAPC Code of Practice for Seabed Development'.
Jones, L.A., Coyle, M.D., Evans, D., Gilliland, P.M. and Murray, A.R. (2004), 'Southern North Sea Marine Natural Area Profile: A contribution to regional planning and management of the seas around England', English Nature.
Judd, A. (2012), 'Guidelines for data acquisition to support marine environmental assessments for offshore renewable energy projects'. Cefas contract report: ME5403 – Module 15.
Kerckhof F, Rumes B, Norro A, Jacques TG, Degraer S. (2010), 'Chapter 5. Seasonal variation and vertical zonation of the marine biofouling on a concrete offshore windmill foundation on the Thorntonbank (southern North Sea)', in Degraer, S., Brabant, R. & Rumes, B. (Eds.), Offshore wind farms in the Belgian part of the North Sea: Early environmental impact assessment and spatio-temporal variability. Royal Belgian Institute of Natural Sciences, Management Unit of the North S: 53–68.
Kober, K., Webb, A., Win, I., Lewis, M., O'Brien, S., Wilson, L.J. and Reid, J.B. (2010), 'An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs'.https://hub.jncc.gov.uk/assets/7db38547-5074-4136-8973-fd7d97666120 [Accessed: July 2021].
Krone R, Gutow L, Joschko TJ, Schröder A. (2013), 'Epifauna dynamics at an offshore foundation - Implications of future wind power farming in the North Sea', Marine Environmental Research 85: 1–12.
Landscape Institute (2017) Visual Representation of Development Proposals.
Landscape Institute with the Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, Third Edition.
Langston, R.H.W. (2010), 'Offshore wind farms and birds: Round 3 zones, extensions to Round 1 and Round 2 sites and Scottish Territorial Waters'. https://www.rspb.org.uk/globalassets/downloads/documents/positions/climate-change/wind-power-publications/offshore-wind-farms-and-birds.-round-3-zones-extensions-to-round-1-and-round-2-sites--scottish-territorial-waters.pdf [Accessed: July 2021].
LDA Design (December 2018) Suffolk, South Norfolk and North Essex Seascape Character Assessment, Final Report.
Leopold, M.F. and Verdaat, H.J.P. 2018, 'Pilot field study: observations from a fixed platform on occurrence and behaviour of common guillemots and other seabirds in offshore wind farm Luchterduinen'. https://tethys.pnnl.gov/publications/pilot-field-study-observations-fixed-platform-occurrence-behaviour-common-guillemots [Accessed: July 2021].
Lilley, M., Firestone, J. and Kempton, W. (2010) 'The Effect of Wind Power Installations on Coastal Tourism'.
Lindeboom, H. J., H. J. Kouwenhoven, M. J. N. Bergman, S. Bouma, S. Brasseur, R. Daan, R. C. Fijn, D. de Haan, S. Dirksen, R. van Hal, R. Hille Ris Lambers, R. ter Hofstede, K. L. Krijgsveld, M. Leopold, and M. Scheidat. 2011. Short-term ecological effects of an offshore wind farm in the Dutch coastal zone; a compilation. Environmental Research Letters 6:1-13.
Linley EA., Wilding TA, Black K, Hawkins A, Mangi S. (2008), 'Review of the reef effects of offshore wind farm structures and their potential for enhancement and mitigation'. https://tethys.pnnl.gov/sites/default/files/publications/Potential_for_Enhancement_and_Mitigation.pdf [Accessed: July 2021].

Lonergan, M., C. Duck, S. Moss, C. Morris, and D. Thompson. 2013. Rescaling of aerial survey data with information from small numbers of telemetry tags to estimate the size of a declining harbour seal population. Aquatic Conservation-Marine and Freshwater Ecosystems 23:135-144.

Low Carbon Innovation Coordination Group (2016) 'Summary Report to the Offshore Wind Programme Board' https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/593464/Refreshed_OSW_TINA_Summary_Report_March2016.pdf [Accessed June 2021]

LUC (2017), 'Historic Seascape Characterisation (HSC): Consolidating the National HSC Database', Historic England.

Madsen, P. T., M. Wahlberg, J. Tougaard, K. Lucke, and P. Tyack. 2006. Wind turbine underwater noise and marine mammals: implications of current knowledge and data needs. Marine Ecology Progress Series 309:279-295.

MAGIC Website (https://magic.defra.gov.uk/) – last accessed 23rd April 2021.

Marine Ecological Surveys Limited (MESL) (2005), 'Thanet Offshore Windfarm, Benthic and Intertidal Resource Survey', Report prepared by Marine Ecological Surveys Ltd for Haskoning UK Ltd.

Marine Ecological Surveys Limited (MESL) (2012), 'East Anglia Offshore Wind Farm: East Anglia One Benthic Biological Characterisation Report', Prepared for East Anglia Offshore Wind Ltd., (Document No. ERMEA10111).

Marine Management Organisation (2012) A Seascape Character Area Assessment for the East Inshore and East Offshore Marine Plan Areas.

Marine Management Organisation (2017). The Margate and Long Sands European Marine Site (Specified Areas) Bottom Towed Fishing Gear Byelaw 2017.

Marine Management Organisation (MMO) (2021). IFISH database with landing statistics data for UK registered vessels for 2015 to 2019 with attributes for: landing year; landing month; vessel length category; country code; ICES rectangle; vessel/gear type; species; live weight (tonnes); and value; and landing year; landing month; vessel length category; country code; vessel/gear type; port of landing; species; live weight (tonnes); and value.

Maritime Archaeology Ltd (2005), 'Greater Gabbard Windfarm – Phase One: Offshore Turbine Area, Archaeological Desk Based Assessment'.

Maritime Archaeology Ltd (2005), 'Greater Gabbard Windfarm – Phase Two: Export Cable Route and Onshore Works, Archaeological Desk Based Assessment'.

Masden E.A., Reeve, R., Desholm, M., Fox, A.D., Furness, R.W. and Haydon, D.T. (2012), 'Assessing the impact of marine wind farms on birds through movement modelling'. Journal of the Royal Society Interface, 9, 2120-2130.

Masden, E.A., Haydon, D.T., Fox, A.D. and Furness, R.W. (2010), 'Barriers to movement: Modelling energetic costs of avoiding marine wind farms amongst breeding seabirds', Marine Pollution Bulletin, 60: 1085-1091.

MCA (2008). MGN 372 (Merchant and Fishing) Offshore Renewable Energy Installations (OREIs) – Guidance to Mariners Operating in the Vicinity of UK OREIs, Southampton: MCA.

MCA (2021) Safety of Navigation: Offshore Renewable Energy Installations OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response.

MCA (2021). MGN 654 (Merchant and Fishing) Offshore Renewable Energy Installations (OREI) – Guidance on UK Navigational Practice, Safety and Emergency Response, Southampton: MCA.

