FIVE ESTUARIES
OFFSHORE WIND FARM

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ENVIRONMENTAL STATEMENT

VOLUME 6, PART 2, CHAPTER 9: SHIPPING AND NAVIGATION

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DEFINITION OF ACRONYMS

Term	Definition
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
CAA	Civil Aviation Authority
CBRA	Cable Burial Risk Assessment
CD	Chart Datum
CEA	Cumulative Effects Assessment
COLREGs	Convention on the International Regulations for Preventing Collisions at Sea
CSIP	Cable Specification and Installation Plan
CTV	Crew Transfer Vessel
DECC	Department of Energy and Climate Change
DESNZ	Department for Energy Security & Net Zero
DfT	Department for Transport
DW	Deep Water
DWT	Dead Weight Tonnage
ECC	Export Cable Corridor
ECR	Export Cable Route
EEA	European Economic Area
EIA	Environmental Impact Assessment
ERCoP	Emergency Response Cooperation Plan
ES	Environmental Statement
GLA	General Lighthouse Authority
GT	Gross Tonnage
HHA	Harwich Haven Authority
HM	Her Majesty's Government (2011)
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IMO	International Maritime Organization
LOA	Length Overall
m	Metre
MAIB	Marine Accident Investigation Branch

Term	Definition
MCA	Maritime and Coastguard Agency
MDS	Maximum Design Scenario
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MPCP	Marine Pollution Contingency Plan
MRCC	Maritime Rescue Coordination Centre
NIP	Navigation Installation Plan
nm	Nautical mile
nm^2	Square nautical mile
NPS	National Policy Statement
NRA	Navigational Risk Assessment
NUC	Not Under Command
O&M	Operations and Maintenance
OREI	Offshore Renewable Energy Installation
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm
PEIR	Preliminary Environmental Information Report
PIANC	World Association for Waterborne Transport Infrastructure
PLL	Potential Loss of Life
Radar	Radio Detection and Ranging
RAM	Restricted in her Ability to Manoeuvre
RNLI	Royal National Lifeboat Institution
Ro-Pax	Roll-on/ Roll-off Passenger
Ro-Ro	Roll-on/ Roll-off (Cargo)
RORC	Royal Ocean Racing Club
RYA	Royal Yachting Association
SAR	Search and Rescue
SLoO	Single Line of Orientation
SOLAS	International Convention for the Safety of Life at Sea
TSS	Traffic Separation Scheme
UK	United Kingdom

Term	Definition
UKHO	United Kingdom Hydrographic Office
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
VE	Five Estuaries Offshore Wind Farm
VE OWFL	Five Estuaries Offshore Wind Farm Limited
VHF	Very High Frequency
VTS	Vessel Traffic Service
WTG	Wind Turbine Generator

GLOSSARY OF TERMS

Term	Definition
Allision	The act of striking or collision of a moving vessel against a stationary object.
Automatic Identification System (AIS)	A system by which vessels automatically broadcast their identity, key statistics including location, destination, length, speed and current status, e.g., under power. Most commercial vessels and European Union (EU) fishing vessels over 15 m length are required to carry an AIS transceiver.
Cable Burial Risk Assessment (CBRA)	Risk assessment to determine suitable burial depths for cables, based upon hazards such as anchor strike, fishing gear interaction and seabed mobility. The CBRA is provided in Volume 9, Report 9: Outline Cable Burial Risk Assessment.
Collision	The act or process of colliding (crashing) between two moving objects.
Design envelope	A description of the range of possible elements that make up the Five Estuaries Offshore Wind Farm (VE) design options under consideration, as set out in detail in Volume 6, Part 2, Chapter 1: Offshore Project Description. This envelope is used to define VE for Environmental Impact Assessment purposes when the exact engineering parameters are not yet known. This is also often referred to as the "Rochdale Envelope" approach.
Environmental Statement (ES)	A document reporting the findings of the Environmental Impact Assessment (EIA) and produced in accordance with the EIA Directive as transposed into United Kingdom (UK) law by the EIA Regulations.
Formal Safety Assessment (FSA)	A structured and systematic process for assessing the risks and costs (if applicable) associated with shipping activity.
Future case	The assessment of risk based on the predicted growth in future shipping densities and traffic types as well as foreseeable changes in the marine environment.
Impact	A potential threat to human life, health, property, or the environment.
International Maritime Organization (IMO) routeing	Predetermined shipping routes established by the IMO.

Term	Definition
Main commercial route	Defined transit route (mean position) of commercial vessels identified within the specified shipping and navigation study area.
Marine Guidance Note (MGN)	A system of guidance notes issued by the Maritime and Coastguard Agency (MCA) which provide significant advice relating to the improvement of the safety of shipping at sea, and to prevent or minimise pollution from shipping.
Maximum Design Scenario (MDS)	The combination of realistic parameters for Five Estuaries Offshore Wind Farm (VE) anticipated to produce the worst-case consequences.
Mitigation	Mitigation measures, or commitments, are commitments made by the project to reduce and/or eliminate the potential for significant effects to arise as a result of the project.
Navigational Risk Assessment (NRA)	A document which assesses the overall impact to shipping and navigation of a proposed Offshore Renewable Energy Installation (OREI) based upon Formal Risk Assessment (FSA).
Offshore Renewable Energy Installation (OREI)	As defined by Marine Guidance Note (MGN) 654 (Merchant and Fishing) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response (Maritime and Coastguard Agency (MCA), 2021). For the purposes of this report and in keeping with the consistency of the Environmental Impact Assessment, OREI can mean offshore wind turbines and the associated electrical infrastructure such as offshore substations.
Radio Detection and Ranging (Radar)	An object-detection system which uses radio waves to determine the range, altitude, direction or speed of objects.
Receptor	The sufferer of a risk arising from a hazard.
Regular Operator	Commercial operator whose vessel(s) are observed to transit through a particular region on a regular basis.
Significance of effect	The combination of frequency of occurrence and severity of consequence of an impact.
Traffic Separation Scheme (TSS)	A traffic management route system ruled by the International Maritime Organization (IMO). The traffic lanes (or clearways) indicate the general direction of the vessels in that zone; vessels navigating within a

Term	Definition
	TSS all sail in the same direction or they cross the lane at an angle as close to 90 degrees (°) as possible.
Unique vessel	An individual vessel identified on any particular calendar day, irrespective of how many tracks were recorded for that vessel on that day. This prevents vessels being over counted. Individual vessels are identified using their Maritime Mobile Service Identity (MMSI).
Vessel Traffic Service (VTS)	A service implemented by a Competent Authority designed to improve the safety and efficiency of vessel traffic and to protect the environment. The service should have the capability to interact with the traffic and to respond to traffic situations developing in the VTS area.

9 SHIPPING AND NAVIGATION

9.1 INTRODUCTION

9.1.1 This chapter of the Environmental Statement (ES) presents the results of the assessment of the likely significant effects of the Five Estuaries Offshore Wind Farm (hereafter referred to as VE) with respect to shipping and navigation during the construction, Operations and Maintenance (O&M), and decommissioning phases.

9.1.2 This chapter has been informed by and should be read in conjunction with the following ES chapters:

- Volume 6, Part 2, Chapter 1: Offshore Project Description;
- Volume 6, Part 2, Chapter 8: Commercial Fisheries;
- Volume 6, Part 2, Chapter 12: Infrastructure Other Marine Users; and
- Volume 6, Part 2, Chapter 13: Military and Civil Aviation.

9.1.3 Additionally, Volume 9, Report 10: Navigational Risk Assessment has informed this chapter and should be read in conjunction with this chapter.

9.2 STATUTORY AND POLICY CONTEXT

9.2.1 Table 9.1 outlines the legislation and policy relevant to the assessment of effects for shipping and navigation receptors, noting that in exact terms the United Nations Convention on the Law of the Sea (UNCLOS), Convention on the International Regulations for Preventing Collisions at Sea (COLREGs), and International Convention for the Safety of Life at Sea (SOLAS) are frameworks for legislation (incorporated into United Kingdom (UK) law through the likes of the Energy Act 2004 and the Merchant Shipping Act 1995).

Table 9.1: Legislation and policy context.

Legislation/ policy	Key provisions	Section where comment addressed
UNCLOS (United Nations (UN), 1982)	Article 60(7) states that structures and associated safety zones should not be established if interference is caused to sea lanes essential to international navigation.	International sea lanes and other identified routes are considered a key element of the existing environment for shipping and navigation and the potential for "interference" has been assessed directly as part of impacts relating to vessel displacement and port access (see Section 9.11).
COLREGs (International Maritime Organization (IMO), 1972/77)	Rule 8(a) advises that any collision avoidance should be taken in accordance with the COLREGs.	Rule 8 of the COLREGs is considered in the impact assessment of collision risk (see Section 9.11).
COLREGs (IMO, 1972/77)	Rule 9 advises navigation within a narrow channel or fairway including vessel priority.	Rule 9 of the COLREGs is considered as part of the safety case for the navigation corridor between VE and the East Anglia Two Offshore Wind Farm (OWF) (see Section 17 of Volume 9, Report 10: Navigational Risk Assessment).
COLREGs (IMO, 1972/77)	Rule 18(a)(ii) advises that powered vessels should keep out of the way of a vessel which is Restricted in her Ability to Manoeuvre (RAM).	Rule 18 of the COLREGs is considered in the impact assessment of third-party vessel to project vessel collision risk (see Section 9.11).
COLREGs (IMO, 1972/77)	Rule 19(b) advises that vessels should proceed at safe speeds based on the conditions including in restricted visibility.	Rule 19 of the COLREGs is considered in the impact assessment of collision risk and allision risk (see Section 9.11).
SOLAS (IMO, 1974)	Regulation 33 states that where able to do so, a vessel should assist persons in distress at sea.	Regulation 33 of SOLAS is considered in the impact assessment of emergency response capability (see Section 9.11).
SOLAS (IMO, 1974)	Regulation 34 states that passage planning should be	Regulation 34 of SOLAS is considered in the impact

Legislation/ policy	Key provisions	Section where comment addressed
	undertaken using the appropriate nautical charts and publications prior to the voyage.	assessment of (see Section 9.11).
National Policy Statement (NPS) for Renewable Energy Infrastructure (EN-3) (Department for Energy Security & Net Zero (DESNZ), 2023)	Paragraph 2.8.179 advises that to ensure safety of shipping applicants should reduce risks to navigational safety to as low as reasonably practicable (ALARP).	ALARP principles have been applied to the environmental assessment methodology in line with the Formal Safety Assessment (FSA) process prescribed in MGN 654 (see Section 9.4).
NPS for Renewable Energy Infrastructure (EN-3) (DESNZ, 2023)	Paragraph 2.8.184 advises that applicants should engage with interested parties in the navigation sector early in the pre-application phase of the proposed offshore wind farm or offshore transmission to help identify mitigation measures to reduce navigational risk to ALARP, to facilitate proposed offshore wind development. This includes the Marine Management Organisation (MMO) or Natural Resources Wales (NRW) in Wales, MCA, the relevant General Lighthouse Authority (GLA), such as Trinity House, the relevant industry bodies (both national and local) and any representatives of recreational users of the sea, such as the Royal Yachting Association (RYA), who may be affected. This should continue throughout the life of the development including during the construction, operation and decommissioning phases.	Consultation with relevant stakeholders has been a key input to the environmental assessment and includes engagement with the MMO, MCA, Trinity House, UK Chamber of Shipping, RYA, Cruising Association, Sunk Vessel Traffic Services (VTS), HHA, PLA, London Gateway, Port of Felixstowe, Brightlingsea Harbour Commissioners, Stena Line, DFDS Seaways, CLdN, and Hanson Aggregate Marine.
NPS for Renewable Energy Infrastructure (EN-3) (DESNZ, 2023)	Paragraph 2.8.186 advises that the presence of the wind turbines can also have impacts on communication and shipborne and shore-based Radar systems.	Impacts relating to navigation, communication, and position fixing equipment have been considered (see Section 13 of Volume 9, Report 10:

Legislation/ policy	Key provisions	Section where comment addressed
		Navigational Risk Assessment).
NPS for Renewable Energy Infrastructure (EN-3) (DESNZ, 2023)	Paragraph 2.8.187 advises that prior to undertaking assessments applicants should consider information on internationally recognised sea lanes, which is publicly available.	IMO routeing measures in proximity to VE have been considered when characterising the existing environment (see Section 9.7).
NPS for Renewable Energy Infrastructure (EN-3) (DESNZ, 2023)	Paragraph 28.189 advises that applicants must undertake an NRA in accordance with relevant government guidance prepared in consultation with the MCA and the other navigation stakeholders listed above [Paragraph 2.8.174].	An NRA has been undertaken in line with MGN 654 and has been informed by consultation with shipping and navigation stakeholders (see Volume 9, Report 10: Navigational Risk Assessment).
NPS for Renewable Energy Infrastructure (EN-3) (DESNZ, 2023)	Paragraph 2.8.190 advises that the NRA will for example necessitate: > A survey of vessel traffic in the vicinity of the proposed wind farm; > A full NRA of the likely impact of the wind farm on navigation in the immediate area of the wind farm in accordance with the relevant guidance; and > Cumulative and in-combination risks associated with the development and other developments (including other wind farms) in the same area of sea.	Vessel traffic surveys have been undertaken for the array areas. An NRA has been undertaken in line with MGN 654 (see Volume 9, Report 10: Navigational Risk Assessment). A full CEA has been undertaken with consideration of other developments including offshore wind farms (see Sections 9.10 and 9.11).
NPS for Renewable Energy Infrastructure (EN-3) (DESNZ, 2023)	Paragraph 2.8.195 advises that applicants should undertake a detailed NRA, which includes Search and Rescue (SAR) Response Assessment and emergency response assessment prior to applying for consent. The specific SAR	An impact relating to the reduction of emergency response capability (including SAR access) has been scoped into the impact assessment and acknowledges the need to

Legislation/ policy	Key provisions	Section where comment addressed
	requirements will then be discussed and agreed post-consent.	complete a SAR Checklist (see Section 9.11).
NPS for Renewable Energy Infrastructure (EN-3) (DESNZ, 2023)	Paragraph 2.8.259 advises that mitigation measures will include site configuration, lighting and marking of projects to take account of any requirements of the GLA.	Lighting and marking is included as a mitigation (see Section 9.9) and the final array layout will be agreed in consultation with MCA and Trinity House post consent.
NPS for Ports (Department for Transport (DfT), 2012)	Paragraph 5.14.2 advises that where likely to occur, socio-economic impacts should be incorporated.	Commercial risks due to reduced access to local ports and harbours and reduction in under keel clearance is considered in Section 9.11 and socioeconomic impacts are assessed in Volume 6, Part 3, Chapter 3: Socioeconomics, Tourism and Recreation.
NPS for Ports (DfT, 2012)	Paragraph 5.14.4 advises that the existing socioeconomic conditions be described and the impact correlated with local planning policies.	
NPS for Ports (DfT, 2012)	Paragraph 5.14.5 advises that socio-economic impacts may be linked to other impacts.	
UK Marine Policy Statement (Her Majesty's Government (HM Government), 2011)	Paragraph 3.4.7 advises that decision makers account for and seek to minimise any negative impacts on navigational safety and freedom of navigation.	Navigational safety impacts have been assessed including vessel displacement (see Section 9.11).
East Marine Plans ((Department for Environment, Food and Rural Affairs (DEFRA), 2014)	Policy PS1: Proposals that require static sea surface infrastructure or that significantly reduce under-keel clearance should not be authorised in International Maritime Organization designated routes.	Reduction in under keel clearance is considered in Section 9.11.
East Marine Plans ((Department for Environment, Food and Rural Affairs (DEFRA), 2014)	Policy PS2: Proposals that require static sea surface infrastructure that encroaches upon important navigation routes should not be authorised unless there are exceptional circumstances. Proposals should:	Navigational safety impacts have been assessed including vessel displacement (see Section 9.11).

Legislation/ policy	Key provisions	Section where comment addressed
	a) be compatible with the need to maintain space for safe navigation, avoiding adverse economic impact. b) anticipate and provide for future safe navigational requirements where evidence and/or stakeholder input allows and c) account for impacts upon navigation in-combination with other existing and proposed activities.	
East Marine Plans ((Department for Environment, Food and Rural Affairs (DEFRA), 2014)	Policy PS3: Proposals should demonstrate, in order of preference: a) that they will not interfere with current activity and future opportunity for expansion of ports and harbours. b) how, if the proposal may interfere with current activity and future opportunities for expansion, they will minimise this. c) how, if the interference cannot be minimised, it will be mitigated d) the case for proceeding if it is not possible to minimise or mitigate the interference.	Commercial risks due to reduced access to local ports and harbours is considered in Section 9.11 and socioeconomic impacts are assessed in Volume 6, Part 3, Chapter 3: Socioeconomics, Tourism and Recreation.