Mendel, B., Schwemmer, P., Peschko, V., Müller, S., Schwemmer, H., Mercker, M. and Garthe, S. (2019), 'Operational offshore wind farms and associated ship traffic cause profound changes in distribution patterns of loons (Gavia spp.)', Journal of Environmental Management 231: 429-438.
Minister for Climate Change and Industry (2017) 'Clean Growth Strategy' https://www.gov.uk/government/speeches/the-clean-growth-strategy [Accessed: June 2021]
Ministry of Housing, Communities and Local Government (MHCLG) 2019: National Planning Policy Framework, Section 16
Mitchell P.I., Newton S.F., Batcliffe N. & Dunn T.E. (2004), 'Seabird Populations of Britain and Ireland', T and AD Poyser (London:Bloomsburry Publishing).
MOD (2021) Military Aeronautical Information Publication
Moorlock, B., Hamblin, R., Booth, S. and Morigi, A. (2000), 'Geology of the country around Lowestoft and Saxmundham. Memoir for 1:50 000 Geological sheets 176 and 191 (England and Wales)', British Geological Society.
Musgrove, A.J., Aebischer, N.J., Eaton, M.A., Hearn, R.D., Newson, S.E., Noble, D.G., Parsons, M., Risely, K. and Stroud, D.A. (2013), 'Population estimates on birds in Great Britain and the United Kingdom', British Birds, 106: 64–100.
National Grid (2014) 'A Study into the Effect of National Grid Major Infrastructure Projects on Socio-economic Factors'.
NATS (2021) CAP 032 United Kingdom Integrated Aeronautical Information Package.
Natural England (2012) An Approach to Seascape Character Assessment.
Natural England (2014) An Approach to Landscape Character Assessment.
Natural England (2017), Geomorphological Advice in respect of East Lane, (Suffolk) coastal changes and their impact on Shingle Street Barrier. https://www.coasteast.org.uk/assets/img/1417033.pdf. [Accessed: July 2021].
Natural England (2019) Suffolk Coast and Heaths AONB Variation Project, Natural Beauty Assessment.
Neal E. and Cheeseman C. (1996). Badgers. Poyser Natural History
NFOWFL (2021). North Falls Offshore Wind Farm Scoping Report. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010119/EN010119-000019-EN010119%20-%20Scoping%20Report.pdf. [Accessed: September, 2021]
NOMIS (2020) 'Labour Market Profile Tendring' https://www.nomisweb.co.uk/reports/lmp/la/1946157220/report.aspx [Accessed: July 2021].
Normandeau, Exponent, T. Tricas, and A. Gill. 2011. Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09.
North Falls Offshore Wind Farm Ltd (2021) 'Environmental Impact Assessment Scoping Report' https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010119/EN010119-000019-EN010119%20-%20Scoping%20Report.pdf [Accessed September 2021]
Offshore Renewable Energy (ORE) Catapult (2017) Cost Reduction Monitoring Framework
Offshore Technology Report: Noise and Vibration OTO 068/2001

ONS (2016) ‘Regional Gross Value Added (Income Approach)’ https://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedincomeapproach/previousReleases [Accessed: July 2021].

OSPAR (2005). 2005 Assessment of data collected under the Co-ordinated Environmental Monitoring Programme (CEMP). ISBN 1-904426-77-8. Available from: https://www.ospar.org/documents?v=7017 [[Accessed July 2021]].

OSPAR (2008), ‘OSPAR Guidance on Environmental Considerations for Offshore Wind Farm Development’. Reference number: 2008-3.

OSPAR (2017). OSPAR Intermediate Assessment 2017 Available from: https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/introduction/ospar-and-intermediate-assessment-2017/ [Accessed July 2021]

OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic (2008), ‘OSPAR Guidance on Environmental Considerations for Offshore Wind Farm Development’. (Reference number: 2008-3).

Osprey (20210) Radar Line of Sight Analysis.

Pale Blue Dot Energy & Axis Well Technology (2016). Progressing Development of the UKs Strategic Carbon Dioxide Storage Resource: A summary of Results from the Strategic UK co2 Storage Appraisal Report. April 2016

Palmer, M., Howard, T., Tinker, J., Lowe J.A., Bricheno L., Calvert D., Edwards T., Gregory J., Harris G.R., Krijnen J., and Roberts, C. (2018), ‘UKCP18 Marine Report.’

Parfitt, S.A., Ashton, N.M., Lewis, S.G., Abel, R.L., Coope, R., Field, M.H., Gale, R., Hoare, P.G., Larkin, N.R., Lewis, M.D., Karloukovski, V., Maher, B.A., Peglar, S.M., Preece, R.C., Whittaker, J.E. and Stringer, C.B. (2010), ‘Early Pleistocene occupation at the edge of the boreal zone in northwest Europe’, Nature, 466: 229-233.

Parfitt, S.A., Barendregt, R.W., Breda, M. Candy, I., Collins, M.J., Coope, R., Durbridge, P., Field, M.H., Lee, J.R., Lister, A.M., Mutch, R., Penkman, K.E.H., Preece, R.C., Rose, J., Stringer, C.B., Symmons, R., Whittaker, J.E., Wymer, J.J. and Stuart, A.J. (2005), ‘The earliest record of human activity in northern Europe’, Nature, 438: 1008-1012.

Paxton, C., L. Scott-Hayward, M. Mackenzie, E. Rexstad, and L. Thomas. 2016. Revised Phase III Data Analysis of Joint Cetacean Protocol Data Resources.

Pearce, B. (2014), ‘The ecology of Sabellaria spinulosa reefs’, A thesis submitted to Plymouth University in partial fulfilment for the degree of Doctor of Philosophy, Marine Biology and Ecology Research Centre (MBERC), in In collaboration with Marine Ecological Surveys Limited and Plymouth Marine Laboratory.

Pearce, B., Fariñas-Franco, J.M., Wilson, C., Pitts, J., de Burgh, A., and Somerfield, P.J. (2014), ‘Repeated mapping of reefs constructed by Sabellaria spinulosa Leuckart 1849 at an offshore wind farm site’, Continental Shelf Research, 83: 3–13

PINS (2017) ‘Advice Note Eighteen: The Water Framework Directive’ https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2017/06/advice_note_18.pdf [Accessed June 2021]

PINS (2017) ‘Advice Note Eleven: Working with public bodies in the infrastructure planning process - Annex H – Evidence Plans for Habitats Regulations Assessments of Nationally Significant Infrastructure Projects’ https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2021/02/Advice-Note-11-Annex-H-Evidence-Plans.odt [Accessed June 2021]

PINS (2017) ‘Advice Note Eleven: Working with public bodies in the infrastructure planning process’ https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2014/12/Advice-note-11-v3_1.pdf [Accessed June 2021]
PINS (2017) ‘Advice Note Nine: Rochdale Envelope’ https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/05/Advice-note-9.-Rochdale-envelope-web.pdf [Accessed June 2021]
PINS (2017) ‘Advice Note Ten: Habitat Regulations Assessment relevant to Nationally Significant Infrastructure Projects’ https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/06/Advice-note-10v4.pdf [Accessed June 2021]
PINS (2017) ‘Advice Note Three: EIA consultation and notification’ https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/07/advice_note_3_v5.pdf [Accessed June 2021]
PINS (2019) ‘Advice Note Seventeen: Cumulative effects assessment’ https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/12/Advice-note-17V4.pdf [Accessed June 2021]
PINS (2020) ‘Advice Note Seven: Environmental Impact Assessment: Preliminary Environmental Information, Screening and Scoping’ https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2017/12/Advice-note-7.pdf [Accessed June 2021]
PINS (2020) ‘Advice Note Twelve: Transboundary Impacts and Process’ https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-twelve-transboundary-impacts-and-process/ [Accessed June 2021]
Planning inspectorate (2015), ‘Advice note seventeen: Cumulative Effects Assessment relevant to nationally significant infrastructure projects’. https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/12/Advice-note-17V4.pdf [Accessed: July 2021].
Planning Inspectorate (2017). 'Advice note eighteen: The Water Framework Directive',: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2017/06/advice_note_18.pdf [Accessed July 2021].
Planning Inspectorate (July, 2018) Advice Note 9: Rochdale Envelope
Planning Practice Guidance, Department for Communities and Local Government (2017)
Planning Practice Guidance, Department for Communities and Local Government (2017)
Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D., Bartol, S., Carlson, Th., Coombs, S., Ellison, W. T., Gentry, R., Hal vorsen, M. B., Lokkeborg, S., Rogers, P., Southall, B. L., Zeddies, D. G. and Tavolga, W. N. (2014), ‘ASA S3/SC1. 4 TR-2014 Sound Exposure Guidelines for Fishes and Sea Turtles. A Technical Report Prepared by ANSI-Accredited Standards Committee S3/SC1 and Registered with ANSI’, New York: Springer International Publishing, 33–51.
Projects. https://ore.catapult.org.uk/app/uploads/2018/01/CRMF-ORE-Catapult-report-to-the-OWPB.pdf [Accessed June 2021]
Projects. Prepared by Wessex Archaeology for The Crown Estate. https://www.wessexarch.co.uk/sites/default/files/field_file/2_Protocol%20For%20Archaeological%20Discoveries.pdf [Accessed June 2021]
Reid, J. B., P. G. Evans, and S. P. Northridge. 2003. Atlas of cetacean distribution in north-west European waters. Joint Nature Conservation Committee.
Renewable UK, 2017. 2017 Report on Offshore Wind UK Content

RenewableUK (2013) Cumulative Impact Assessment Guidelines - Guiding Principles for Cumulative Impact Assessment in Offshore Wind Farms.

RenewableUK. (2013). Cumulative impact assessment guidelines, guiding principles for cumulative impacts assessments in offshore wind farms.

Research Council of Norway (2012). Long-term Effects of Discharges to Sea from Petroleum-Related Activities. The Results of Ten Years of Research. A sub-programme under the Ocean and Coastal Areas (Havkyst) programme, PROOFNY and the concluded PROOF research programme. ISBN 978-82-12-03027-5.

Robinson, R.A. (2005), 'Bird Facts: profiles of birds occurring in Britain and Ireland'. https://www.bto.org/understanding-birds/birdfacts [Accessed: July 2021].

Robinson, S. P., Theobald, P. D., Hayman, G., Wang, L. S., Lepper, P. A., Humphrey, V. and Mumford, S. (2011), 'Measurement of underwater noise arising from marine aggregate dredging operations – MEPF report 09/P108'. Marine Aggregate Levy Sustainability Fund (MALSF).

Royal Haskoning. 2011. Galloper Wind Farm Project Environmental Statement - Chapter 14: Marine Mammals.

Royal Haskoning (2010). Kentish Flats Offshore Wind Farm Extension Environmental Scoping Study (Report No. 9V9546/01/R0001). Report by Vattenfall. Report for Vattenfall.

RPS (2008), 'Preconstruction Benthic Ecology. Gunfleet Sands Offshore Wind Farm Development', A report to Gunfleet Sands Ltd.

Russell, D. J., G. D. Hastie, D. Thompson, V. M. Janik, P. S. Hammond, L. A. Scott-Hayward, J. Matthiopoulos, E. L. Jones, and B. J. McConnell. 2016b. Avoidance of wind farms by harbour seals is limited to pile driving activities. Journal of Applied Ecology 53:1642-1652.

Russell, D. J., S. M. Brasseur, D. Thompson, G. D. Hastie, V. M. Janik, G. Aarts, B. T. McClintock, J. Matthiopoulos, S. E. Moss, and B. McConnell. 2014. Marine mammals trace anthropogenic structures at sea. Current Biology 24:R638-R639.

Russell, D., C. Duck, C. Morris, and D. Thompson. 2016a. SCOS –BP-16/03: Independent estimates of grey seal population size: 2008 and 2014.

RWE (2021). Awel y Môr Offshore Wind Farm Preliminary Environmental Information Report https://exhibition.awelymor.cymru/peir/.[Accessed: September 2021].

RWE Npower renewables (Galloper Wind Farm Limited), 2011. Galloper Wind Farm Project Environmental Statement, October 2011

RYA (2015). The RYA's Position on Offshore Energy Developments: Paper 1 – Wind Energy. Southampton: RYA.

RYA (2019). UK Coastal Atlas of Recreational Boating. Sourced from https://www.rya.org.uk/knowledge-advice/planning-environment/Pages/uk-coastal-atlas-of-recreational-boating.aspx

Scheidat, M., J. Tougaard, S. Brasseur, J. Carstensen, T. van Polanen Petel, J. Teilmann, and P. Reijnders. 2011. Harbour porpoises (Phocoena phocoena) and wind farms: a case study in the Dutch North Sea. Environmental Research Letters 6:1-10.

SCOS. 2021. Scientific Advice on Matters Related to the Management of Seal Populations: 2020.

Scott, K., Harsanyi, P. and Lyndon A.R. (2018), 'Understanding the effects of electromagnetic field emissions from Marine Renewable Energy Devices (MREDs) on the commercially important edible crab, Cancer pagurus (L.)', Marine Pollution Bulletin, 131/A: 580–588.

Scottish Natural Heritage (2012) Assessing the Cumulative Impact of Onshore Wind Energy Developments.
Scottish Natural Heritage (2017) Visual Representation of Windfarms. Version 2.2.
Seafish (2012). Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments. Available online: http://www.seafish.org/media/634910/ukfen%20ia%20best%20practice%20guidance.pdf [Accessed November 2019]
Sewell D, Griffiths R, Beebee T, Foster J and Wilkinson J (2013). Survey Protocols for the British Herpetofauna.
SNCB 2017, 'Joint SNCB Interim Displacement Advice Note'.
Southall, B., J. J. Finneran, C. Reichmuth, P. E. Nachtigall, D. R. Ketten, A. E. Bowles, W. T. Ellison, D. Nowacek, and P. Tyack. 2019. Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquatic Mammals 45:125-232.
Speakman, J., Gray, H. and Furness, L. (2009), 'University of Aberdeen report on effects of offshore wind farms on the energy demands of seabirds'. Report to the Department of Energy and Climate Change.
SSE Renewables Development UK Ltd and RWE Npower Renewables Ltd (2010), 'Galloper Wind Farm Project, Scoping Study'.
Stern Report 2006. The Stern Review on the Economics of Climate Change, 2006.
Stienen, E.W., Waeyenberge, V., Kuijken, E. and Seys, J. (2007), 'Trapped within the corridor of the southern North Sea: the potential impact of offshore wind farms on seabirds, in de Lucas, M., Janss, G.F.E. and Ferrer, M. (Eds), Birds and Wind farms (Madrid: Quercus).
Stone, C.J. Webb, A., Barton, C., Ratcliffe, N., Reed, T.C. Tasker, M.L. Camphuysen, C.J. and Pienkowski, M.W. (1995), 'An atlas of seabird distribution in north-west European waters'. https://hub.jncc.gov.uk/assets/c132752f-827c-41fc-b617-e681db21eaf5 [Accessed: July 2021].
Stour and Orwell Society (2013) Shotley Peninsula and Hinterland Landscape Character Assessment.
Strachan, R., Moorhouse, T., Gelling, M. (2011) Water Vole Conservation Handbook, Third Edition. WildCRU, University of Oxford
Suffolk Coast & Heaths AONB (2013) Suffolk Coast & Heaths AONB Management Plan 2013 – 2018.
Suffolk Coast & Heaths AONB Partnership (2015) Development in the Setting of the Suffolk Coast & Heaths AONB.
Suffolk Coast and Heaths AONB (2012) Touching the Tide Landscape Character Assessment.
Suffolk Coast Tourism Strategy (2013-2023) 'The Energy Coast 2019'.
Suffolk Coastal District Council (2009), 'Shoreline Management Plan 7: Lowestoft Ness to Felixstowe Landguard Point'. http://www.suffolksmp2.org.uk/ [Accessed: July 2021].
Suffolk Coastal District Council (2018) Suffolk Coastal Landscape Character Assessment (2018).
Suffolk County Council (2011/updated 2018) Suffolk Landscape Assessment.
Suffolk County Council (2018) Suffolk, South Norfolk and North Essex Seascape Character Assessment.
Suffolk County Council (2020) Suffolk Seascape Sensitivity to Offshore Wind Farms.
TEDA (2012), 'Thames Marine Aggregate Regional Environmental Assessment (MAREA)'