9.2.2 Although the overarching guidance principles set out in the Overarching NPS for Energy (EN-1) (DESNZ, 2023) does not specifically refer to shipping and navigation, it has been considered.

9.3 CONSULTATION

9.3.1 The full list of stakeholders consulted during the Environmental Impact Assessment (EIA) process is provided in Volume 9, Report 10: Navigational Risk Assessment. A summary of the key issues raised during consultation is provided in Table 9.2, noting that consultation with key stakeholders has been ongoing since November 2019.

Table 9.2: Summary of consultation relating to shipping and navigation.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
18 January 2021 Pre scoping meeting with MCA and Trinity House	Agree with the proposed array traffic and routeing study areas.	Addressed in Section 3.4 of Volume 9, Report 10: Navigational Risk Assessment.
	Agreed with the winter vessel traffic survey being undertaken between late November 2021 and late February 2022 and the summer vessel traffic survey in July or August 2022.	MCA and Trinity House agreement on the approach to the vessel traffic surveys is acknowledged in Section 5.2 of Volume 9, Report 10: Navigational Risk Assessment.
30 March 2021 Pre scoping meeting with MCA and Trinity House	The alignment of the offshore Export Cable Corridor (ECC) through the south of the Sunk Traffic Separation Scheme (TSS) East appears feasible from a traffic management perspective, so long as cable installation does not coincide with the installation of NeuConnect.	Acknowledged in the environmental assessment in Section 9.11.
	Aids to navigation will need to be managed given the offshore ECC. There may be opportunities to lift and replace aids to navigation during installation works but the preference would be to retain locations if possible.	Acknowledged in the environmental assessment in Section 9.11.
27 April 2021 Pre scoping meeting with HHA	There are concerns with development close to the Harwich Deep Water Channel based on the current water depth with the southern tip of the channel also a concern due to the types of activities undertaken by vessels (i.e., pilot boarding).	Acknowledged in the environmental assessment in Section 9.11, with the offshore ECC refined – based on consultation feedback – to pass as far south of the Harwich Deep Water Channel as possible and utilise the greatest water depths possible.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	All large vessels operating in/ out of Harwich Haven travel along the Sunk Deep Water Route and smaller vessels have the option to transit to the north.	Acknowledged in the environmental assessment in Section 9.11.
	Pilot vessels operate out of Harwich Haven for boarding and disembarking regardless of which port the arriving or departing vessel is headed to/ from.	Acknowledged in Section 10.2 of Volume 9, Report 10: Navigational Risk Assessment and acknowledged in the environmental assessment in Section 9.11.
21 May 2021 Pre scoping meeting with Tarmac Marine	There are no current plans to start exploiting the Longsand A509/1 marine aggregate area due to deep water vessel activity from the deep water routes in the area. Therefore, there are no concerns with the offshore ECC and even if there is a decision to exploit the area in the future the offshore ECC should not pose any concerns.	Acknowledged in the review of the existing environment in Section 9.7.
12 November 2021 Scoping Opinion response from UK Chamber of Shipping	The array routeing study area is welcomed but there is a preference for this to extend further west to full incorporate the Sunk TSS North and Sunk TSS South.	A change to incorporate the UK Chamber of Shipping's preference is acknowledged in Section 3.4 of Volume 9, Report 10: Navigational Risk Assessment.
	There is strong value in examination of a full 20 years of Marine Accident Investigation Branch (MAIB) incident data.	A review of earlier MAIB incident data has been undertaken in Section 9.6 of Section 3.4 of Volume 9, Report 10: Navigational Risk Assessment.
	Two charted anchorages exist at Sunk Inner and Sunk Deep Water (DW) and general anchoring activity in the region should be	Anchoring activity associated with these designated anchorage areas has been identified in the vessel traffic data in

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	considered in the vessel traffic data.	Section 9.7 and is acknowledged in the environmental assessment in Section 9.11.
12 November 2021 Scoping Opinion response from Planning Inspectorate	The full rationale behind the choice of study areas should be provided and agreement with the MCA and Trinity House should be evidenced.	The choice of study areas is justified and acknowledgement given to agreement with MCA and Trinity House in Section 3.4 of Volume 9, Report 10: Navigational Risk Assessment.
12 November 2021 Scoping Opinion response from MCA	The region carries a significant volume of through traffic to major ports and attention needs to be paid to routeing, particularly in heavy weather. It should be ensured that shipping can continue to make safe passage without large-scale deviations.	Vessel displacement including in adverse weather conditions is assessed in the environmental assessment in Section 9.11.
	Cumulative risks for routes should be considered including the impact on nearby IMO routeing measures and the Sunk VTS.	Vessel displacement including in relation to approaching nearby IMO routeing measures is assessed in the environmental assessment in Section 9.11.
	An appropriate assessment of the distances between wind farm boundaries and routes should be included as per Marine Guidance Note (MGN) 654.	Consideration of post wind farm routeing including application of the Shipping Route Template from MGN 654 is given in Section 15.6 of Volume 9, Report 10: Navigational Risk Assessment.
	The additional analysis of vessel traffic within the array routeing study area is welcomed.	Acknowledged in Section 3.4 of Volume 9, Report 10: Navigational Risk Assessment.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	The NRA should be accompanied by a detailed MGN 654 Checklist.	The completed MGN 654 Checklist is provided in Appendix A of Volume 9, Report 10: Navigational Risk Assessment.
	If cable protection measures are required, the MCA would be willing to accept a 5% reduction in surrounding depths referenced to Chart Datum (CD).	Compliance with MGN 654 including in relation to reduction in under keel clearance is included as mitigation in Section 9.9 and this requirement is considered in the environmental assessment in Section 9.11.
	Particular consideration will need to be given to the implications due to the presence of VE on Search and Rescue (SAR) resources and Emergency Response Cooperation Plans (ERCoP). A SAR Checklist will also need to be completed in consultation with the MCA.	An assessment of the impact on emergency response capability is undertaken in the environmental assessment in Section 9.11 and compliance with MGN 654 including in relation to reduction in under keel clearance is included as mitigation in Section 9.9.
30 November 2021 Scoping response from Trinity House	VE will need to be marked with marine aids to navigation in accordance with the general principles outlined in International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation O-139.	Lighting and marking as required by Trinity House, MCA and Civil Aviation Authority (CAA) is included as mitigation in Section 9.9 and use of IALA Recommendation O-139 (IALA, 2021) and G1162 (IALA, 2021) are acknowledged in Section 2.3 of Volume 9, Report 10: Navigational Risk Assessment.
	Additional aids to navigation such as buoys may be necessary to mitigate the risk posed, particularly during the construction	Acknowledged in the environmental assessment in Section 9.11 and lighting and marking as required by Trinity House, MCA, and

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	phase. All marine navigational marking will need to be addressed and agreed with Trinity House.	CAA is included as mitigation in Section 9.9.
	An assessment of how traffic patterns created by VE will interact with the North Hinder Junction and North Hinder TSS is expected. Major routes must abide by the COLREGs when joining or leaving these schemes.	Vessel displacement including in relation to approaching nearby IMO routeing measures is considered in the environmental assessment in Section 9.11.
	Trinity House have no plans to relocate existing aids to navigation although should any changes be required this should be explored.	Acknowledged in the environmental assessment in Section 9.11.
	The northern array area interacts with a major route between Harwich Haven/ Port of Felixstowe and the Port of Rotterdam. Traffic routeing changes should be assessed including alignment with the North Hinder Junction.	Vessel displacement including in relation to approaching nearby IMO routeing measures is considered in the environmental assessment in Section 9.11.
7 April 2022 Post scoping consultation meeting with UK Chamber of Shipping and DFDS Seaways	Bulk, cargo and tankers should be contacted in addition to commercial ferry operators.	Regular Operator consultation has included consideration of all commercial vessel types based on the vessel traffic data and is summarised in Section 4.1 and Appendix C of Volume 9, Report 10: Navigational Risk Assessment.
	Adverse weather routeing represents a very small proportion of all routeing in the region.	Acknowledged in the environmental assessment in Section 9.11.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
8 April 2022 Post scoping consultation meeting with MCA and Trinity House	The refinement of the array areas [since the Scoping stage] reduces the probability of encounters given the lesser amalgamation of hotspots of vessel traffic. The refinement also allows vessels to maintain existing courses thus provisionally addressing concerns relating to approaches to the North Hinder Junction.	Acknowledged in the environmental assessment in Section 9.11.
16 June 2022 Post scoping consultation meeting with CLdN	The key concern is the potential for deviation of routes and additional mileage.	Acknowledged in the environmental assessment in Section 9.11.
	The presence of project vessels is not a notable concern and vessels can comfortably and safely operate around such activity.	Acknowledged in the environmental assessment in Section 9.11.
	Routeing differences observed in the vessel traffic data (including adverse weather transits) are likely due to Master preference, although the benefits of such routeing may be limited.	Acknowledged in the environmental assessment in Section 9.11.
1 September 2022 Regular Operator consultation response from Tarmac Marine	Preference to be informed via Notification to Mariners when cable installation works commence.	Promulgation of information via Notifications to Mariners is included as mitigation in Section 9.9 and the preference is acknowledged in the environmental assessment in Section 9.11.
7 September 2022	A new marine aggregate dredging area is being developed to the west of the array areas which may lead	The East Orford Ness 1809 marine aggregate area has been considered in the Cumulative Effects

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
Regular Operator consultation response from Hanson Aggregates Marine	to additional cumulative impacts.	Assessment (CEA) screening in Section 9.10.
	Hanson Aggregates Marine operated vessels would provisionally not make passage internally within the operational arrays.	Acknowledged in the environmental assessment in Section 9.11.
8 September 2022 Regular Operator consultation response from Stena Line	The presence of VE will impact routeing including increases in passage length. Decreasing sea room (including cumulatively) reduces opportunity for potential changes in course due to other traffic or weather.	Acknowledged in the environmental assessment in Section 9.11.
	Stena Line operated vessels will never transit through the operational arrays although will continue to pass in close proximity.	Acknowledged in the environmental assessment in Section 9.11.
15 September 2022 Regular Operator consultation response from Intrada Ship Management (Scotline)	The presence of VE will remove navigable waters resulting in potential for deviations to existing passages.	Acknowledged in the environmental assessment in Section 9.11.
	The region is already busy in terms of vessel traffic and there is potential for a bottleneck to cause increases in encounters.	Acknowledged in the environmental assessment in Section 9.11.
16 September 2022 Regular Operator consultation response from A2B-online	A2B-online operated vessels would not pass through the operational arrays.	Acknowledged in the environmental assessment in Section 9.11.
16 September 2022 Regular Operator consultation response from Mediterranean Shipping Company (MSC)	Suggest that Sunk TSS East should be extended and the arrays marked with cardinal buoys.	Acknowledged in the environmental assessment in Section 9.11.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
20 October 2022 Hazard Workshop feedback from MCA	The MCA is not proposing to pursue an extension to the Sunk TSS East on the basis of VE.	Acknowledged in the environmental assessment in Section 9.11.
	It is important to consider deviations and 'squeeze' from the presence of East Anglia Two including use of the World Association for Waterborne Transport Infrastructure (PIANC) guidance.	Acknowledged in the safety case for the navigation corridor between VE and East Anglia Two in Section 17.11 of Volume 9, Report 10: Navigational Risk Assessment.
20 October 2022 Hazard Workshop feedback from UK Chamber of Shipping	Application of additional rules for entry and exit to/ from the array areas should be considered and has been applied elsewhere.	Marine coordination for project vessels is included as mitigation in Section 9.9 and includes the use of entry/ exit points to and from the array areas.
	The deviation and navigation corridor formed between the northern array area and East Anglia Two is highlighted.	Acknowledged in the safety case for the navigation corridor between VE and East Anglia Two in Section 17.11 of Volume 9, Report 10: Navigational Risk Assessment.
20 October 2022 Hazard Workshop feedback from Cruising Association	Sailing vessels would likely avoid the array areas but advice on how to transit the arrays would be useful.	Acknowledged in the environmental assessment in Section 9.11.
20 October 2022 Hazard Workshop feedback from Sunk VTS	The array areas are outside the Sunk VTS area so present a problem for inbound traffic management.	Acknowledged in the environmental assessment in Section 9.11.
	Wind farm vessels already cross the Sunk TSS East for Galloper and Greater Gabbard. The presence of VE and North Falls would create further crossings with associated risk for vessels in emergency situations.	Acknowledged in the environmental assessment in Section 9.11.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	Wind farm vessels already cross the Sunk TSS East for Galloper and Greater Gabbard. The presence of VE and North Falls would create further crossings with associated risk.	Acknowledged in the environmental assessment in Section 9.11.
20 October 2022 Hazard Workshop feedback from Stena Line	The array areas create a natural corridor and therefore an extension of the Sunk TSS East will not be required. Instead, the placement of a buoy on the corners of the array areas is suggested.	Acknowledged in the environmental assessment in Section 9.11.
	The implementation of recommended routes for small boat owners to provide some segregation from larger commercial vessels in the Sunk TSS East is suggested.	Acknowledged in the environmental assessment in Section 9.11.
	Where the offshore ECC crosses the Sunk TSS East needs to be deeper than when following the TSS. The key area is the Sunk Outer Precautionary Area.	Acknowledged in the environmental assessment in Section 9.11.
	The depth of burial may be the key to resolving issues rather than the location.	Acknowledged in the environmental assessment in Section 9.11.
	A 400 metre (m) vessel may drag anchor and this could cause problems, particularly when the anchor is dropped to prevent drifting.	Acknowledged in the environmental assessment in Section 9.11.
20 October 2022 Hazard Workshop feedback from HHA	Subsea cables will need to be buried deeper where there is increased risk from anchorage areas.	Acknowledged in the environmental assessment in Section 9.11.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	The Sunk Inner light vessel may need to be moved westward.	Acknowledged in the environmental assessment in Section 9.11.
	The preferred offshore Export Cable Route (ECR) is the most desirable in the Sunk Inner Precautionary Area but a cumulative issue exists when North Falls and Sea Link are also considered.	Acknowledged in the environmental assessment in Section 9.11.
	The broad area covered by the offshore ECC is the main concern and if buried across the full width (including consideration of North Falls) then there would be a problem.	Acknowledged in the environmental assessment in Section 9.11.
	The depth required for export cable burial will likely need to be greater than 0.5 m in many areas.	A Cable Burial Risk Assessment (CBRA) is included as mitigation in Section 9.9 but this has been acknowledged in the environmental assessment in Section 9.11. The CBRA is provided in Volume 9, Report 9: Outline Cable Burial Risk Assessment.
	The Harwich Deep Water Channel is currently being dredged down to 16 m.	Acknowledged in the outline of the baseline environment in Section 9.7 and acknowledged in the environmental assessment in Section 9.11.
	It is suggested to investigate how vessel draught has increased over the last 30 years and relate this to the lifespan of the export cables. A draught of 20 m may be a realistic maximum and would enable vessels to	Acknowledged in the outline of the evolution of the baseline in Section 9.7 and the analysis of future case vessel traffic in Section 15 of Volume 9, Report 10: Navigational Risk Assessment.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	continue accessing the local ports.	
	Increased coordination between VE and North Falls to minimise the associated cumulative risks is recommended.	The Outline NIP (which will give due regard to cumulative considerations) is identified as mitigation in Section 9.11 and is outlined in Volume 9, Report 20: Outline Navigation Installation Plan.
	Reduced pilotage during export cable installation would not be tenable from a commercial perspective.	Acknowledged in the environmental assessment in Section 9.11.
	The shifting seabed needs to be considered in relation to export cable burial and there needs to be futureproofing without the need for scour/ cable protection or remedial burial works in sensitive locations.	Acknowledged in the environmental assessment in Section 9.11.
	There will be pinch points along the offshore ECC where traffic management is critical.	Acknowledged in the environmental assessment in Section 9.11.
20 October 2022 Hazard Workshop feedback from London Gateway	London Gateway is only 50% constructed and therefore port capacity could double over the next 10 years.	Acknowledged in the outline of the evolution of the baseline in Section 9.7 and the analysis of future case vessel traffic in Section 15 of Volume 9, Report 10: Navigational Risk Assessment.
	Depth of burial for export cables is the key issue and maintenance/ monitoring of the depth requires consideration.	A CBRA is included as mitigation in Section 9.9 (and provided in Volume 9, Report 9: Outline Cable Burial Risk Assessment) but this has been acknowledged in the environmental assessment in Section 9.11.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
20 October 2022 Hazard Workshop feedback from Port of Felixstowe	There is potential for impeding traffic during cable installation and the greater the burial depth the longer the installation vessel may be located on-site.	Acknowledged in the environmental assessment in Section 9.11.
	The Port of Felixstowe has nine berths currently but plans are in place for the addition of smaller berths.	Acknowledged in the outline of the evolution of the baseline in Section 9.7 and the analysis of future case vessel traffic in Section 15 of Volume 9, Report 10: Navigational Risk Assessment.
20 October 2022 Hazard Workshop feedback from Hanson Aggregates Marine	From a small vessel perspective there are not the same draught issues relating to the export cables. However, the preference for futureproofing is shared with other stakeholders given the traffic volumes and additional cumulative pressure.	Acknowledged in the environmental assessment in Section 9.11.
9 May 2023 Section 42 response from PLA	It must be ensured that the export cables and any cable protection maintains at least access for 20 m below CD where cables cross the deep water route into the Port of London.	A realistic future worst case vessel draught of 20 m is considered in the evolution of the baseline in Section 9.7 and in the environmental assessment in Section 9.11.
	Request to be consulted on the Cable Specification and Installation Plan (CSIP) when produced and the Navigation Installation Plan (NIP) when developed.	PLA will be consulted on an Outline CSIP at submission (see Volume 9, Report 12: Outline Cable Specification and Installation Plan) and have been identified as an Interested Party for the creation of the Outline NIP which is included as mitigation in Section 9.9 and outlined in Volume 9, Report