Teilmann, J., J. Carstensen, R. Dietz, S. M. C. Edrén, and S. M. Andersen. 2006a. Final report on aerial monitoring of seals near Nysted Offshore Wind Farm.
Teilmann, J., J. Tougaard, and J. Carstensen. 2006b. Summary on harbour porpoise monitoring 1999-2006 around Nysted and Horns Rev Offshore Wind Farms.
Tendring District Council (2020). '2020 Air Quality Annual Status Report'.
Tendring District Council Visitor Information (2021) 'Essex Sunshine Coast' www.essex-sunshine-coast.org.uk [Accessed: July 2021].
Thaxter, C.B., Lascelles, B., Sugar, K., Cook, A.S.C.P., Roos, S., Bolton, M., Langston, R.H.W. and Burton, N.H.K. (2012), 'Seabird foraging ranges as a preliminary tool for identifying Marine Protected Areas', Biological Conservation, 156: 53-61.
The Assessment and Rating of Noise from Wind Farms', The Working Group on Noise from Wind Turbines, ETSU Report for the DTI, ETSU-R-97, 1996ETSU-R-97 and the
The Contaminated Land (England) Regulations 2006 (2006/1380)
The Crown Estate (2012), UK Fisheries Information Project (UKFIM) mapping.
The Crown Estate (2014) Protocol for Archaeological Discoveries: Offshore Renewables
The Crown Estate (2014), 'Protocol for Archaeological Discoveries: Offshore Renewables Project', Wessex Archaeology.
The Crown Estate (2019) Plan-level Habitats Regulations Assessment For The 2017 Offshore Wind Farm Extensions, Cable Route Protocol
The Crown Estate (2019), 'Cumulative Effects Assessment Tool – Scoping Study'. Final Report by NIRAS Consulting Ltd.
The Crown Estate (2021), 'Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects', Wessex Archaeology.
The Crown Estate (TCE) (2016), 'Bawdsey Coastal process assessment'. Report by HR Wallingford for TCE. https://www.coasteast.org.uk/assets/img/1417029.pdf. [Accessed: July 2021].
The Guidelines for Environmental Noise Impact Assessment, produced by the Institute of Environmental Management and Assessment (IEMA), (October 2014)
The Merchant Shipping and Fishing Vessels 'Control of Noise at Work' Regulations (2007)
The Planning Inspectorate (2012) Scoping Opinion: Proposed East Anglia THREE Offshore
The Planning Inspectorate (2016) Scoping Opinion: Proposed Norfolk Vanguard Offshore Wind Farm.
The Planning Inspectorate, (2018), 'Advice Note Nine: Rochdale Envelope', Available from:
The Stationery Office (TSO) (2009b), 'The Carbon Budgets Order 2009' http://www.legislation.gov.uk/uksi/2009/1259/contents/made [Accessed: June 2021].
The Stationery Office (TSO) (2009c), 'The UK Renewable Energy Strategy' [online] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228866/7686.pdf [Accessed June 2021].
The Stationery Office (TSO) (2011), 'The Carbon Budgets Order 2011' http://www.legislation.gov.uk/uksi/2011/1603/made [Accessed: June 2021].
The Stationery Office (TSO) (2016), 'The Carbon Budgets Order 2016' http://www.legislation.gov.uk/uksi/2016/785/made [Accessed: October 2019].
Tizzard, L., Bicket, B.A. and Loecker, D. (2014), 'A Middle Palaeolithic site in the Southern North Sea: Investigating the archaeology and palaeogeography of Area 240', Journal of Quaternary Science, 29/7: 698-710.
Town and Country Planning Act 1990
UK Energy Research Centre (2018), 'The Security of UK Energy Futures' Available: http://www.ukerc.ac.uk/publications/uk-energy-security.html [Accessed June 2021]

UK Habitat (UKHab) Classification (https://ukhab.org/)
UK Oil and Gas (2015). Fisheries Liaison Guidelines - Issue 6.
UKHO (2017). NP28 Admiralty Sailing Directions Dover Strait Pilot Book 12th Edition. Taunton: UKHO.
UKHO (2021), 'Admiralty Marine Data Portal'. https://seabed.admiralty.co.uk [Accessed: July 2021].
VE OWLF. 2021. Five Estuaries Offshore Wind Farm Habitat Regulation Assessment: Screening Report.
Vincent, C., M. Huon, F. Caurant, W. Dabin, A. Deniau, S. Dixneuf, L. Dupuis, J.-F. Elder, M.-H. Fremau, and S. Hassani. 2017. Grey and harbour seals in France: Distribution at sea, connectivity and trends in abundance at haulout sites. Deep Sea Research Part II: Topical Studies in Oceanography.
Visit Essex (2021) 'Things to Do guide' www.visitessex.com [Accessed: July 2021].
Waggitt, J. J., P. G. H. Evans, J. Andrade, A. N. Banks, O. Boisseau, M. Bolton, G. Bradbury, T. Brereton, C. J. Camphuysen, J. Durinck, T. Felce, R. C. Fijn, I. Garcia-Baron, S. Garthe, S. C. V. Geelhoed, A. Gilles, M. Goodall, J. Haelters, S. Hamilton, L. Hartny-Mills, N. Hodgins, K. James, M. Jessopp, A. S. Kavanagh, M. Leopold, K. Lohrengel, M. Louzao, N. Markones, J. Martinez-Cediera, O. O'Cadhla, S. L. Perry, G. J. Pierce, V. Ridoux, K. P. Robinson, M. B. Santos, C. Saavedra, H. Skov, E. W. M. Stienen, S. Sveegaard, P. Thompson, N. Vanermen, D. Wall, A. Webb, J. Wilson, S. Wanless, and J. G. Hiddink. 2020. Distribution maps of cetacean and seabird populations in the North-East Atlantic. Journal of Applied Ecology 57:253-269.
Wernham, C.V., Toms, M.P., Marchant, J.H., Clark, J.A., Siriwardena, G.M. and Baillie, S.R. (eds). (2002), 'The Migration Atlas: Movements of the birds of Britain and Ireland', T and AD Poyser (London:Bloomsburry Publishing).
Wessex Archaeology (2011), 'Galloper Wind Farm Project Environmental Statement – Chapter 19: Archaeology and Cultural Heritage', Document ref. 5.2.19.
Whalley, C., Rowlatt, S., Bennet, M. & Lavell. D. (1999). Total Arsenic in Sediments from the Western North Sea and the Humber Estuary. Marine Pollution Bulletin, 38, (5), pp. 394-400.
White Consultants (2020) Offshore Energy Strategic Environmental Assessment.
Wilhelmsson, D., Malm, T. and Ohman, M.C. (2006), 'The influence of offshore windpower on demersal fish',ICES Journal of Marine Science, 63: 775-784.
Woodward, I., Thaxter, C.B., Owen, E. and Cook, A.S.C.P. (2019), 'Desk-based revision of seabird foraging ranges used for HRA screening', BTO Research Report No. 724. (Thetford: The British Trust for Ornithology).
World Health Organisation (WHO) Environmental Noise Guidelines for the European Region – Guideline Values for Community Noise in Specific Environments, 2018
Worsfold, T.M. and Dyer, M.F. (2005), 'Benthic Ecology of Scroby Sands wind farm site: results of July 2005 (post-construction) survey and comparison with 1998 (pre-construction) survey', Unicomarine Report EONSCR05 to E.ON UK Renewables Offshore Wind Ltd.
Wright, L.J., Ross-Smith, V.H., Massimino, D., Dadam, D., Cook, A.S.C.P. and Burton, N.H.K. (2012), 'Assessing the risk of offshore windfarm development to migratory birds designated as features of UK Special Protection Areas (and other Annex I species)'.https://tethys.pnnl.gov/publications/assessing-risk-offshore-wind-farm-development-migratory-birds-designated-features-uk [Accessed: July 2021].

Wireline drawing

Location grid reference:	650817 E 275764 N	Paper size:	841mm x 297mm (half A1)
Direction of view:	120°	Corrected print image size:	820mm x 130mm
Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm
Distance:	49.5km		

Notes:

- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5a

Viewpoint 1 - Southwold

FIVE ESTUARIES OFFSHORE WINDFARM

APPENDIX A

Wireline drawing

Location grid reference:	647961 E 267778 N	Paper size:	841mm x 297mm (half A1)
Direction of view:	115°	Corrected print image size:	820mm x 130mm
Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm
Distance:	47.9km		

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5b

Viewpoint 2 - Dunwich (Beach)

FIVE ESTUARIES OFFSHORE WINDFARM

APPENDIX A

Wireline drawing

Location grid reference:	647696 E 267787 N	Paper size:	841mm x 297mm (half A1)
Direction of view:	110°	Corrected print image size:	820mm x 130mm
Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm
Distance:	46.2km		

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5c

Viewpoint 3 - Dunwich Heath (Coastguard Cottages)

FIVE ESTUARIES OFFSHORE WINDFARM

APPENDIX A

Wireline drawing

Location grid reference:	647542 E 262862 N	Paper size:	841mm x 297mm (half A1)
Direction of view:	110°	Corrected print image size:	820mm x 130mm
Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm
Distance:	43.4km		

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5d
Viewpoint 4 - Sizewell Beach
FIVE ESTUARIES OFFSHORE WINDFARM
APPENDIX A

Wireline drawing

Location grid reference:	647287 E 259492 N
Direction of view:	108°
Horizontal field of view:	90° (cylindrical projection)
Distance:	41.9km