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
		20: Outline Navigation and Installation Plan.
	Target burial depths are not always achieved. There is a small area where the offshore export cable corridor crosses the Sunk deep water route which is already at or deeper than 20 m and routeing through this 250 m depression is workable if full cable burial is not achieved. Likewise, there are areas of deeper than 20 m crossing the Trinity deep water route which should be targeted.	Five Estuaries Offshore Wind Farm Limited (VE OWFL) (hereafter referred to as 'the Applicant') plans to utilise the suggested locations where feasible with the refinements to the offshore ECC taking account of these more favourable locations. Details pertaining to the refinement of the offshore ECC are provided in Section 6 of Volume 9, Report 10: Navigational Risk Assessment.
	In the areas of the deep water routes the quickest methods of cable laying should be used to minimise disruption to traffic.	The Outline NIP (Volume 9, Report 20) will address the approach to cable laying and is included as mitigation in Section 9.9.
12 May 2023 Section 42 response from MCA	Refinement of the northern array area to address concerns raised earlier in the consultation process is welcomed.	Acknowledged in the project description relevant to shipping and navigation in Section 6 of Volume 9, Report 10: Navigational Risk Assessment.
	Inclusion of 12 cumulative developments in addition to the baseline case is welcomed.	Acknowledged in the CEA screening in Section 9.10.
	Where burial depths as informed by the CBRA cannot be achieved in the area around the Sunk pilot boarding station and channels with a charted maintained depth, any potential reduction in surrounding depths referenced to CD will need	The CBRA, CSIP and compliance with MGN 654 are included as mitigation in Section 9.9 and are provided in Volume 9, Report 9: Outline Cable Burial Risk Assessment and Volume 9, Report 12: Outline Cable Specification

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	special attention and further consultation with the MCA and relevant stakeholders.	and Installation Plan, respectively.
	There are also some stakeholder concerns regarding the route and burial of the export cables, including the target burial depth of 0.5 m and the possible effect of future dredging of channels for port expansion to accommodate deeper draught vessels.	Additional feedback has been sought from relevant stakeholders and reduced access to local ports is considered in the environmental assessment in Section 9.11.
	The potential for the NeuConnect and North Falls cables crossing the area and being installed at the same time is a concern and continued comprehensive consultation with the other projects and stakeholders will be key moving forwards.	NeuConnect and North Falls have been screened into the CEA in Section 9.10.
	Content at Preliminary Environmental Impact Report (PEIR) stage with regards to the process undertaken to comply with MGN 654 and its annexes and welcome the work undertaken for addressing the guidance and recommendations so far.	Compliance with MGN 654 continues to be included as mitigation in Section 9.9.
12 May 2023 Section 42 response from Trinity House	Welcome the earliest possible consultation regarding proposed layouts as this matter may well require significant work to reach agreement.	Post PEIR consultation with Trinity House confirmed that layout discussions will be picked up post consent when agreeing the final array layout and this is acknowledged in the environmental assessment in Section 9.11.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
12 May 2023 Section 42 response from UK Chamber of Shipping (joint position with DFDS Seaways and Stena Line)	Strongly welcome the proactive approach taken in addressing concerns of navigational safety by reducing the northern array area which significantly reduces the navigational risk for east-west traffic, in particular when viewed in combination with East Anglia Two.	Acknowledged in the project description relevant to shipping and navigation in Section 6 of Volume 9, Report 10: Navigational Risk Assessment.
	The new northern array area tapers to a point at the north where the navigational corridor is narrowest and could lead to isolated structures protruding into the channel with increased collision and allision risk.	Acknowledged in the navigation corridor safety case in Section 17 of Volume 9, Report 10: Navigational Risk Assessment.
	Greater analysis of vessel traffic movements incorporating East Anglia Two is requested, including an illustration of simulated tracks with East Anglia Two in situ.	Simulated AIS has been presented in the navigation corridor safety case in Section 17 of Volume 9, Report 10: Navigational Risk Assessment.
	Illustrations of potential Radar interference of VE in combination with East Anglia Two and the potential for Radar interference overlap between the two developments is requested.	An illustration of Radar interference for the cumulative scenario is presented in Section 13 of Volume 9, Report 10: Navigational Risk Assessment.
12 May 2023 Section 42 response from UK Chamber of Shipping	Careful consideration of cable burial depth is needed where the offshore ECC crosses IMO routeing measures and deep water routes used by deep draught vessels so as not to impinge on navigational safety, port access, and the UK's economic prosperity.	A CBRA is included as mitigation in Section 9.9 and provided in Volume 9, Report 9: Outline Cable Burial Risk Assessment.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	A burial depth of 0.5 m is likely insufficient in some areas and may need to be substantially more.	A CBRA is included as mitigation in Section 9.9 and it is noted that 0.5 m is the indicative average cable burial depth – the indicative maximum burial depth is 3.3 m. The CBRA is provided in Volume 9, Report 9: Outline Cable Burial Risk Assessment
	Fuller analysis of vessels with draughts over 12 m is recommended to aid granularity.	Additional analysis of vessel draughts is provided in Section 10 of Volume 9, Report 10: Navigational Risk Assessment including isolation of vessels with greater than 12 m draught within the Sunk offshore ECC study area.
	The expansion of major ports in the area, in combination with the proximity of several other new offshore wind farm projects leads to a suggestion that 20% may be too low a figure for future case vessel traffic growth – an addition scenario of 30% increases in overall numbers is recommended.	Acknowledged in the evolution of the baseline in Section 9.7.
	The nearly 1,800 annual round trips for project vessels associated with VE may be expected similarly for North Falls and East Anglia Two, leading to an additional 3,800 annual round trips due to the presence of the offshore wind farms in the area.	Acknowledged in the environmental assessment in Section 9.11.
	Object to the preferred decommissioning	The best environmental option will be considered at

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	assumption of leaving the cables in situ given the risk of exposure, anchor fouling, and constraints on future use of the seabed.	the time of decommissioning as noted in Section 6 of Volume 9, Report 10: Navigational Risk Assessment and a Decommissioning Plan is included as mitigation in Section 9.9.
12 May 2023 Section 42 response from Greater Gabbard Offshore Winds Ltd	During all phases of VE there exists a risk of disruption to marine/ maritime operations and therefore it is requested that sufficient marine coordination between the parties is put in place, appropriate in its timing, frequency, and detail.	Marine coordination for project vessels is included as mitigation in Section 9.9.
9 June 2023 Section 42 response from HHA	The worldwide maritime industry trend for less vessel movements but larger vessels carrying equivalent tonnage is set to continue.	Acknowledged in the evolution of the baseline in Section 9.7.
	Pilotage services cannot be interrupted, with delayed or missed Megamax arrivals having significant cost implications to HHA.	Acknowledged in the environmental assessment in Section 9.11.
	Accounting for vessel draughts and future dredging, a maximum draught of 20 m plus 10% under keel clearance should be considered, i.e., minimum depth required of 22 m below CD.	Acknowledged in the evolution of the baseline in Section 9.7.
	Safety zones will not be able to impede vessel traffic movements within the Sunk area or normal operations such as pilot boarding.	Although an application for safety zones is included as mitigation in Section 9.9, these will be limited to activities associated with surface piercing structures.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
		i.e., clear of the offshore ECC.
	Recommend that the export cables are routed in the southern portion of the offshore ECC [as presented at the PEIR stage] due to the location of the Sunk pilot boarding station. Routeing close to the Sunk pilot boarding station would cause disruption for vessels boarding pilots and increase collision risk.	The offshore ECC has been refined for the ES stage to be less intrusive to the Sunk pilot boarding station as detailed in Section 6 of Volume 9, Report 10: Navigational Risk Assessment.
	No RAM installation vessels associated with the export cables should operate in the Sunk area when visibility is below 2 nm.	Protocol for project vessels including with respect to weather conditions will be captured in the Outline NIP which is included as mitigation in Section 9.9 and outlined in Volume 9, Report 20: Outline Navigation and Installation Plan.
20 June 2023 Section 42 response from London Gateway	Cable burial depth is key with maintaining depths and minimising disruption during installation important. It is also necessary to take account of the future depth of the channel required for future vessels.	A CBRA is included as mitigation in Section 9.9 and provided in Volume 9, Report 9: Outline Cable Burial Risk Assessment. Protocol for project vessels will be captured in the Outline NIP which is included as mitigation in Section 9.9 and outlined in Volume 9,Report 20: Outline Navigation and Installation Plan. Evolution of the baseline is considered in Section 9.7.
	To account for potential of vessel draughts of 20 m and additional under keel clearance of 10%, a 22 m channel should be	Acknowledged in the evolution of the baseline in Section 9.7.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	considered during the lifetime of VE.	
	Entrance and passage into the Sunk and Trinity deep water routes are managed by the PLA who undertake the passage planning. The Sunk deep water route is used mostly rather than the Trinity deep water route.	Acknowledged in the baseline characterisation of vessel traffic movements in Section 10 of Volume 9, Report 10: Navigational Risk Assessment.
26 July 2023 Post PEIR consultation meeting with UK Chamber of Shipping	The worst case scenario for East Anglia Two should be accounted for when assessing collision risk and the key interest is the allision risk on the northern perimeter of the northern array area.	A safety case for the navigation corridor between VE and East Anglia Two is provided in Section 17 of Section 10 of Volume 9, Report 10: Navigational Risk Assessment.
	Historically the Suez Canal has been dredged deeper and so this could happen again.	Acknowledged in the evolution of the baseline in Section 9.7.
26 July 2023 Post PEIR consultation meeting with DFDS Seaways	The northern array area is concerning in relation to the pinch point with East Anglia Two but the layout itself may offer comfort.	Acknowledged in the safety case for the navigation corridor between VE and East Anglia Two in Section 17 of Section 10 of Volume 9, Report 10: Navigational Risk Assessment.
31 July 2023 Post PEIR consultation meeting with HHA (joint meeting with North Falls)	There are no current plans to deepen the Harwich Deep Water Channel.	Acknowledged in the evolution of the baseline in Section 9.7.
	In recent years vessel draughts out of Rotterdam have increased from 12 to 17 m but it is difficult to forecast how this may change in the future. A theoretical maximum draught of 22 m may be possible in the future noting	Acknowledged in the evolution of the baseline in Section 9.7.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	the existence of Chinamax vessels.	
	The location of export cables is not an issue if the under keel clearance is not reduced but any further restrictions to current draughts would create an issue.	Reduction in under keel clearance has been considered in the environmental assessment in Section 9.11.
	The area in proximity to the Sunk pilot boarding station is of greatest concern given the variety of ongoing activities with vessels approaching at various headings and potentially simultaneously. Lack of space is the key safety issue, especially during construction and maintenance activities and with easterly winds.	The Outline NIP will address the approach to installation and maintenance associated with the offshore ECC is included as mitigation in Section 9.9 and outlined in Volume 9,Report 20: Outline Navigation and Installation Plan.
	HHA should have involvement with the creation of the NIP as the coordinator of pilotage operations in the area.	HHA have been identified as an Interested Party for the creation of the NIP which is included as mitigation in Section 9.9 and outlined in Volume 9, Report 20: Outline Navigation Installation Plan.
29 August 2023 Post PEIR consultation meeting with UK Chamber of Shipping	Content with the navigational corridor between the northern array area and East Anglia Two when considered in alignment with Galloper and appreciative that the possibility of no build in the overlap area is being investigated.	Acknowledged in the safety case for the navigation corridor between VE and East Anglia Two in Section 17 of Section 10 of Volume 9, Report 10: Navigational Risk Assessment.
	Content with the 30% increase in traffic volume and maximum draught of	Acknowledged in the evolution of the baseline in Section 9.7

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	23 m proposed for the future case.	
29 August 2023 Post PEIR consultation meeting with DFDS Seaways	Content with the navigational corridor between the northern array area and East Anglia Two when considered in alignment with Galloper.	Acknowledged in the safety case for the navigation corridor between VE and East Anglia Two in Section 17 of Section 10 of Volume 9, Report 10: Navigational Risk Assessment.
	A 10% increase in vessel length for navigation corridor users is very conservative with vessel beam likely to increase.	A 10% increase in commercial vessel size for potential corridor users has been conservatively assumed in the safety case for the navigation corridor between VE and East Anglia Two in Section 17 of Section 10 of Volume 9, Report 10: Navigational Risk Assessment.
	Content with the 30% increase in traffic volumes proposed for the future case.	A 30% increase in commercial vessel volumes has been assumed in the evolution of the baseline in Section 9.7.
22 September 2023 Post PEIR consultation meeting with HHA (joint meeting with North Falls)	Pilotage activities are highly dynamic with various factors requiring consideration including weather, other vessels, and early/ late arrivals. The presence of fishing and recreational vessels can make operations challenging and all the factors contributed to the creation of the Sunk VTS.	The Outline NIP addresses the approach to installation and maintenance associated with the offshore ECC including in relation to pilotage operations and is included as mitigation in Section 9.9 and outlined in Volume 9, Report 20: Outline Navigation and Installation Plan.
	The largest vessels board east of the Sunk pilot boarding station.	Acknowledged in the baseline characterisation of vessel traffic movements in Section 10 of Volume 9,

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
		Report 10: Navigational Risk Assessment.
	Pilot boarding occurs between six and eight knots (kt) so vessels can get into more confined waters quickly.	The Outline NIP addresses time constraints for pilotage operations and is included as mitigation in Section 9.9 and outlined in Volume 9,Report 20: Outline Navigation and Installation Plan.
	Refinement of the offshore ECC [for the ES stage] is much better since it is moved away from the most sensitive areas.	Acknowledged in the project description relevant to shipping and navigation in Section 6 of Volume 9, Report 10: Navigational Risk Assessment.
	A dredge campaign has recently been completed applying a measure where the vessel may be required to move with a certain notice period, and this was effective.	The Outline NIP considers protocols for project vessels and is included as mitigation in Section 9.9 and outlined in Volume 9, Report 20: Outline Navigation and Installation Plan.
	The ability to demonstrate ‘cut and run’ capability for cable laying is important for hazardous scenarios, e.g., a drifting vessel.	The Outline NIP considers protocols for project vessels and is included as mitigation in Section 9.9 and outlined in Volume 9,Report 20: Outline Navigation and Installation Plan. The CSIP will consider contingency operations and is provided in Volume 9, Report 12: Outline Cable Specification and Installation Plan.
	Sunk VTS and Medway are also considered as appropriate stakeholders for the NIP.	Sunk VTS and Medway have been identified as an Interested Party for the creation of the Outline NIP which is included as mitigation in Section 9.9 and outlined in Volume 9, Report