Paper size:	841mm x 297mm (half A1)
Corrected print image size:	820mm x 130mm
Principal distance:	522mm

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5e
Viewpoint 5 - Thorpeness
FIVE ESTUARIES OFFSHORE WINDFARM
APPENDIX A

Wireline drawing

Location grid reference:	646586 E 256852 N
Direction of view:	102°
Horizontal field of view:	90° (cylindrical projection)
Distance:	41.2km

Paper size:	841mm x 297mm (half A1)
Corrected print image size:	820mm x 130mm
Principal distance:	522mm

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5f
Viewpoint 6 - Aldeburgh
FIVE ESTUARIES OFFSHORE WINDFARM
APPENDIX A

Wireline drawing

Location grid reference: 641941 E 249876 N
Direction of view: 97°
Horizontal field of view: 90° (cylindrical projection)
Distance: 43.2km

Paper size: 841mm x 297mm (half A1)
Corrected print image size: 820mm x 130mm
Principal distance: 522mm

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5g
Viewpoint 7 - Orford Castle
FIVE ESTUARIES OFFSHORE WINDFARM
APPENDIX A

Wireline drawing

Location grid reference:	638992 E 248481 N	Paper size:	841mm x 297mm (half A1)
Direction of view:	95°	Corrected print image size:	820mm x 130mm
Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm
Distance:	45.7km		

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5h

Viewpoint 8 - Burrow Hill (Suffolk Coast Path)

FIVE ESTUARIES OFFSHORE WINDFARM

APPENDIX A

Wireline drawing

Location grid reference: 644543 E 249215 N
Direction of view: 98°
Horizontal field of view: 90° (cylindrical projection)
Distance: 40.5km

Paper size: 841mm x 297mm (half A1)
Corrected print image size: 820mm x 130mm
Principal distance: 522mm

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5i

Viewpoint 9 - Orfordness (Roof - Bomb Ballistics Building)

FIVE ESTUARIES OFFSHORE WINDFARM

APPENDIX A

Wireline drawing

Location grid reference:	636604 E 242531 N	Paper size:	841mm x 297mm (half A1)
Direction of view:	91°	Corrected print image size:	820mm x 130mm
Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm
Distance:	47.2km		

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5j
Viewpoint 10 - Shingle Street
FIVE ESTUARIES OFFSHORE WINDFARM
APPENDIX A

Wireline drawing

Location grid reference: 632379 E 236250 N
Direction of view: 86°
Horizontal field of view: 90° (cylindrical projection)
Distance: 51.0km

Paper size: 841mm x 297mm (half A1)
Corrected print image size: 820mm x 130mm
Principal distance: 522mm

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5k
Viewpoint 11 - Old Felixstowe
FIVE ESTUARIES OFFSHORE WINDFARM
APPENDIX A

Wireline drawing

Location grid reference: 626489 E 223535 N
Direction of view: 80°
Horizontal field of view: 90° (cylindrical projection)
Distance: 54.9km

Paper size: 841mm x 297mm (half A1)
Corrected print image size: 820mm x 130mm
Principal distance: 522mm

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
- © Crown copyright and database rights 2020 Ordnance Survey 0100031673.
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5l
Viewpoint 12 - The Naze
FIVE ESTUARIES OFFSHORE WINDFARM
APPENDIX A

Wireline drawing

Location grid reference: 651138 E 276658 N
Direction of view: 120°
Horizontal field of view: 90° (cylindrical projection)
Distance: 49.9km

Paper size: 841mm x 297mm (half A1)
Corrected print image size: 820mm x 130mm
Principal distance: 522mm

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
- © Crown copyright and database rights 2020 Ordnance Survey 0100031673.
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5m
Viewpoint A- Southwold Pier
FIVE ESTUARIES OFFSHORE WINDFARM
APPENDIX A

Wireline drawing

Location grid reference:	633529 E 237748 N	Paper size:	841mm x 297mm (half A1)
Direction of view:	92°	Corrected print image size:	820mm x 130mm
Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm
Distance:	49.9km		

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5n
Viewpoint B - Bawdsey Manor
FIVE ESTUARIES OFFSHORE WINDFARM
APPENDIX A

Wireline drawing

Location grid reference:	628501 E 231912 N	Paper size:	841mm x 297mm (half A1)
Direction of view:	85°	Corrected print image size:	820mm x 130mm
Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm
Distance:	53.9km		

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5o
Viewpoint C - Landguard Fort
FIVE ESTUARIES OFFSHORE WINDFARM
APPENDIX A

Wireline drawing

Location grid reference:	625125 E 230625 N	Paper size:	841mm x 297mm (half A1)
Direction of view:	87°	Corrected print image size:	820mm x 130mm
Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm
Distance:	57.0km		

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
- © Crown copyright and database rights 2020 Ordnance Survey 0100031673.
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5p
Viewpoint D - Harwich
FIVE ESTUARIES OFFSHORE WINDFARM
APPENDIX A

Wireline drawing

Location grid reference:	619474 E 215730 N	Paper size:	841mm x 297mm (half A1)
Direction of view:	95°	Corrected print image size:	820mm x 130mm
Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm
Distance:	61.5km		

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
- © Crown copyright and database rights 2020 Ordnance Survey 0100031673.
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5q
Viewpoint E - Clacton-on-Sea
FIVE ESTUARIES OFFSHORE WINDFARM
APPENDIX A

Wireline drawing

Location grid reference:	638476 E 171504 N	Paper size:	841mm x 297mm (half A1)
Direction of view:	39°	Corrected print image size:	820mm x 130mm
Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm
Distance:	61.1km		

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Figure: 17.5r
Viewpoint F - Foreness Point (Kent)
FIVE ESTUARIES OFFSHORE WINDFARM
APPENDIX A

APPENDIX B - GAZETTEER OF THE UKHO WRECKS, OBSTRUCTIONS AND FOUL GROUND

There are 25 sites within the marine archaeology study area covered in the HER data.

HOB ID	NAME	DESCRIPTION	HER ID	DATE	X	Y
1567625	Unknown	A microphone hand set was found at Greenwich wharf after dredging operations from licence area 447 which is located approximately 19 kilometres east of Walton-on-the-Naze in the Thames Estuary dredging region. The object was found in March 2012.	TM4471923063	Unknown date	400398.3625	5745562.662
802463	Unknown	Small wreck	TM5437020260	Unknown date	409829.1222	5742106.288
802553	Unknown	Wreck, partially buried.	TM4356023654	Unknown date	399283.2092	5746231.436
802614	Unknown	Unidentified wreck	TM4182726603	Unknown date	397757.4098	5749290.832
802471	Unknown	Small wreck	TM5585020954	Unknown date	411352.3145	5742696.796

HOB ID	NAME	DESCRIPTION	HER ID	DATE	X	Y
802599	Unknown	Unidentified feature	TM4301426227	Unknown date	398915.2322	5748834.494
1478820	Diver Box Diver Battery K29	Possible site of a Second World War heavy anti aircraft (Diver) Battery in the Diver Box at Holland on Sea. On 3rd March 1945 it was listed as to be occupied and equipped with 3.7-inch guns, Predictor AA No.10 Mark I and Radar AA No.3 Mark V.	TM2070016432	WWII	375873.6282	5740656.329
1460880	Martello Tower H	Site of Martello tower H, sold for building materials in 1819, small sections of boundary ditch survive (2007).	TM2234017720	Post-Medieval	377596.4574	5741828.14
1567521	Unknown	An aircraft component was found at Greenwich Wharf after dredging operations from	TM4471923063	Unknown date	400398.3653	5745562.666

HOB ID	NAME	DESCRIPTION	HER ID	DATE	X	Y
		licence area 447 which is located approximately 6 kilometres east of Walton on the Naze in the Outer Thames dredging region. The object was found in January 2012.				
802335	Unknown	Unidentified wreck or obstruction	TM6208917933	Unknown date	417365.6536	5739257.346
1485448	Frinton Emergency Coastal Battery	The site of Frinton coastal battery, an emergency battery built during the Second World War as part of Eastern Command's coastal defences. It was operational by January 1941 and armed with two 6-inch Mk. VII ex-naval guns.	TM2370019200	WWII	379054.0279	5743210.803
389485	Unknown	The remains of the medieval parish church and cemetery	TM2092016650	Medieval	376107.1468	5740858.413

HOB ID	NAME	DESCRIPTION	HER ID	DATE	X	Y
		lying within the grounds of Little Holland Hall, approximately 130 metres inland at Holland-on-Sea. It is thought that the church may date back to the 11th century and was demolished circa 1660.				
802546	Unknown	Unidentified object	TM4341923399	Unknown date	399125.1299	5745986.835
1531075	Unknown	Two modern horseshoes have been discovered at CEMEX's Angerstein wharf in material dredged on 6th September 2010 in Licence area 447, which lies in the Thames region, south-east of Felixstowe. The artefacts were	TM4476821119	Modern	400313.8332	5743620.647

HOB ID	NAME	DESCRIPTION	HER ID	DATE	X	Y
		identified as two modern horseshoes.				
1531084	Unknown	An unidentified metal object has been discovered at CEMEX's Angerstein wharf in material dredged on 6th September 2010 in Licence area 447, which lies in the Thames region, south-east of Felixstowe. The object is an L-shaped scrap of riveted and non-ferrous.	TM6447722112	Unknown date	400313.8332	5743620.647
1567628	Unknown	A machine gun fragment was found at Angerstein wharf after dredging operations from licence area 447 which is located approximately 19 kilometres east of Walton-on-the-Naze in the Outer Thames	TM4471923063	WWII	400398.3653	5745562.666

HOB ID	NAME	DESCRIPTION	HER ID	DATE	X	Y
		Estuary dredging region. The object was found in April 2012.				
1567631	Unknown	An animal bone was found at Angerstein wharf after dredging operations from licence area 447 which is located approximately 19 kilometres east of Walton-on-the-Naze in the Outer Thames Estuary dredging region. The object was found in April 2012	TM4471923063	Unknown date	400398.3653	5745562.666
1460883	Martello Tower I	Site of Martello Tower I, sold for building materials in 1819. Sections of the boundary ditch survive as earthworks (2007).	TM2290018230	Post-Medieval	378189.821	5742298.342
802565	Unknown	Unidentified feature	TM4050924930	Unknown date	396328.4109	5747713.011

HOB ID	NAME	DESCRIPTION	HER ID	DATE	X	Y
1460875	Martello Tower G	The site of Martello tower G. Sold for building material in 1819. No surviving remains visible in 2007.	TM2145016900	Post-Medieval	376652.7828	5741071.406
389498	Unknown	A ditch containing Romano British pottery was noted in a cliff top opposite Connaught Avenue in 1904 and 1910.	TM2390019520	Roman	379275.3913	5743516.199
1478600	Diver Strip Diver Battery K14	Site of a Second World War heavy anti aircraft (Diver) battery in the Diver Strip at Sandy Point. It was armed with four 3.7-inch Mark IIc guns equipped with Predictor BTL, and Radar AA No.3 Mark V when it was deployed here on 24th November 1944.	TM2297318218	WWII	378262.368	5742281.856
389488	Unknown	Two Bronze Age beakers	TM2138016900	Bronze Age	376582.9802	5741076.202

HOB ID	NAME	DESCRIPTION	HER ID	DATE	X	Y
1427932	Unknown	Second World War pillbox; possibly a Type 27. Holland-on-Sea	TM2183017150	WWII	377048.8402	5741294.673
1471898	Heavy Anti Aircraft Battery Clacton C4	Site of Second World War heavy anti aircraft battery at Little Holland, which formed part of the defences of Clacton. It was armed with four 3.7-inch mobile guns in 1942, when it was manned by 325 Battery of the 72nd Royal Artillery Regiment.	TM2150017000	WWII	376709.4936	5741167.702
1532592	Unknown	A Palaeolithic mammoth tooth and a timber fragment have been found in dredging material at Erith Wharf in August 2010. The objects were found in aggregates dredged by either the vessel	TM4471923063	Palaeolithic	400398.3653	5745562.666

HOB ID	NAME	DESCRIPTION	HER ID	DATE	X	Y
		City of London or City of Westminster.				
1531588	Unknown	A modern fork, spoon and shoemaker's last were discovered in aggregate at Erith wharf in August 2010 during dredging operations. The material was dredged either from Licence Area 296 or 447.	TM4486021215	Unknown date	400412.2686	5743710.323
1549833	Unknown	A mammoth tooth was found on board the Sand Fulmar after dredging operations from licence area 447 which is located approximately 19 kilometres east of Walton-on-the-Naze. The material was dredged in November 2011.	TM4490020940	Palaeolithic	400433.3034	5743433.374
1591910	Unknown	Mammoth tooth found in material dredged by Lafarge	TM4529922828	Paleolithic	400960.5858	5745288.577

HOB ID	NAME	DESCRIPTION	HER ID	DATE	X	Y
		Tarmac from Licence Area 447 in the Thames Estuary dredging region, approximately 10.19 nautical miles east of the Naze, Essex.The tooth has been identified by the Natural History Museum				
1584743	St James's Day Fight 1666	The St. James's Day Fight or St. James's Day Battle was a two-day battle which took place on 25-26 July 1666 (25 July being St. James's Day). It is known in Dutch as the Tweedaagse Zeeslag,	TM8552029370	Post-Medieval	441507.6014	5749052.451
1354233	HURRICANE MK IIA Z2701	British Fighter, 1941	TM4093024520	WWII	396720.0974	5747275.307
1376824	Unknown	The 1839 wreck of Scottish sloop or smack which	TM4093024520	Post-Medieval	396720.0973	5747275.307

HOB ID	NAME	DESCRIPTION	HER ID	DATE	X	Y
		foundered in Goldmer Gat; a wooden sailing vessel.				
1353388	SPITFIRE MK VA W3129	British Fighter, 1944	TM4093024520	WWII	396720.0974	5747275.307
1377946	Jane	1848 wreck of English craft which foundered between the Roughs and the Sunk Sand after a collision; a wooden sailing vessel.	TM4093024520	WWII	396720.0973	5747275.307
1268936	Sunbeam	English cutter, 1911	TM4093024520	20th Century	396720.0974	5747275.307
914045	Unknown	English cutter, 1909	TM4093024520	20th Century	396720.0973	5747275.307
1591909	Unknown	Fragment of a brass gauge found in material dredged by Lafarge Tarmac from Licence Area 447, in the Thames Estuary dredging region, approximately 10.16 nautical miles east of the Naze, Essex. The	TM4534922813	Unknown date	401009.4136	5745270.192

HOB ID	NAME	DESCRIPTION	HER ID	DATE	X	Y
		object was discovered in March 2013.				
1300317	Tam O Shanter	English barge, 1943	TM4093024520	WWII	396720.0974	5747275.307
893490	Oak	British craft, 1764	TM4093024520	Post-Medieval	396720.0988	5747275.306
1268470	Prima Donna	ENGLISH BARGE, 1908	TM4093024520	20th Century	396720.0974	5747275.307
1379584	C S M	The 1862 wreck of English brig which foundered in Goldmer Gat while on her passage from Newcastle-upon-Tyne with coal; a wooden sailing vessel.	TM4093024520	Post-Medieval	396720.0973	5747275.307

APPENDIX C - GAZETTEER OF NRHE WRECKS, INTERTIDAL SITES

There are 97 wrecks, obstructions and fouls within the marine archaeology study area recorded in the UKHO data.