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
		20: Outline Navigation and Installation Plan.
6 October 2023 Post PEIR consultation meeting with MCA and Trinity House	Content with the array areas and will pick up layout discussions post consent including the potential for a WTG location at the northern point of the northern array area with enhanced marking an option if considered necessary.	Lighting and marking discussions (including with Trinity House) for the final array layout post consent is included as additional mitigation in Section 9.9.
	Alignment of the array layout with Galloper is sensible.	Acknowledged in the project description relevant to shipping and navigation in Section 6 of Volume 9, Report 10: Navigational Risk Assessment.
	Failures to aids to navigation should be included in the NIP noting that Trinity House vessels could be present where maintenance works are required.	The Outline NIP considers protocols for project vessels and is included as mitigation in Section 9.9 and outlined in Volume 9,Report 20: Outline Navigation and Installation Plan.
	If ports/ terminals are content with the approach to the future case then the MCA have nothing further to add noting that the 30% increase in commercial vessel movements is fair.	Acknowledged in the evolution of the baseline in Section 9.7
12 October 2023 Post PEIR consultation meeting with PLA and London Gateway	There have been difficulties in the past with information on activities not being effectively disseminated down the chain with crews on vessels not being aware of what is required so it is important to lay out points of contact and responsible persons.	The Outline NIP considers dissemination of planned activities and is included as mitigation in Section 9.9 and outlined in Volume 9, Report 20: Outline Navigation and Installation Plan.
	The NIP could mitigate PLA and London Gateway	The Outline NIP is included as mitigation in Section 9.9

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	concerns relating to the offshore ECC and port access and setting up a small working group to establish a draft plan is preferable.	and outlined in Volume 9, report 20: Outline Navigation and Installation Plan.
15 January 2024 Post PEIR consultation with MCA	The MCA is willing to accept a three-month extension to the vessel traffic survey data noting the current use of a long-term AIS dataset as validation. However, this does not set a precedent for future developments.	Noted.
23 January 2024 NIP consultation meeting with HHA, PLA, and Sunk VTS	Since Trinity House's remit involving aids to navigation is relevant to safe passage in a complex area it would be reasonable to include Trinity House in discussions relating to the NIP.	Trinity House have been identified as a potential stakeholder for the Outline NIP which is outlined in Volume 9, Report 20: Outline Navigation and Installation Plan.
	Medway have large vessels coming in via the Sunk and thus should be included in discussions relating to the NIP.	Medway have been identified as a potential stakeholder for the Outline NIP which is outlined in Volume 9,Report 20: Outline Navigation and Installation Plan.
	Recreational vessel activity is high during summer and it is not always possible to communicate with recreational vessels as they do not partake in the Sunk VTS. Guard vessels may be needed as mitigation during export cable installation.	Guard vessel(s) where deemed appropriate by risk assessment are included as mitigation in Section 9.9 and will be considered further in the Outline NIP which is outlined in Volume 9, Report 20: Outline Navigation Installation Plan.
25 January 2024 Hazard Workshop follow-up feedback from UK Chamber of Shipping	Defer to the local ports and Sunk VTS with respect to the refinements made to the offshore ECC.	Noted.
25 January 2024	Given the number of vessels which may be	The Outline NIP considers protocols for project vessels

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
Hazard Workshop follow-up feedback from Sunk VTS	undertaking works associated with the offshore ECC at any one time, there is concern that any limits on the restriction of the number of commercial vessels allowed in proximity will have an effect on local ports.	and is included as mitigation in Section 9.9 and outlined in Volume 9, Report 20: Outline Navigation and Installation Plan.
25 January 2024 Hazard Workshop follow-up feedback from HHA	Cable crossings west of the Harwich Deep Water Channel are a concern given the additional time which will be needed.	The Outline NIP considers protocols for project vessels including in relation to timings and is included as mitigation in Section 9.9 and outlined in Volume 9, Report 20: Outline Navigation and Installation Plan.

9.4 SCOPE AND METHODOLOGY

SCOPE OF THE ASSESSMENT

IMPACTS SCOPED IN FOR ASSESSMENT

9.4.1 The following impacts have been scoped into this assessment:

- Construction:
  - Impact C1: Vessel displacement and increased collision risk (array areas);
  - Impact C2: Vessel displacement and increased collision risk (offshore ECC);
  - Impact C3: Third-party with project vessel collision risk (array areas);
  - Impact C4: Third-party with project vessel collision risk (offshore ECC);
  - Impact C5: Reduced access to local ports and harbours and reduction in under keel clearance (array areas); and
  - Impact C6: Reduced access to local ports and harbours and reduction in under keel clearance (offshore ECC).
- O&M:
  - Impact O1: Vessel displacement and increased collision risk (array areas);
  - Impact O2: Vessel displacement and increased collision risk (offshore ECC);
  - Impact O3: Third-party with project vessel collision risk (array areas);
  - Impact O4: Third-party with project vessel collision risk (offshore ECC);

- Impact O5: Reduced access to local ports and harbours and reduction in under keel clearance (array areas);
- Impact O6: Reduced access to local ports and harbours and reduction in under keel clearance (offshore ECC);
- Impact O7: Creation of allision risk (array areas);
- Impact O8: Anchor interaction with subsea cables (array areas);
- Impact O9: Anchor interaction with subsea cables (offshore ECC); and
- Impact O10: Reduction of emergency response capability (including SAR access).

- Decommissioning:
  - Impact D1: Vessel displacement and increased collision risk (array areas);
  - Impact D2: Vessel displacement and increased collision risk (offshore ECC);
  - Impact D3: Third-party with project vessel collision risk (array areas);
  - Impact D4: Third-party with project vessel collision risk (offshore ECC);
  - Impact D5: Reduced access to local ports and harbours and reduction in under keel clearance (array areas); and
  - Impact D6: Reduced access to local ports and harbours and reduction in under keel clearance (offshore ECC).

IMPACTS SCOPED OUT OF ASSESSMENT

9.4.2 On the basis of the preliminary desktop assessment undertaken in Section 15 of Volume 9, Report 10: Navigational Risk Assessment, the following impact has been scoped out:

- O&M:
  - Interference with marine navigation, communication and position fixing equipment.

9.4.3 It is noted that allision risk has not been assessed for the construction and decommissioning phases on the basis that third-party vessels are not expected to navigate within the array areas during these phases, recognising the presence of the buoyed construction/decommissioning areas.

STUDY AREA

ARRAY AREAS

9.4.4 Two distinct, but overlapping, study areas have been applied around the array areas, as shown in Figure 9.1.

9.4.5 The first is a buffer generally of 10 nautical miles (nm) around the array areas (hereafter the 'array traffic study area') but with the portion of a complete 10 nm buffer intersecting the North Hinder Junction and North Hinder South TSS excluded. This study area has been defined to provide local context to the analysis of effects by capturing vessel traffic movements and historical incident data within and in proximity to the array areas. Exclusion of the areas incorporating the North Hinder Junction and North Hinder South TSS ensures that the high volume of vessel traffic known to utilise these areas do not skew the analysis. The 10 nm buffer otherwise applied is standard practice for shipping and navigation assessment and has been used in the majority of UK offshore wind farm NRAs.

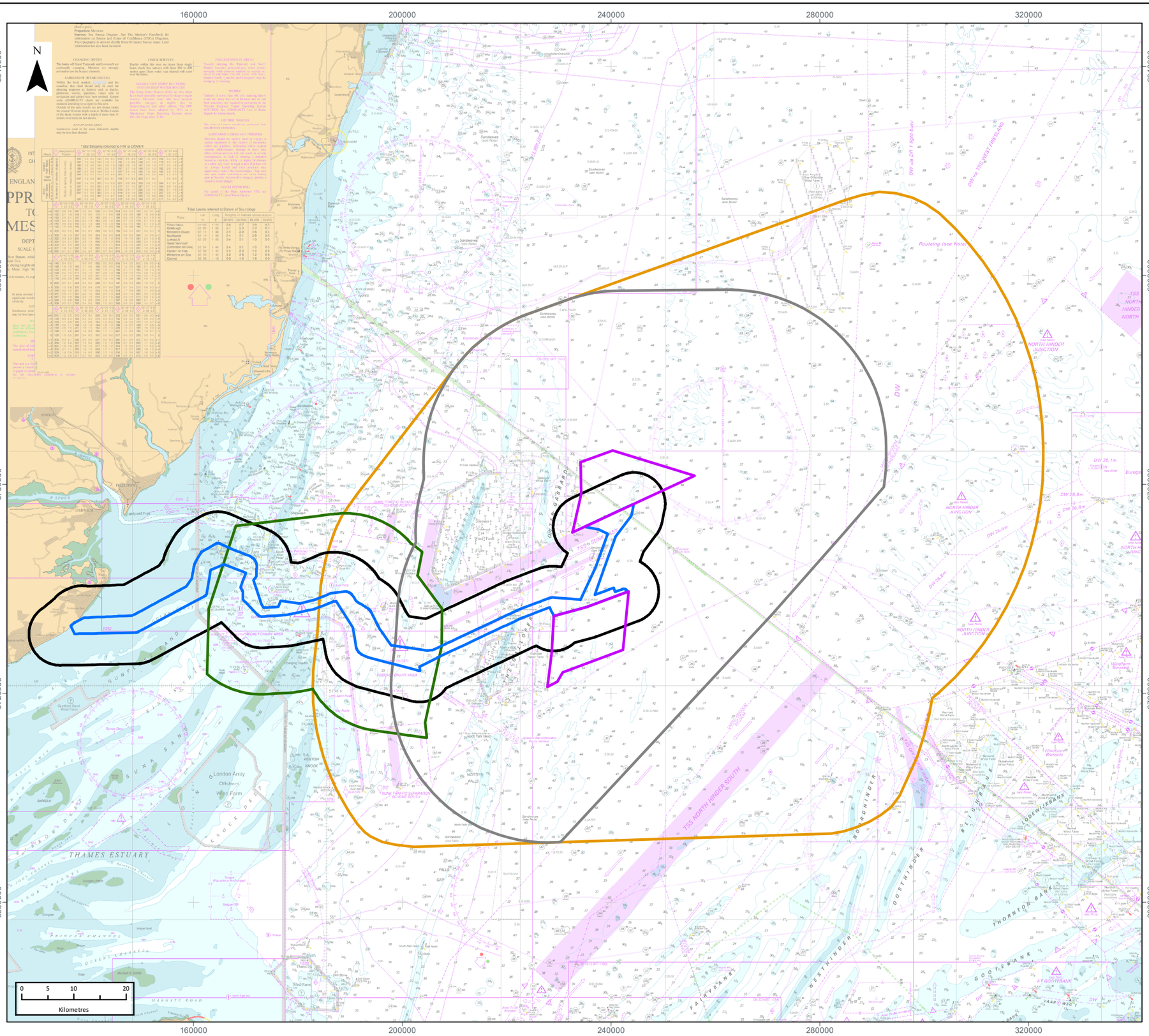
9.4.6 The second is a buffer of up to around 20 nm around the array areas (hereafter the 'array routeing study area'), with the buffer particularly extended to the east and south-east. This study area has been defined for the purpose of establishing the main commercial routes operated in the region and is used for post wind farm collision and allision risk modelling. Use of this study area ensures that vessel traffic utilising the North Hinder Junction and North Hinder South TSS is adequately characterised in the existing environment and impact assessment, as appropriate.

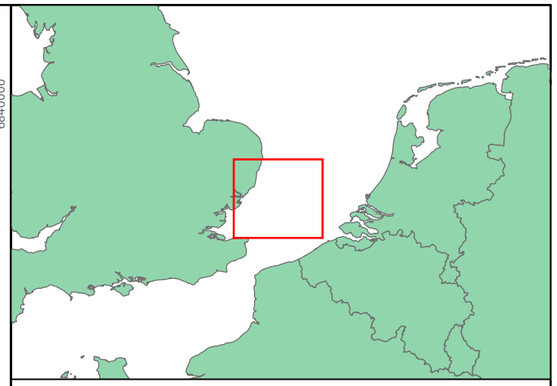
9.4.7 The notion of two distinct study areas to cover the array areas was first developed at the Scoping stage and has been discussed and agreed with stakeholders during consultation, including the MCA and Trinity House. Additionally, an amendment to the array routeing study area was made following a request from the UK Chamber of Shipping during consultation, which involved an extension to the western extent to fully incorporate the Sunk TSS North and Sunk TSS South areas. Stakeholders have acknowledged that these study areas are suitable for the characterisation of the existing environment for shipping and navigation.

OFFSHORE EXPORT CABLE CORRIDOR

9.4.8 A 2 nm buffer has been applied around the offshore ECC (hereafter the 'offshore ECC study area') as shown in Figure 9.1. As with the array traffic study area, this study area has been defined to capture relevant receptors and their movements within, and nearby, the offshore ECC. The 2 nm buffer is standard practice for shipping and navigation assessment and has been used in the majority of UK offshore wind farm NRAs. Additionally, the 2 nm buffer is sufficient to ensure vessel traffic movements within potentially sensitive areas within and in proximity to the offshore ECC are suitably characterised, such as the Sunk TSS East and Sunk Outer and Inner Precautionary Areas.

9.4.9 An additional study area associated with a section of the offshore ECC has also been applied (hereafter the 'Sunk offshore ECC study area') as shown in Figure 9.1. This study area incorporates up to a 5 nm buffer of the offshore ECC with the eastern extent incorporating the Sunk Outer Precautionary Area and the western extent covering up to the NE Gunfleet west cardinal mark. This study area has been used to provide further context of vessel movements in sections of the offshore ECC considered more sensitive during consultation.





LEGEND

- Array Areas
- Offshore Export Cable Corridor
- Array Traffic Study Area
- Offshore Export Cable Corridor Study Area
- Array Routeing Study Area
- Sunk Offshore Export Cable Corridor Study Area

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Study area for shipping and navigation

VER	DATE	REMARKS	Drawn	Checked
1	13/02/2024	ES	DS	JM

DRAWING NUMBER:

Figure 9.1

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

FIVE ESTUARIES OFFSHORE WIND FARM

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DATA SOURCES

9.4.10 The main data sources used to inform the existing environment relative to VE are outlined in Table 9.3.

Table 9.3: Main Data Sources.

Data	Source(s)	Purpose
Vessel traffic	Winter vessel traffic survey data consisting of Automatic Identification System (AIS), Radio Detection and Ranging (Radar), and visual observations for the array traffic study area (14 days, 15 January 2022 – 29 January 2022) recorded from a dedicated survey vessel on-site.	Characterising vessel traffic movements within and in proximity to VE in line with MGN 654 (MCA, 2021) requirements.
	Summer vessel traffic survey data consisting of AIS, Radar, and visual observations for the array traffic study area (14 days, 15 June 2022 – 29 June 2022) recorded from a dedicated survey vessel on-site.	
	AIS data for the array traffic study area (12 months, 2019) (hereafter the 'long-term vessel traffic data') recorded from coastal receivers	Validation of the vessel traffic survey data and characterising seasonal variations.
	Anatec's ShipRoutes database (2022).	Secondary source for characterising vessel traffic movements including cumulatively within and in proximity to VE.
	RYA Coastal Atlas of Recreational Boating (RYA, 2019)	Secondary source for characterising recreational activity within and in proximity to VE.
Maritime incidents	MAIB marine accidents database (2002 – 2021)	Review of maritime incidents within and in proximity to VE.
	Royal National Lifeboat Institution (RNLI) incident data (2013 – 2022).	
	DfT UK civilian SAR helicopter taskings (2015 – 2023).	
Other navigational features	Admiralty Charts 1183, 1610, 1630, and 2052 (United Kingdom Hydrographic Office (UKHO), 2022).	Characterising other navigational features within and in proximity to VE.

Data	Source(s)	Purpose
	Admiralty Sailing Directions Dover Strait Pilot NP28 (UKHO, 2020) and Admiralty Sailing Directions North Sea (West) Pilot NP54 (UKHO, 2021).	
Weather	Wind direction data modelled by Vortex.	Characterising weather conditions in proximity to VE for use as input to the collision and allision risk modelling.
	Significant wave height data recorded by Fugro between December 2010 and May 2012.	
	Tidal data provided by Admiralty Charts 1610 and 1630 (UKHO, 2022).	
	Visibility data provided in Admiralty Sailing Directions North Sea (West) Pilot NP54 (UKHO, 2021).	
	Case Studies of Past Weather Events (Met Office, 2019).	Identifying periods of adverse weather in proximity to VE coinciding with the long-term vessel traffic data.

9.4.11 Further details pertaining to the collection of the vessel traffic survey data is provided in Section 5.2 of Volume 9, Report 10: Navigational Risk Assessment, noting that these datasets provide comprehensive coverage of the array traffic study area and is compliant with the requirements of MGN 654 (MCA, 2021).

ASSESSMENT METHODOLOGY

9.4.12 The primary guidance used when defining the assessment methodology for shipping and navigation includes:

- MGN 654 (Merchant and Fishing) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021); and
- Revised Guidelines for FSA for Use in the IMO Rule-Making Process (IMO, 2018).

9.4.13 The IMO FSA methodology is the internationally recognised approach for assessing impacts on shipping and navigation receptors, and is the approach required under MGN 654. This systematic methodology applies risk analysis to reduce impacts to ALARP and requires consideration of each impact in terms of frequency of occurrence and severity of consequence. Inputs used to inform the assessment include:

- Established existing environment;
- Expert opinion;

- Outputs of collision and allision risk modelling;
- Outputs of the Hazard Workshop;
- Stakeholder concerns;
- Lessons learnt from existing offshore developments; and
- Mitigation.

9.5 ASSESSMENT CRITERIA AND ASSIGNMENT OF SIGNIFICANCE

9.5.1 The frequency of occurrence rankings used to assess impacts are defined in Table 9.4.

Table 9.4: Impact frequency of occurrence definitions.

Frequency of occurrence	Description
Frequent	Yearly.
Reasonably Probable	One occurrence per 1 to 10 years.
Remote	One occurrence per 10 to 100 years.
Extremely Unlikely	One occurrence per 100 to 10,000 years.
Negligible	Less than one occurrence per 10,000 years.

9.5.2 The severity of consequence rankings used to assess impacts are defined in Table 9.5.

Table 9.5: Impact severity of consequence definitions.

Severity of consequence	Description
Major	More than one fatality, total loss of property, tier 3 national assistance required and international reputational effects.
Serious	Multiple serious injuries or single fatality, damage resulting in critical impact on operations, tier 2 regional assistance required, and national reputational effects.
Moderate	Multiple minor or single serious injury, damage no critical to operations, tier 2 limited external assistance required, and local reputational effects.
Minor	Slight injury to people, minor damage to property, tier 1 local assistance required, and minor reputational effects limited to receptors.
Negligible	No perceptible impact on people, property, environment. And business.

9.5.3 Assessment of the significance of potential effects is described in Table 9.6.

Table 9.6: Matrix to determine effect significance.

Severity of consequence						
		Tolerable with Mitigation	Tolerable with Mitigation	Unacceptable	Unacceptable	Unacceptable
	Serious	Broadly Acceptable	Tolerable with Mitigation	Tolerable with Mitigation	Unacceptable	Unacceptable
	Moderate	Broadly Acceptable	Broadly Acceptable	Tolerable with Mitigation	Tolerable with Mitigation	Unacceptable
	Minor	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable with Mitigation	Tolerable with Mitigation
	Negligible	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable with Mitigation
		Negligible	Extremely Unlikely	Remote	Reasonably Probable	Frequent
		Frequency of occurrence				

9.5.4 Effects determined to be of Broadly Acceptable significance are low risk and not significant in EIA terms. Effects determined to be of Tolerable with Mitigation significance are intermediate risk and not significant in EIA terms. Effects determined to be of Unacceptable significance are high risk and significant in EIA terms.

9.5.5 Additionally, differences in terminology between this chapter (which uses EIA terminology) and the NRA (which uses FSA terminology) are summarised in Table 9.7.

Table 9.7: Summary of differences in terminology between EIA and NRA.

EIA term	NRA term	Definition
Impact	Hazard	A potential threat to human life, health, property, or the environment.
Effect	Risk	The combination of frequency of occurrence and severity of consequence of an impact.
Receptor	User	Sufferer of effect.
Mitigation	Embedded mitigation measure	A commitment made by the Applicant to reduce and/ or eliminate the potential for significant effects.

9.6 UNCERTAINTY AND TECHNICAL DIFFICULTIES ENCOUNTERED

9.6.1 Due to the design envelope approach, a number of assumptions have been made to allow an assessment of a realistic worst-case scenario for shipping and navigation. These assumptions have been made to ensure that the impact assessment is suitable irrespective of the combination of parameters from the design envelope taken forward.

9.6.2 Key assumptions include:

- Full build out of the array areas to maximise displacement and the reduction in available sea room;
- Deployment of the maximum possible number of wind turbine generators (WTG) to maximise exposure to allision risk;
- Use of four-legged pile jacket foundations to maximise the structure dimensions at the sea surface and therefore the exposure to allision risk;
- A single line of orientation (SLoO) layout for the northern array area (noting southern array area may also proceed with a SLoO) to maximise disruption to SAR access; and
- Offshore Substation Platforms (OSP) located near areas where exposure to allision risk is deemed to be greatest.

9.7 EXISTING ENVIRONMENT

NAVIGATIONAL FEATURES

9.7.1 A plot of the navigational features in proximity to the array areas and offshore ECC is presented in

9.7.2 Figure 9.2.

9.7.3 It is noted that the navigational features in proximity to the Sunk TSS include a restricted area to the north, an anchorage area to the west, an explosive dumping ground and marine aggregate dredging area to the south-west, the Long Sand Head two-way route to the south-east and deep water routes running through the inner precautionary area.

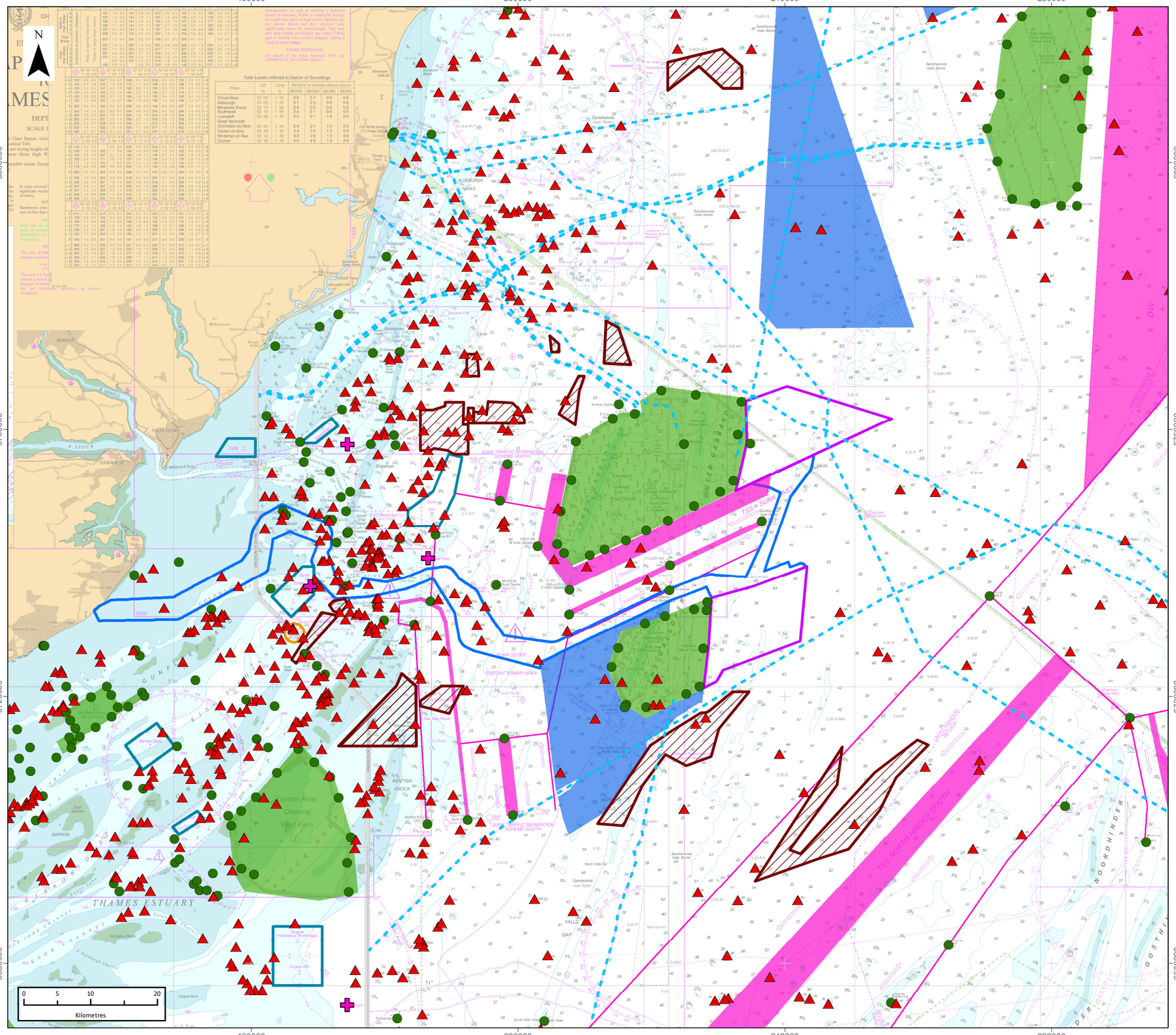
9.7.4 This subsection summarises the navigational features, with additional details provided in Volume 9, Report 10: Navigational Risk Assessment.

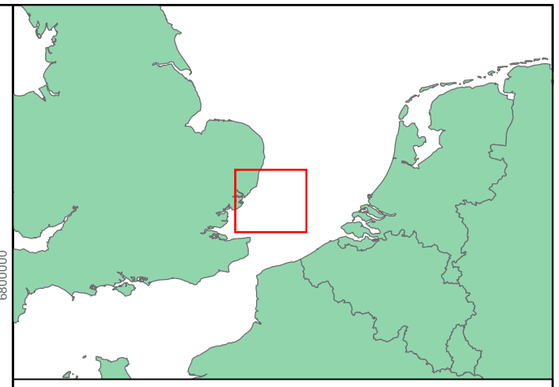
9.7.5 The closest OWF developments to the array areas are Galloper (operational, directly to the west), Greater Gabbard (operational, 1.9 nm to the west), and East Anglia Two (consented, 2.9 nm to the north). Other UK OWF developments in the region include (but are not limited to) North Falls (scoped), East Anglia Two (consented), East Anglia One (operational), and East Anglia One North (consented).

9.7.6 The Sunk routeing measure is located directly west of the array areas. This includes the Sunk TSS East, which ends between the array areas. The North Hinder South TSS – which connects to the North Hinder Junction – is located approximately 5.5 nm to the south-east of the array areas. The offshore ECC passes through the Sunk routeing measure; it passes directly south of the Sunk TSS East before crossing the Sunk Outer and Inner Precautionary Areas, and finally making landfall at Holland-on-Sea.

9.7.7 The closest port or harbour to the array areas is the Port of Felixstowe (UK), located approximately 28 nm to the west, on the Suffolk coast. Harwich Haven (UK) is located approximately 30 nm to the west on the Suffolk coast. The Sunk VTS is operated from Harwich Operations Centre, with participation *"mandatory for all vessels over 50 gross tonnage (GT) and vessels licensed to carry 12 or more passengers. These vessels should obtain permission before entering the area and maintain very high frequency (VHF) contact thereafter."* (UKHO, 2020).

9.7.8 There are two pilot boarding stations within or in proximity to the offshore ECC study area – the Rivers Colne & Crouch pilot station (located 0.5 nm south-west of the offshore ECC), and the Sunk pilot station (located within the offshore ECC itself).





LEGEND

- Array Areas
- Offshore Export Cable Corridor

Navigational Features

- Key Aid to Navigation
- Wreck or Obstruction
- Pilot Boarding Station
- Subsea Cable
- Anchorage Area
- Explosives Dumping Ground
- IMO Routeing Measure
- Marine Aggregate Dredging Area

Other OWFs

- In Planning
- Active/In Operation

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Study area for shipping and navigation

VER	DATE	REMARKS	Drawn	Checked
1	13/02/2024	ES	DS	JM

DRAWING NUMBER:

Figure 9.2

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:600,000	A3	WGS84	World Mercator

FIVE ESTUARIES
OFFSHORE WIND FARM

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9.7.9 There are three deep water routes located within the Sunk Inner Precautionary Area, with these are charted for use by deep-draught vessels entering or leaving the major ports in the region. Two of the deep water routes cross the offshore ECC (the Trinity and Sunk deep water routes) with minimum charted water depths of 18 m and 16 m below CD, respectively, where the crossing occurs. The London Gateway Port Harbour Empowerment Order 2008 gives approval for London Gateway Port to dredge to a maximum of 16.5 m within the Sunk and the Black Deep (which the Sunk and Trinity deep water routes pass through). The remaining deep water route curves north to direct traffic in/ out of the Harwich Deep Water Channel which HHA have confirmed during consultation is currently dredged to 16 m depth.

9.7.10 There are two key designated anchorage locations in proximity to VE; the Sunk Inner anchorage is located directly south of the offshore ECC and the Sunk DW anchorage is located approximately 1.5 nm north of the offshore ECC.

9.7.11 Several marine aggregate dredging areas are present within the area surrounding VE, with the closest located immediately south of the offshore ECC Longsand A509/1 and A509/2), operated by Tarmac Marine. However, Tarmac Marine have confirmed during consultation that Longsand A509/1 is not currently being exploited and there are no current plans to do so.

9.7.12 There are a number of existing subsea cables in proximity to the array areas, including three which pass through the northern array area: Atlantic Crossing 1, Concerto 1 North, and Farland. The BritNed subsea cable passes in close proximity to the south-eastern corner of the southern array area. Planned future subsea cable developments are considered in the cumulative effects assessment screening (see Section 9.10).

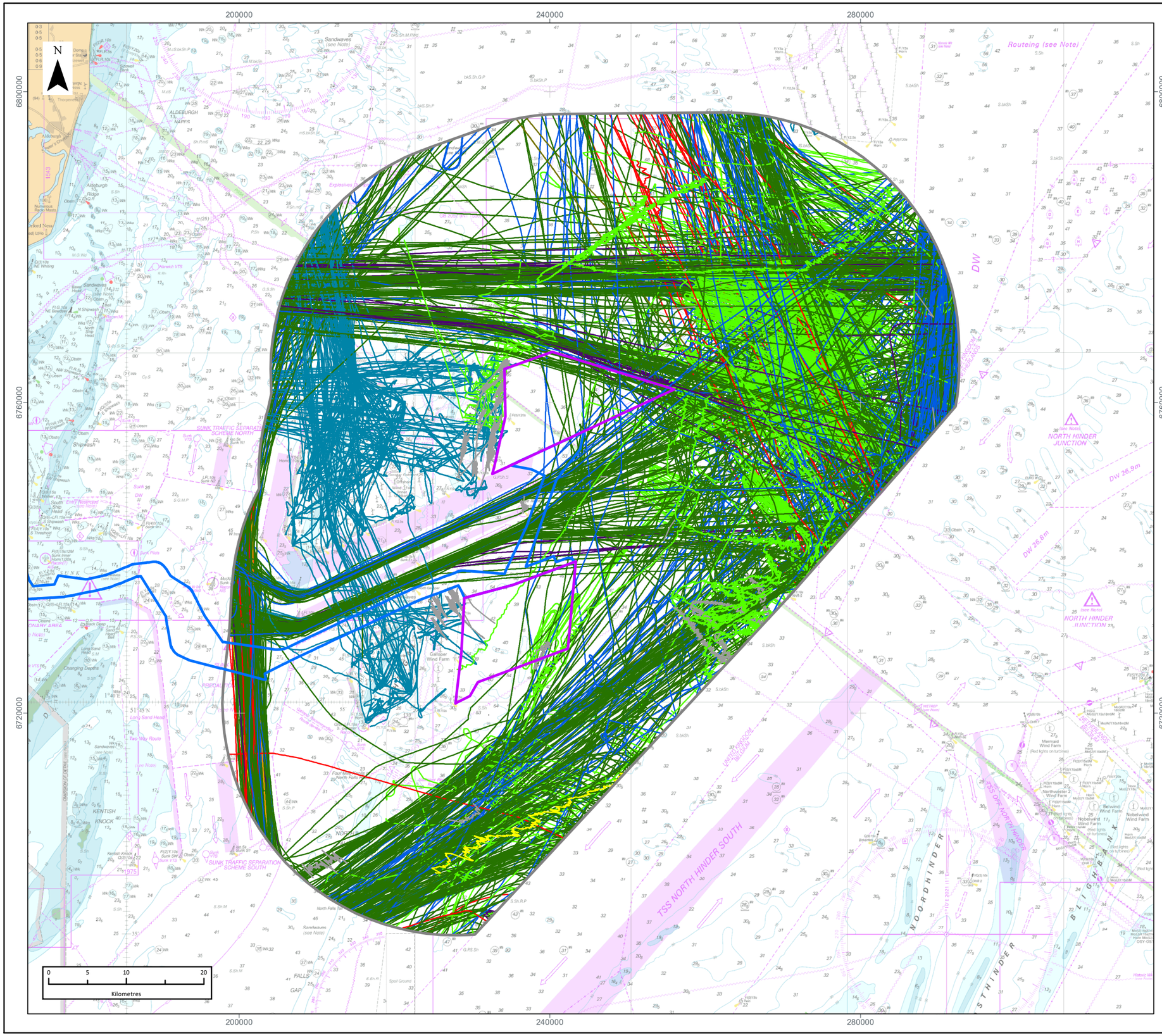
9.7.13 There are various aids to navigation located within the region, with the majority marking the Greater Gabbard and Galloper OWFs or the Sunk routeing measure. The North Galloper north cardinal mark, located on the edge of the eastbound lane of the Sunk TSS East, is within the offshore ECC. Moving further inshore, the offshore ECC avoids most aids to navigation within the Sunk Outer and Inner Precautionary Areas, including the Storm south cardinal buoy, Sunk Inner light vessel and South Threshold special mark.