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
Obstruction, Foul ground	1001696058	DROFLI	Yacht; Sunk: 1956/08/02	live	Modern	381387.3719	5743125.412
Obstruction, Foul ground	1001696091	Unknown	N/A	dead	Unknown	401343.9003	5741888.921
Obstruction, Foul ground	1001694526	Unknown	N/A	unknown	Unknown	396208.1972	5747772.294
Obstruction, Foul ground	1001694539	Unknown	N/A	unknown	Unknown	396462.7948	5747594.579
Obstruction, Foul ground	1001694552	Unknown	N/A	unknown	Unknown	399010.0544	5746061.054
Obstruction, Foul ground	1001694579	HMS LORD ST VINCENT (PART OF)	Drifter; Sunk: 1941/07/07; Length: 28m; Beam: 6.1m; Draught: 2.4m; Tonnage: 115	live	WWII	391832.9895	5744495.401
Obstruction, Foul ground	1001694592	Unknown	N/A	unknown	Unknown	397513.7553	5744253.799

DESCRIPTION	ID	NAME	INFORMATIO N	STATUS	DATE	X	Y
Obstruction, Foul ground	1001694609	Unknown	N/A	unknown	Unknown	400777.8742	5745343.409
Obstruction, Foul ground	1001694591	Unknown	N/A	unknown	Unknown	404792.1871	5745571.572
Obstruction, Foul ground	1001694675	Unknown	N/A	unknown	Unknown	396743.683	5751475.429
Obstruction, Foul ground	1001694707	Unknown	N/A	unknown	Unknown	394553.4803	5750959.205
Obstruction, Foul ground	1001705686	Unknown	N/A	dead	Unknown	417242.3576	5739317.622
Obstruction, Foul ground	1001705949	Unknown	N/A	dead	Unknown	399619.5538	5749032.346
Obstruction, Foul ground	1001706069	Unknown	Cables/Chains /Mooring/Nets/ Tackle/Wires	dead	Foul	403326.3138	5744820.831
Obstruction, Foul ground	1001706106	Unknown	N/A	dead	Unknown	407113.664	5743757.313
Obstruction, Foul ground	1001706098	Unknown	Cables/Chains /Mooring/Nets/ Tackle/Wires	dead	Foul	399572.662	5744798.128
Obstruction, Foul ground	1001706186	Unknown	Cables/Chains /Mooring/Nets/ Tackle/Wires	dead	Foul	402806.1558	5741977.229

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
Obstruction, Foul ground	1001706189	Unknown	Pile Of Debris	dead	Foul	401315.7853	5741861.659
Obstruction, Foul ground	2003036644	Unknown	N/A	unknown	Unknown	399545.4348	5745503.294
Obstruction, Foul ground	2003036645	Unknown	N/A	unknown	Unknown	399672.2842	5744955.602
Obstruction, Foul ground	2003036648	Unknown	N/A	unknown	Unknown	398282.7644	5743828.36
Obstruction, Foul ground	2003036649	Unknown	N/A	unknown	Unknown	401837.3956	5743737.194
Obstruction, Foul ground	2003036650	Unknown	N/A	unknown	Unknown	401219.0036	5743600.985
Obstruction, Foul ground	2003036651	Unknown	N/A	unknown	Unknown	398396.9547	5743510.82
Obstruction, Foul ground	2003974790	Unknown	Aircraft Remains	live	Aircraft	379766.6156	5743441.026
Wreck, Non-dangerous wreck	1001694786	WILLY	Steam Ship; Sunk: 1911/01/01; Tonnage: 862	live	20th Century	447236.6309	5757516.646
Wreck, Non-dangerous wreck	1001694510	Unknown	N/A	live	Unidentified wreck	439938.5932	5747689.91

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
Wreck, Non-dangerous wreck	1001705704	Unknown	N/A	dead	Unidentified wreck	425292.6359	5738325.73
Wreck, Non-dangerous wreck	1001706085	MARIE SIMONE	Fishing Vessel; Sunk: 1968/10/24	dead	Modern	441778.4997	5762206.477
Wreck, Non-dangerous wreck	1001706100	Unknown	Sunk: 1916/01/01	dead	WWI	411467.8876	5744266.391
Wreck, Non-dangerous wreck	1001706138	Unknown	N/A	dead	Unidentified wreck	410038.9617	5743550.142
Wreck, Non-dangerous wreck	1001706139	HMS HASTFEN	Trawler; Sunk: 1917/09/24; Tonnage: 77	dead	WWI	408006.5322	5743401.558
Wreck, Non-dangerous wreck	1001706143	HMSM E6	Submarine; Sunk: 1915/12/26; Length: 55.2m; Beam: 6.7m; Tonnage: 800	dead	Submarine	405701.1661	5742980.784
Wreck, Non-dangerous wreck	1001706147	Unknown	N/A	dead	Unidentified wreck	411231.007	5742755.75

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
Wreck, Dangerous wreck	1001694472	Unknown	N/A	live	Unidentified wreck	397637.3303	5749348.735
Wreck, Dangerous wreck	1001694500	Unknown	N/A	live	Unidentified wreck	398793.9626	5748893.191
Wreck, Dangerous wreck	1001694528	Unknown	Wooden Vessel	live	Unidentified wreck	398510.5362	5747647.278
Wreck, Dangerous wreck	1001694551	Unknown	N/A	live	Unidentified wreck	399636.6499	5745987.287
Wreck, Dangerous wreck	1001694553	HMS RESONO (POSSIBLY)	Trawler; Sunk: 1915/12/26; Length: 35.7m; Beam: 6.7m; Draught: 3.7m; Tonnage: 230	live	WWI	405904.1915	5745095.944
Wreck, Dangerous wreck	1001694556	BONNINGTON COURT	Motor Vessel; Sunk: 1941/01/19; Length: 123.4m;	live	WWII	400453.1727	5745022.008

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
			Beam: 16.8m; Draught: 7.9m; Tonnage: 4909; Cargo: 537				
Wreck, Dangerous wreck	1001694558	Unknown	Submarine	live	Submarine	405619.7995	5744775.318
Wreck, Dangerous wreck	1001694571	Unknown	N/A	live	Unidentified wreck	398879.7773	5745920.899
Wreck, Dangerous wreck	1001694573	MARIE LEONHARDT (PROBABLY)	Steam Ship; Sunk: 1917/02/14; Length: 76.5m; Beam: 11.3m; Draught: 4.9m; Tonnage: 1466; Cargo: 5	live	WWI	405077.4071	5744624.232
Wreck, Dangerous wreck	1001694576	Unknown	N/A	live	Unidentified wreck	389637.2547	5744728.644

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
Wreck, Dangerous wreck	1001694586	VANCOUVER	Tanker; Sunk: 1941/09/21; Length: 125m; Beam: 16.5m; Draught: 9.1m; Tonnage: 5729; Cargo: 1	live	WWII	399158.6584	5745970.913
Wreck, Dangerous wreck	1001694593	TERUKUNI MARU	Liner; Sunk: 1939/11/21; Length: 154.5m; Beam: 19.5m; Draught: 11.3m; Tonnage: 11930; Cargo: 517	live	WWII	398210.6898	5744228.12
Wreck, Dangerous wreck	1001694594	SECOND CHANCE (POSSIBLY)	Cabin Cruiser; Sunk: 1977/09/30; Length: 11m	live	Modern	400505.0777	5744152.817
Wreck, Dangerous wreck	1001695927	PALEMBANG (PROBABLY)	Steam Ship; Sunk: 1916/03/18;	live	WWI	429836.6819	5743050.873

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
			Length: 131.7m; Beam: 16.5m; Draught: 10.4m; Tonnage: 6674				
Wreck, Dangerous wreck	1001695928	MAC 5 (POSSIBLY)	Military Vessel; Sunk: 1940/12/26	live	WWII	391109.0163	5743739.639
Wreck, Dangerous wreck	1001694614	NORHAUK	Steam Ship; Sunk: 1943/12/21; Length: 122.2m; Beam: 16.2m; Draught: 9.8m; Tonnage: 6086; Cargo: 506,507	live	WWII	400134.1094	5744097.139
Wreck, Dangerous wreck	1001694615	DYNAMO	Steam Ship; Sunk: 1943/04/17; Tonnage: 809; Cargo: 517	live	WWII	401439.1705	5743756.493

DESCRIPTION	ID	NAME	INFORMATIO N	STATUS	DATE	X	Y
Wreck, Dangerous wreck	1001696077	Unknown	Trawler	live	Unidentified wreck	418807.8431	5736384.962
Wreck, Dangerous wreck	1001696090	SIMON BOLIVAR	Liner; Sunk: 1939/11/18; Length: 128m; Beam: 18m; Draught: 8.5m; Tonnage: 8309	live	WWII	404012.2505	5741893.217
Wreck, Dangerous wreck	1001694754	KONINGEN EMMA (PART OF)(PROBAB LY)	Steam Ship; Sunk: 1915/09/22; Length: 143.3m; Beam: 17.4m; Draught: 10.7m; Tonnage: 9181	live	WWI	398255.5369	5750634.153
Wreck, Dangerous wreck	1001694779	PROTINUS (POSSIBLY)	Trawler; Sunk: 1940/03/18; Tonnage: 202	live	WWII	398251.7718	5750448.799