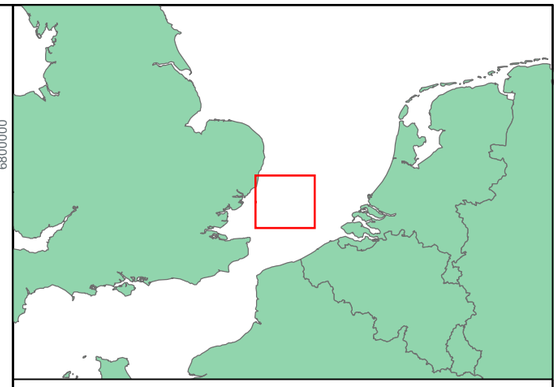
VESSEL TRAFFIC MOVEMENTS

ARRAY AREAS

9.7.14 A plot of vessel traffic recorded via AIS, Radar and visual observations over 14 full days in January 2022 (winter) within the array traffic study area, colour-coded by vessel type, is presented in Figure 9.3. Following this, a similar plot over 14 full days in June 2022 (summer) is presented in Figure 9.4.

9.7.15 A number of vessel tracks recorded during the two 14-day survey periods were classified as temporary (non-routine), such as those undertaking surveys or acting as guard vessels. These have therefore been excluded from the figures and the analysis that follows.





LEGEND

- Array Areas
- Offshore Export Cable Corridor
- Array Traffic Study Area

Vessel Type

- Unspecified
- Fishing
- Military
- Dredger
- Tug
- Passenger
- Cargo
- Tanker
- Other
- Oil and Gas
- Wind Farm

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

14 days winter 2022 AIS and Radar data by vessel type

VER	DATE	REMARKS	Drawn	Checked
1	13/02/2024	ES	DS	JM

DRAWING NUMBER:

Figure 9.3

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

FIVE ESTUARIES
OFFSHORE WIND FARM

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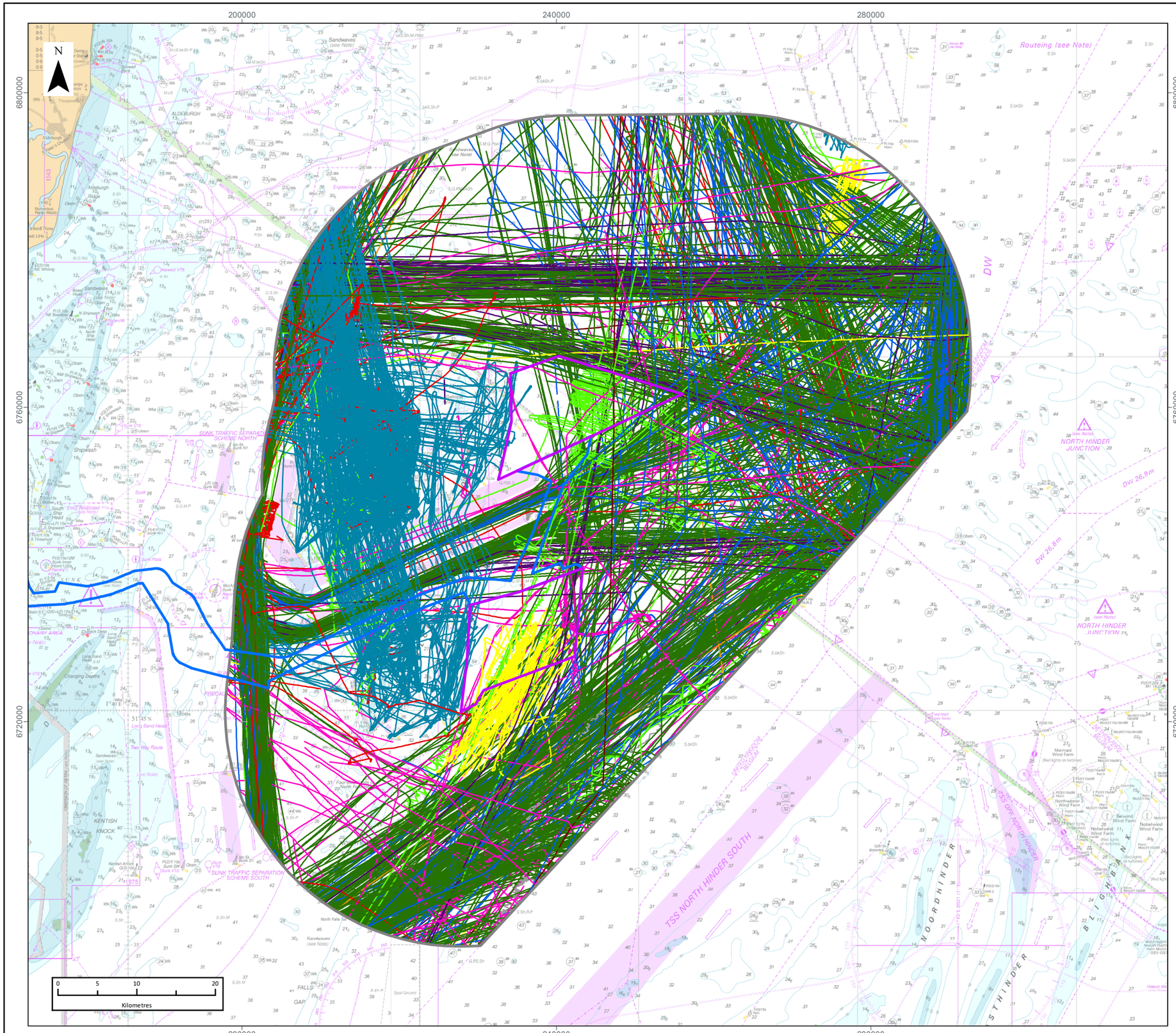
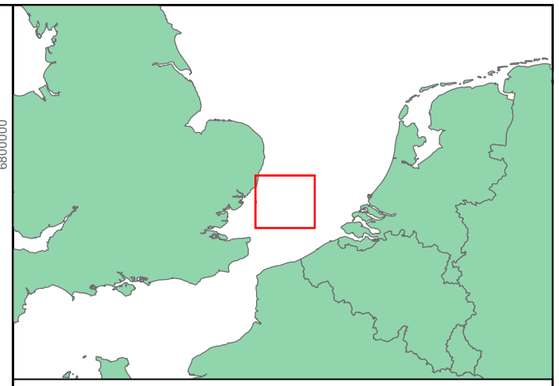




LEGEND

- Array Areas
- Offshore Export Cable Corridor
- Array Traffic Study Area

Vessel Type

- Unspecified
- Fishing
- Military
- Dredger
- Tug
- Passenger
- Cargo
- Tanker
- Other
- Recreational
- Oil and Gas
- Wind Farm

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

14 days summer 2022 AIS and Radar data by vessel type

VER	DATE	REMARKS	Drawn	Checked
1	13/02/2024	ES	DS	JM

DRAWING NUMBER:

Figure 9.4

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

FIVE ESTUARIES
OFFSHORE WIND FARM

P:\Project\A4542 Five Esturies (VE) GoBe\GIS\ESRI\ES\MXD\VE_Shipping_Navigation_ES_14DaysSummerArray.mxd

9.7.16 Throughout the winter survey, approximately 94% of vessel tracks were recorded via AIS with the remaining 6% recorded via Radar. Throughout the summer survey, approximately 98% of vessel tracks were recorded via AIS with the remaining 2% recorded via Radar.

9.7.17 For the 14 days analysed in winter, there was an average of 102 unique vessels per day recorded within the array traffic study area and 7-8 unique vessels per day intersecting the array areas. The main vessel types within the array traffic study area were cargo vessels (57%), tankers (23%), and fishing vessels (9%).

9.7.18 For the 14 days analysed in summer, there was an average of 116 unique vessels per day recorded within the array traffic study area and 12 unique vessels per day intersecting the array areas. The main vessel types within the array traffic study area were cargo vessels (49%), tankers (18%), and wind farm vessels (14%).

9.7.19 A number of Roll-on/ Roll-off (Ro-Ro) and Roll-on/ Roll-off Passenger (Ro-Pax) operators were recorded during the two 14-day survey periods, including CLdN, DFDS Seaways, P&O Ferries, and Stena Line. Details of some of these services are included in Table 9.8.

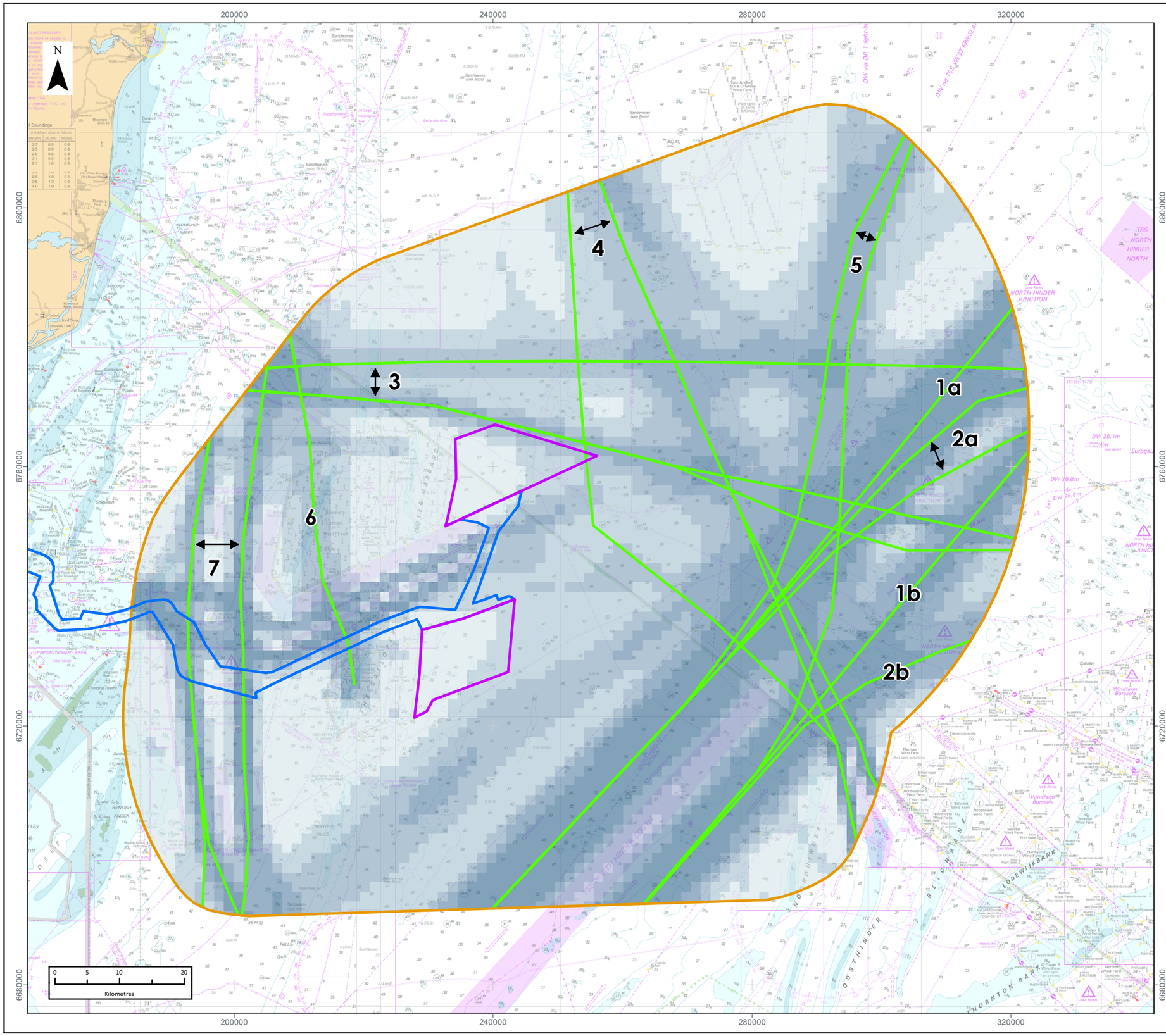
9.7.20 No recreational vessels were recorded during the winter survey period. Throughout the summer survey period an average of seven unique recreational vessels per day were recorded within the array traffic study area. Approximately 92% of recreational vessels were recorded on AIS, 6% on Radar, and 2% from visual observations.

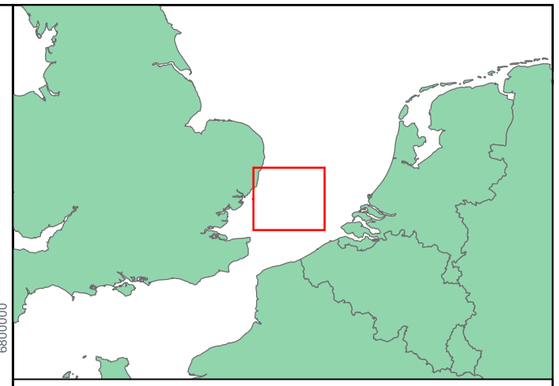
9.7.21 Vessel length was available for approximately 97% of vessels recorded throughout the two 14-day survey periods and ranged from 8 m for a sailing vessel to 400 m for a container vessel. Excluding the proportion of vessels for which length was not available, the average length of vessels within the array traffic study area throughout the winter and summer survey periods was 154 m and 140 m, respectively.

9.7.22 Vessel draught was available for approximately 89% of vessels recorded throughout the two 14-day survey periods and ranged from 1.2 m for two wind farm support vessels to 21.5 m for an oil products tanker. Excluding the proportion of vessels for which draught was not available, the average draught of vessels within the array traffic study area throughout the winter and summer survey periods was 6.4 m and 5.6 m, respectively.

9.7.23 Main commercial routes have been identified using the principles set out in MGN 654 (MCA, 2021). Further details of the process for identifying main commercial routes is provided in Section 11.2 of Volume 9, Report 10: Navigational Risk Assessment. A total of 26 main commercial routes were identified within the array routeing study area. A plot of the high use routes is presented in

9.7.24 Figure 9.5 alongside the vessel traffic density associated with all routeing within the array routeing study area.





LEGEND

- Array Areas
- Offshore Export Cable Corridor
- Array Routeing Study Area

Vessel Routes

- Mean Position

Vessel Routes Density

- Highest
- Lowest

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

High use base case vessel routes

VER	DATE	REMARKS	Drawn	Checked
1	13/02/2024	ES	DS	JM

DRAWING NUMBER:

Figure 9.5

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:600,000	A3	WGS84	World Mercator

FIVE ESTUARIES OFFSHORE WIND FARM

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9.7.25 Descriptions for each of the high use main commercial routes are provided in Table 9.8, with the average vessels per day rounded to the nearest whole number.

Table 9.8: Details of high use main commercial routes within array traffic study area.

Route number	Average vessels per day	Description
1	30	**Port of Amsterdam (Netherlands) – Dover Strait.** Generally used by cargo vessels (74%). Route 1a is eastbound only and Route 1b is westbound only.
2	22	**Dover Strait – Port of Rotterdam (Netherlands).** Used by cargo vessels (59%) and tankers (38%). Route 2a is westbound only and Route 2b is eastbound only, with the latter passing north and south of the NHR buoy.
3	11	**Harwich Haven (UK) – Port of Rotterdam (Netherlands).** Generally used by cargo vessels (77%) including DFDS Seaways and Stena Line operated Ro-Ro services between Felixstowe and Rotterdam, and between Harwich and Rotterdam respectively. This route also includes a Stena Line operated Ro-Pax service between Harwich and Rotterdam.
4	9	**Port of Hull (UK) – Port of Zeebrugge (Belgium).** Used by cargo vessels (50%) and passenger vessels (43%), including a CLdN-operated Ro-Ro services between Killingholme and Zeebrugge, and P&O Ferries-operated Ro-Ro services between Tilbury and Zeebrugge, and between Tees and Zeebrugge. Route 4a is north and southbound whereas Route 4b is southbound only.
5	7	**Dover Strait – North Europe Ports.** Used by cargo vessels (44%) and tankers (53%).
6	7	**Port of Lowestoft (UK) – Greater Gabbard OWF.** Only used by wind farm vessels (100%).
7	6	**Dover Strait – Humber Ports (UK).** Generally used by cargo vessels (68%).

9.7.26 Medium use and low use main commercial routes are presented and described in Section 11.2 of Volume 9, Report 10: Navigational Risk Assessment.

OFFSHORE EXPORT CABLE CORRIDOR

9.7.27 A plot of vessel traffic recorded via AIS over 14 full days in January 2022 (winter) within the offshore ECC study area, colour-coded by vessel type, is presented in

9.7.28 Figure 9.6. Following this, a similar plot over 14 full days in June 2022 (summer) is presented in Figure 9.7.

9.7.29 A number of vessel tracks recorded during the two 14-day survey periods were classified as temporary (non-routine), such as those undertaking surveys or acting as guard vessels. These have therefore been excluded from the analysis.

9.7.30 For the 14 days analysed in winter, there was an average of 44 unique vessels per day recorded within the offshore ECC study area and 37 unique vessels per day intersecting the offshore ECC. The main vessel types within the offshore ECC study area were cargo vessels (66%), tankers (13%), and dredgers (6%).

9.7.31 For the 14 days analysed in summer, there was an average of 70 unique vessels per day recorded within the offshore ECC study area and 59 unique vessels per day intersecting the offshore ECC. The main vessel types within the offshore ECC study area were cargo vessels (40%), recreational vessels (32%), and dredgers (6%).

9.7.32 No recreational vessels were recorded during the winter survey period. Throughout the summer survey period an average of 12 unique recreational vessels per day were recorded within the ECC study area, primarily close to shore including yacht use of a 2 m channel off Frinton-on-Sea.

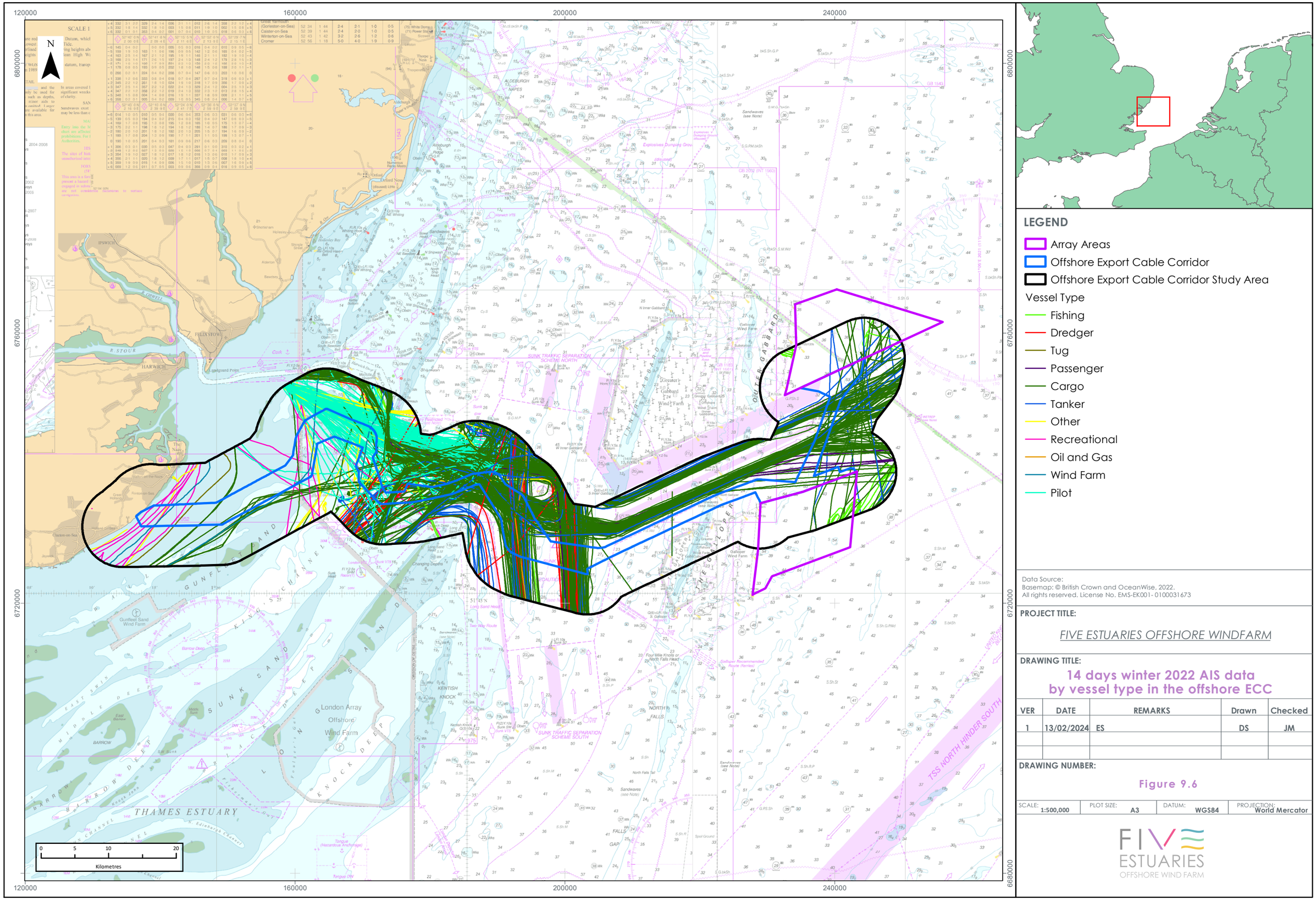
9.7.33 Throughout the survey periods an average of two unique pilot vessels per day were recorded within the offshore ECC study area. These pilot vessels were typically involved in operations out of Harwich Haven from pilot boarding stations in the Sunk routeing measure, with the Sunk pilot boarding station utilised primarily over the Colne and Crouch pilot boarding station. This aligns with feedback received from HHA during consultation.

9.7.34 Vessel length was available for more than 99% of vessels recorded throughout the two 14-day survey periods and ranged from 5 m for a sailing vessel to 400 m for a container vessel. Excluding the proportion of vessels for which length was not available, the average length of vessels within the offshore ECC study area throughout the winter and summer survey periods was 156 m and 107 m, respectively.

9.7.35 Vessel draught was available for approximately 82% of vessels recorded throughout the two 14-day survey periods and ranged from 0.9 m for a wind farm vessel to 15.7 m for two container vessels. Excluding the proportion of vessels for which draught was not available, the average length of vessels within the array traffic study area throughout the winter and summer survey periods was 6.9 m and 6.8 m, respectively.

9.7.36 Further analysis of vessel draught is provided in Section 10 of Volume 9, Report 10: Navigational Risk Assessment based on long-term vessel traffic data collected within the Sunk offshore study area. This analysis found that there is clear and regular use of the deep water routes and Harwich Deep Water Channel by commercial vessels, particularly deeper draught vessels (which are primarily container vessels).

9.7.37 After applying the same criteria as for the analysis of vessel traffic within the array traffic study area, numerous instances of anchoring activity was identified, typically occurring within either of the two designated anchorages in proximity to the offshore ECC. Vessels anchoring in the Sunk DW anchorage were typically of greater length (on average 257 m) than those using the Sunk Inner anchorage (112 m).



LEGEND

- Array Areas
- Offshore Export Cable Corridor
- Offshore Export Cable Corridor Study Area

Vessel Type

- Fishing
- Dredger
- Tug
- Passenger
- Cargo
- Tanker
- Other
- Recreational
- Oil and Gas
- Wind Farm
- Pilot

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

14 days winter 2022 AIS data by vessel type in the offshore ECC

VER	DATE	REMARKS	Drawn	Checked
1	13/02/2024	ES	DS	JM

DRAWING NUMBER:

Figure 9.6

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

FIVE ESTUARIES OFFSHORE WIND FARM

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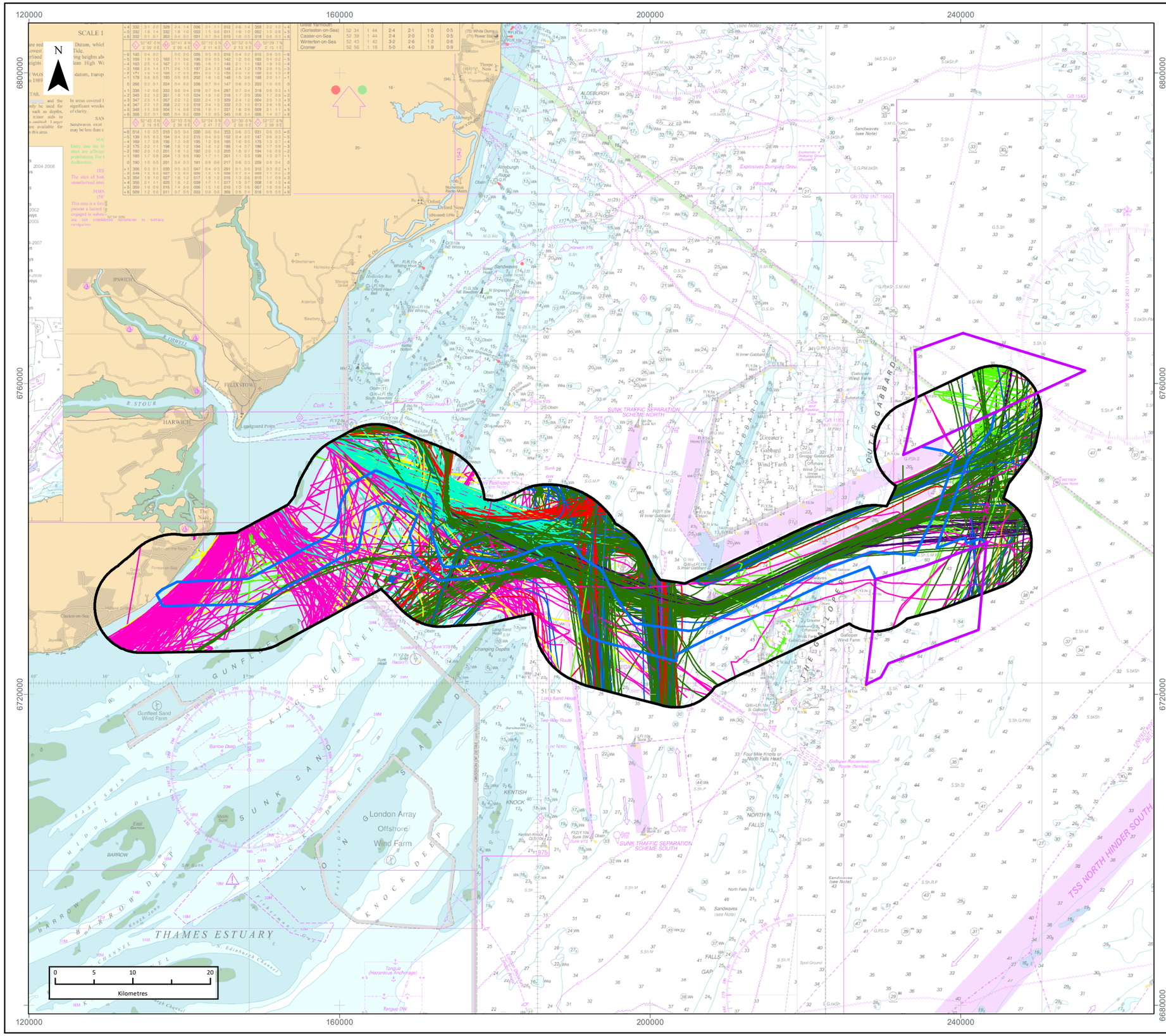
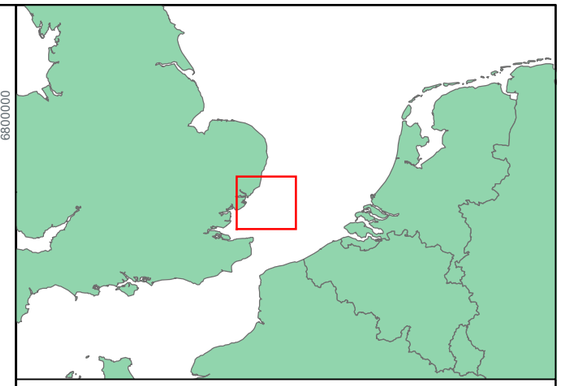




LEGEND

- Array Areas
- Offshore Export Cable Corridor
- Offshore Export Cable Corridor Study Area

Vessel Type

- Fishing
- Military
- Dredger
- Tug
- Passenger
- Cargo
- Tanker
- Other
- Recreational
- Oil and Gas
- Wind Farm
- Pilot

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

14 days summer 2022 AIS data by vessel type in the offshore ECC

VER	DATE	REMARKS	Drawn	Checked
1	13/02/2024	ES	DS	JM

DRAWING NUMBER:

Figure 9.7

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

FIVE ESTUARIES OFFSHORE WIND FARM

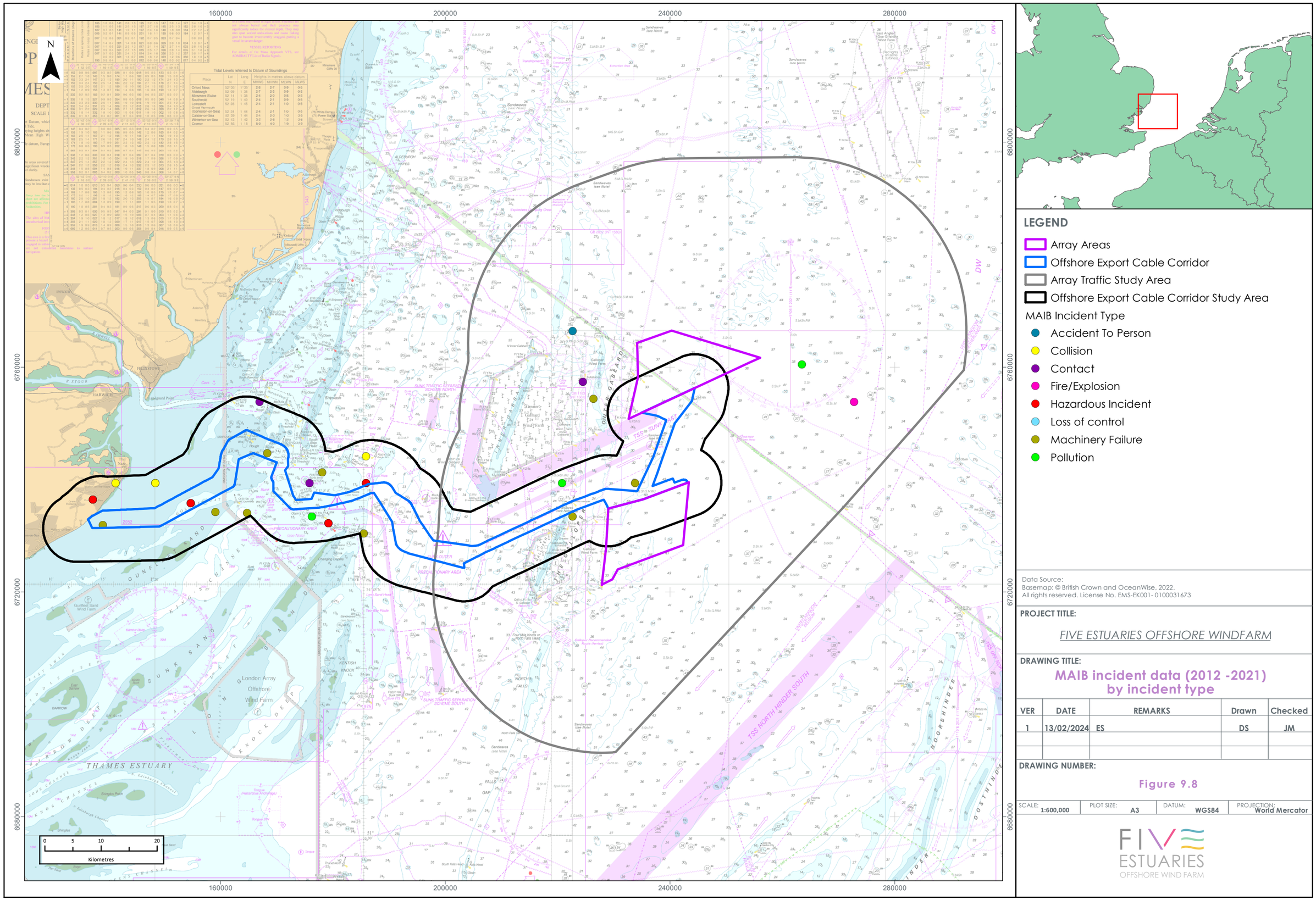
P:\Project\A4542 Five Esturies (VE) GoBe\GIS\ESRI\ES\MXD\VE_Shipping_Navigation_ES_14DaysSummerECC.mxd

HISTORICAL MARITIME INCIDENTS

9.7.38 A plot of the locations of the incidents reported to the MAIB between 2012 and 2021 within the array traffic and offshore ECC study areas, colour-coded by incident type, is presented in Figure 9.8.