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
Wreck, Dangerous wreck	1001694780	KONINGEN EMMA (POSSIBLY)	Steam Ship; Sunk: 1915/09/22; Length: 143.3m; Beam: 17.4m; Draught: 10.7m; Tonnage: 9181	live	WWI	398785.4304	5750345.273
Wreck, Dangerous wreck	1001695957	WEARSIDE	Steam Ship; Sunk: 1917/10/25; Length: 103m; Beam: 15.5m; Draught: 7.3m; Tonnage: 3560; Cargo: 5	live	WWI	398680.4125	5743564.428
Wreck, Dangerous wreck	1001695988	INGI	Carrier; Sunk: 1972/09/14; Cargo: BUILDING BLOCKS	live	Modern	412931.471	5739850.257

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
Wreck, Dangerous wreck	1001696006	MORAR	Steam Ship; Sunk: 1943/11/27; Length: 73.2m; Beam: 11.3m; Draught: 5.5m; Tonnage: 1507; Cargo: 21	live	WWII	400697.2351	5743182.577
Wreck, Dangerous wreck	1001694842	CORCREST	Steam Ship; Sunk: 1949/06/24; Length: 86.9m; Beam: 12.8m; Draught: 5.8m; Tonnage: 2373; Cargo: 537	live	Modern	399761.3775	5749754.53
Wreck, Dangerous wreck	1001694843	FORT MASSAC	Steam Ship; Sunk: 1946/02/01; Length: 129.2m;	live	Modern	399761.2657	5749737.473

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
			Beam: 17.4m; Draught: 10.7m; Tonnage: 7157; Cargo: 517				
Wreck, Dangerous wreck	1001694844	EMPIRE BRIDGE	Steam Ship; Sunk: 1946/04/09; Length: 54.9m; Tonnage: 348	live	Modern	399711.6897	5749736.982
Wreck, Dangerous wreck	1001705685	HMS SCOTCH THISTLE	Drifter; Sunk: 1940/10/07; Tonnage: 84	dead	WWII	384914.7978	5739951.968
Wreck, Dangerous wreck	1001705687	Unknown	N/A	dead	Unidentified wreck	421569.1444	5739092.516
Wreck, Dangerous wreck	1001696123	NICO	Steam Ship; Sunk: 1915/12/18; Length: 56.1m; Beam: 9.1m; Draught: 4.3m;	live	WWI	413955.934	5741410.449

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
			Tonnage: 712; Cargo: 11				
Wreck, Dangerous wreck	1001696148	HMML 127 (POSSIBLY)	Launch; Sunk: 1940/11/22; Length: 34.1m; Beam: 5.5m; Draught: 1.2m; Tonnage: 65	live	WWII	389344.3378	5741860.791
Wreck, Dangerous wreck	1001696155	JANNY	Motor Vessel; Sunk: 1967/01/26; Length: 45.1m; Beam: 6.7m; Draught: 2.4m; Tonnage: 248	live	Modern	413706.0054	5738431.498
Wreck, Dangerous wreck	1001706024	Unknown	N/A	dead	Unidentified wreck	399162.772	5746289.766
Wreck, Dangerous wreck	1001706028	Unknown	N/A	dead	Unidentified wreck	404909.9821	5745485.899

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
Wreck, Dangerous wreck	1001706146	Unknown	N/A	dead	Unidentified wreck	430274.5001	5742486.735
Wreck, Dangerous wreck	1001706182	Unknown	N/A	dead	Unidentified wreck	409707.3727	5742165.486
Wreck, Dangerous wreck	1001706184	Unknown	N/A	dead	Unidentified wreck	429996.5677	5741749.022
Wreck, Dangerous wreck	1001706185	PAULLETTE	Fishing Vessel; Sunk: 1950/05/19	dead	Modern	412231.0839	5741935.337
Wreck, Dangerous wreck	1001706203	Unknown	N/A	dead	Unidentified wreck	440463.6422	5758056.227
Wreck, Dangerous wreck	2003975452	Unknown	Aircraft Remains	live	Aircraft	384193.3906	5741916.082
Obstruction, Undefined	302115843	Unknown	N/A	live	Unidentified wreck	399456.2956	5748216.028
Obstruction, Undefined	1001694630	Unknown	N/A	live	Unidentified wreck	437719.9338	5756302.481
Obstruction, Undefined	1001696032	Unknown	N/A	dead	Unidentified wreck	399077.4548	5743016.839

DESCRIPTION	ID	NAME	INFORMATIO N	STATUS	DATE	X	Y
Obstruction, Foul ground	302113897	Unknown	N/A	live	Unidentified wreck	399284.2535	5743073.877
Obstruction, Undefined	1001705665	Unknown	Non-sub contact	dead	Unidentified wreck	414061.0115	5741440.17
Obstruction, Undefined	1001706105	Unknown	Non-sub contact	dead	Unknown	402234.2136	5743881.497
Wreck, Dangerous wreck	1001705696	Unknown	605	dead	Unidentified wreck	410605.9538	5738875.021
Wreck, Dangerous wreck	1001706026	Unknown	N/A	dead	Unidentified wreck	406936.7651	5745614.77
Wreck, Dangerous wreck	1001706065	MARIE LEONHARDT (POSSIBLY)	501; Sunk: 1917/02/14; Length: 76.5m; Beam: 11.3m; Draught: 4.9m; Tonnage: 1466; Cargo: 5	dead	WWI	406318.6386	5745286.958
Wreck, Dangerous wreck	1001706068	MICHAIL ONTCHOUKO FF	501; Sunk: 1916/12/17; Length:	dead	WWI	405392.7305	5744901.97

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
			89.9m; Beam: 12.8m; Draught: 6.1m; Tonnage: 2118; Cargo: 514				
Wreck, Dangerous wreck	1001706104	HMS LORD ST VINCENT (PART OF)	521; Sunk: 1941/07/07; Tonnage: 115	dead	WWII	392133.5649	5744210.778
Wreck, Non-dangerous wreck	1001705688	HAYTOR	501; Sunk: 1940/07/26; Tonnage: 1189	dead	WWII	417466.6075	5738972.789
Wreck, Non-dangerous wreck	1001705703	HMS FLEMING	522; Sunk: 1940/07/24; Tonnage: 356	dead	WWII	417690.4035	5738598.309
Wreck, Non-dangerous wreck	1001705707	SELMA	501; Sunk: 1915/10/25; Length: 82.3m; Beam: 11.9m; Draught: 5.5m; Tonnage: 1654	dead	WWI	424007.5219	5738191.105

DESCRIPTION	ID	NAME	INFORMATION	STATUS	DATE	X	Y
Wreck, Dangerous wreck	302113672	Unknown	N/A	live	Unknown	412331.6317	5742232.094
Wreck, Dangerous wreck	302115842	Unknown	N/A	live	Unknown	397381.916	5748699.389
Wreck, Dangerous wreck	302112098	Unknown	N/A	live	Unknown	393729.8745	5749068.483
Wreck, Dangerous wreck	302112099	Unknown	N/A	live	Unknown	395148.4485	5749624.571
Wreck, Distributed remains of wreck	302112097	Unknown	N/A	live	Unknown	395349.1167	5750167.404
Obstruction, Foul ground	301379162	Unknown	N/A	live	Foul	399284.2512	5743073.877
Obstruction, Undefined	301621285	Unknown	N/A	live	Unknown	399456.2933	5748216.028
Obstruction, Undefined	302333118	Unknown	N/A	live	Unknown	401343.9004	5741888.924

PHONE	0333 880 5306
EMAIL	fiveestuaries@rwe.com
WEBSITE	www.fiveestuaries.co.uk
ADDRESS	Five Estuaries Offshore Wind Farm Ltd Windmill Hill Business Park Whitehill Way, Swindon, SN5 6PB
COMPANY NO	Registered in England and Wales company number 12292474