9.7.39 A total of 12 incidents were recorded by the MAIB within the array traffic study area between 2012 and 2021, which corresponds to an average of one incident per year. Throughout the 10-year period, no incidents were recorded within the array areas. The most common incident types were accident to person (42%) and machinery failure (25%). The main vessel types involved in incidents were other commercial vessels (50%).

9.7.40 A total of 26 incidents were recorded by the MAIB within the offshore ECC study area between 2012 and 2021, which corresponds to an average of two to three incidents per year. Throughout the 10-year period, three incidents were recorded within the offshore ECC itself. The most common incident types recorded within the offshore ECC study area were machinery failure (31%), accident to person (15%), and hazardous incident (15%). The main vessel types involved in incidents were dry cargo (38%), fishing vessels (15%), and other commercial vessels (15%).



LEGEND

- Array Areas
- Offshore Export Cable Corridor
- Array Traffic Study Area
- Offshore Export Cable Corridor Study Area

MAIB Incident Type

- Accident To Person
- Collision
- Contact
- Fire/Explosion
- Hazardous Incident
- Loss of control
- Machinery Failure
- Pollution

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

MAIB incident data (2012 -2021) by incident type

VER	DATE	REMARKS	Drawn	Checked
1	13/02/2024	ES	DS	JM

DRAWING NUMBER:

Figure 9.8

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:600,000	A3	WGS84	World Mercator

FIVE ESTUARIES
OFFSHORE WIND FARM

P:\Project\A4542 Five Esturies (VE) GoBe\GIS\ESRI\ES\MXD\VE_Shipping_Navigation_ES_MAIB.mxd

EVOLUTION OF THE BASELINE

9.7.41 The characterisation of vessel traffic established for the existing environment is used as input to the environmental assessment (see Section 9.11). However, it is also necessary to consider potential future case vessel traffic, in terms of general volume[1] and size changes, port developments which may influence movements, and changes to movements associated with the presence of VE (the post wind farm scenario).

9.7.42 Section 15 of Volume 9, Report 10: Navigational Risk Assessment provides a detailed review of relevant consultation feedback, vessel trends, the influence of the Suez Canal, and under keel clearance calculations. The conclusions summarised in the subsections below are based on the findings of this review and are considered in the environmental assessment.

VESSEL VOLUME

9.7.43 Defining a suitable growth in commercial vessel volume for the future case is challenging and this has been acknowledged by stakeholders during consultation. There have been various views, but the majority of stakeholders indicated that a 20% increase across all vessels was insufficient.

9.7.44 Noting the concerns are specific to commercial vessels and traffic associated with offshore wind farms, the 20% increase in volume is considered a realistic worst case for commercial fishing vessels and recreational vessels.

9.7.45 For commercial vessels, three distinct bands of vessel traffic growth are considered in the environmental assessment: 10%, 20%, and 30% increases in volume. This reflects the UK Chamber of Shipping's recommendation and strikes a balance between the recommendations of other stakeholders including London Gateway, HHA, and DFDS Seaways, as well as accounting for current vessel trends and constraints.

9.7.46 This increase applies across commercial vessels as a whole and it is recognised that the increase will vary for different routes, areas, and types of commercial vessel. In particular, the increase may be greater than 30% for container vessels utilising the deep water routes within the Sunk Inner Precautionary Area given the further port development at London Gateway and Felixstowe. The level of increase will also be influenced by changes to navigable water depths, with the potential for port access constraints to be reduced should these be increased. Increases by 30% are only expected within the Sunk routeing measure.

VESSEL SIZE

9.7.47 Similarly to vessel volumes, defining a suitable growth in commercial vessel size for the future case is challenging and this has been acknowledged by stakeholders during consultation. Again, there have been various views shared with the focus of discussions (and subsequent desktop review) relating to vessel draught.

[1] Throughout this chapter the term 'vessel volume' refers to the number of vessels and not vessel capacity.

9.7.48 For commercial vessels, a worst case maximum draught of 23 m is considered, with a realistic maximum draught of 20 m. This reflects feedback from HHA and London Gateway recommending use of a 22 m and 20 m draught, respectively, whilst also allowing for some modest future increases noting the uncertainty with future values.

9.7.49 It is noted that the likelihood of a 23 m draught vessel accessing local ports during the lifetime of VE is considered low due to various factors:

- Historical vessel trends suggest that there is limited appetite for container vessels with draughts exceeding 16 m.
- The Suez Canal allows for a maximum draught of 22.1 m and thus would require material dredging works to facilitate use by a vessel with 23 m draught.
- The maximum vessel draught permitted in the Suez Canal has increased only once since 2001 indicating that there is limited international appetite for deeper draught vessels.
- Charted water depths and bathymetric data collected by VE in the area surrounding the offshore ECC indicates that large scale and extensive dredging would be required to allow a 23 m draught vessel to access local ports with such works extending beyond the jurisdiction of the local ports, noting that charted water depths within the Sunk TSS are under 24 m in some locations.

9.7.50 No material changes to the size of commercial fishing vessels and recreational vessels are anticipated nor have any changes been raised by stakeholders during consultation.

VE OPERATIONS

9.7.51 During the construction phase up to 4,311 annual round trips to port will be made by vessels involved in the installation of VE (see Section 9.8). During the O&M phase, up to 1,776 annual round trips to port will be made by vessels involved in the O&M of VE.

MARINE AGGREGATE DREDGING ACTIVITIES

9.7.52 There are numerous marine aggregate dredging areas in the region, the majority of which are active. In the future production associated with these areas may be discontinued, thus reducing the volume of marine aggregate dredger movements. Likewise, new marine aggregate dredging areas may be designated, with two exploration areas screened into the CEA (see Section 9.10).

9.7.53 At this time, it is unclear how frequent marine aggregate dredging activities may be at new sites and therefore no specific changes are considered in the future baseline, noting that marine aggregate dredgers are included in the 10%, 20%, and 30% growth of commercial vessel movements described above.

DATA LIMITATIONS

AUTOMATIC IDENTIFICATION SYSTEM DATA

9.7.54 The carriage of AIS is required on board all vessels of greater than 300 GT engaged on international voyages, cargo vessels of more than 500 GT not engaged on international voyages, passenger vessels irrespective of size built on or after 1 July 2002, and fishing vessels over 15 m length overall (LOA).

9.7.55 Therefore, for the vessel traffic surveys larger vessels were recorded on AIS, while smaller vessels without AIS installed (including fishing vessels under 15 m LOA and recreational craft) were recorded, where possible, on the Automatic Radar Plotting Aid (ARPA) on board the survey vessel. A proportion of smaller vessels also carry AIS voluntarily, typically utilising a Class B AIS device potentially reducing the reliance on Radar.

HISTORICAL INCIDENT DATA

9.7.56 Although all UK commercial vessels are required to report accidents to the MAIB, non-UK vessels do not have to report unless they are in a UK port or within 12 nm territorial waters (noting that the array traffic study area is not located entirely within 12 nm territorial waters) or carrying passengers to a UK port. There are also no requirements for non-commercial recreational craft to report accidents to the MAIB.

9.7.57 The RNLI incident data cannot be considered comprehensive of all incidents in the array traffic study area. Although hoaxes and false alarms are excluded, any incident to which a RNLI resource was not mobilised has not been accounted for in this dataset.

UNITED KINGDOM HYDROGRAPHIC OFFICE ADMIRALTY CHARTS

9.7.58 The UKHO admiralty charts are updated periodically and therefore the information shown may not reflect the real time features within the region with total accuracy. However, during consultation input has been sought from relevant stakeholders regarding the navigational features in the existing environment.

9.8 KEY PARAMETERS FOR ASSESSMENT

9.8.1 The Maximum Design Scenario (MDS) for shipping and navigation has been identified based on parameters included in the project design envelope (see Volume 6, Part 2, Chapter 1: Offshore Project Description). The MDS for each potential effect is provided in Table 9.9.

Table 9.9: Maximum design scenario for the project alone.

Potential effect	Maximum design scenario assessed	Justification
Construction		
Impact C1: Vessel displacement and increased collision risk (array areas)	> Single phase of construction of up to five years; > Full build out of the array areas; > Buoyed construction area encompassing the maximum extent of the array areas; > Presence of 500 m construction safety zones and 50 m pre commissioning safety zones around surface piercing structures; and	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on vessel displacement and subsequent collision risk

Potential effect	Maximum design scenario assessed	Justification
	> Up to 35 construction vessels on-site simultaneously.	involving third-party vessels.
Impact C2: Vessel displacement and increased collision risk (offshore ECC)	> Single phase of construction of up to five years; > Up to two export cables each of 53 nm length; > Indicative separation of between 50 and 200 m between export cables; and > Up to 35 construction vessels on-site simultaneously.	
Impact C3: Third-party with project vessel collision risk (array areas)	> Single phase of construction of up to five years; > Full build out of the array areas; > Buoyed construction area encompassing the maximum extent of the array areas; > Presence of 500 m construction safety zones and 50 m pre commissioning safety zones around surface piercing structures; and > Up to 35 construction vessels on-site simultaneously and up to 4,311 round trips to port.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on third-party with vessel and a project vessel.
Impact C4: Third-party with project vessel collision risk (offshore ECC)	> Single phase of construction of up to five years; > Up to two export cables each of 53 nm length; > Indicative separation of between 50 and 200 m between export cables; and > Up to 35 construction vessels on-site simultaneously and up to 4,311 round trips to port.	
Impact C5: Reduced access to local ports and harbours and reduction in under keel	> Single phase of construction of up to five years; > Full build out of the array areas; > Buoyed construction area encompassing the maximum extent of the array areas;	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal

Potential effect	Maximum design scenario assessed	Justification
clearance (array areas)	> Presence of 500 m construction safety zones and 50 m pre commissioning safety zones around surface piercing structures; > Up to 108 nm of array cables; > Indicative maximum proportion of array cable protection requirement of 20%; > Up to 26 array cable crossings; > Indicative height of protection for array cables of 1.0 m and 1.4 m when including crossings; and > Up to 35 construction vessels on-site simultaneously and up to 4,311 round trips to port.	effect on access to local ports and harbours and reduction in under keel clearance.
Impact C6: Reduced access to local ports and harbours and reduction in under keel clearance (offshore ECC)	> Single phase of construction of up to five years; > Up to two export cables each of 53 nm length; > Indicative separation of between 50 and 200 m between export cables; > Indicative maximum proportion of export cable protection requirement of 10%; > Up to 30 export cable crossings; > Indicative height of protection for export cables of 1.0 m and 1.4 m when including crossings; and > Up to 35 construction vessels on-site simultaneously and up to 4,311 round trips to port.	
O&M		
Impact O1: Vessel displacement and increased collision risk (array areas)	> Maximum operational life of up to 40 years; > Full build out of the array areas; > Presence of 500 m safety zones during major maintenance around surface piercing structures; and	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum

Potential effect	Maximum design scenario assessed	Justification
	> Up to 27 O&M vessels on-site simultaneously and up to 1,776 annual round trips to port.	spatial and temporal effect on vessel displacement and subsequent collision risk involving third-party vessels.
Impact O2: Vessel displacement and increased collision risk (offshore ECC)	> Maximum operational life of up to 40 years; > Up to two export cables each of 53 nm length; > Indicative separation of between 50 and 200 m between export cables; and > Up to 27 O&M vessels on-site simultaneously and up to 1,776 annual round trips to port.	
Impact O3: Third-party with project vessel collision risk (array areas)	> Maximum operational life of up to 40 years; > Full build out of the array areas; > Presence of 500 m safety zones during major maintenance around surface piercing structures; and > Up to 27 O&M vessels on-site simultaneously and up to 1,776 annual round trips to port.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on vessel to vessel collision risk involving a third-party vessel and a project vessel.
Impact O4: Third-party with project vessel collision risk (offshore ECC)	> Maximum operational life up to 40 years; > Up to two export cables each of 53 nm length; > Indicative separation of between 50 and 200 m between export cables; and > Up to 27 O&M vessels on-site simultaneously and up to 1,776 annual round trips to port.	
Impact O5: Reduced access to local port and harbours and reduction in under keel clearance (array areas)	> Maximum operational life of up to 40 years; > Full build out of the array areas; > Presence of 500 m safety zones during major maintenance around surface piercing structures; > Up to 108 nm of array cables; > Indicative maximum proportion of array cable protection requirement of 20%;	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on access to local ports and harbours and

Potential effect	Maximum design scenario assessed	Justification
	> Up to 26 array cable crossings; and > Indicative height of protection for array cables of 1.0 m and 1.4 m when including crossings; and > Up to 27 O&M vessels on-site simultaneously and up to 1,776 annual round trips to port.	reduction in under keel clearance.
Impact O6: Reduced access to local port and harbours and reduction in under keel clearance (offshore ECC)	> Maximum operational life of up to 40 years; > Up to two export cables each of 53 nm length; > Indicative separation of between 50 and 200 m between export cables; > Indicative maximum proportion of export cable protection requirement of 10%; > Up to 30 export cable crossings; > Indicative height of protection for export cables of 1.1 m and 1.4 m when including crossings; and > Up to 27 O&M vessels on-site simultaneously and up to 1,776 annual round trips to port.	
Impact O7: Creation of allision risk (array areas)	> Maximum operational life of up to 40 years; > Full build out of the array areas; > Minimum spacing of 830 m between array structures; > OSP locations as per Figure 6.5 of Volume 9, Report 10: Navigational Risk Assessment; > Up to 79 WTGs on four-legged suction bucket jackets with sea surface dimensions of 38.5×38.5 m; and > Up to two OSPs with topside dimensions of 125×110 m.	Largest possible extent of surface infrastructure, greatest number of surface structures and greatest duration resulting in the maximum spatial and temporal effect on vessel to structure allision risk.
Impact O8: Anchor interaction with	> Maximum operational life of up to 40 years; > Up to 108 nm of array cables;	Largest possible extent of subsea infrastructure and greatest duration

Potential effect	Maximum design scenario assessed	Justification
subsea cables (array areas)	> Indicative maximum burial depth for array cables of 3.3 m; > Indicative maximum proportion of array cable protection requirement of 20%; > Up to 26 array cable crossings; and > Indicative height of protection for array cables of 1.0 m and 1.4 m when including crossings.	resulting in the maximum spatial and temporal effect on anchor interaction with subsea cables.
Impact O9: Anchor interaction with subsea cables (offshore ECC)	> Maximum operational life of up to 40 years; > Up to two export cables each of 53 nm length; > Indicative separation of between 50 and 200 m between export cables; > Indicative maximum burial depth for array cables of 3.3 m; > Indicative maximum proportion of export cable protection requirement of 10%; > Up to 30 export cable crossings; and > Indicative height of protection for export cables of 1.1 m and 1.4 m when including crossings.	
Impact O10: Reduction of emergency response capability (including SAR access)	> Maximum operational life of up to 40 years; > Full build out of the array areas; > Up to 79 WTGs; > Up to two OSPs; > Array layout as per Figure 6.5 of Volume 9, Report 10: Navigational Risk Assessment; and > Up to 27 O&M vessels on-site simultaneously and up to 1,776 annual round trips to port.	Largest possible extent, greatest number of surface structures, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on emergency response capability.
Decommissioning		
Impact D1: Vessel displacement	> Single phase of decommissioning of up to three years;	Largest possible extent of infrastructure, greatest number of simultaneous

Potential effect	Maximum design scenario assessed	Justification
and increased collision risk (array areas)	> Full build out of the array areas; > Buoyed decommissioning area encompassing the maximum extent of the array areas; > Presence of 500 m decommissioning safety zones and 50 m pre decommissioning safety zones around surface piercing structures; and > Up to 35 decommissioning vessels on-site simultaneously.	vessel activities and greatest duration resulting in the maximum spatial and temporal effect on vessel displacement and subsequent collision risk involving third-party vessels.
Impact D2: Vessel displacement and increased collision risk (offshore ECC)	> Single phase of decommissioning of up to three years; > Up to two export cables each of 53 nm length; > Indicative separation of between 50 and 200 m between export cables; and > Up to 35 decommissioning vessels on-site simultaneously.	
Impact D3: Third-party with project vessel collision risk (array areas)	> Single phase of decommissioning of up to three years; > Full build out of the array areas; > Buoyed decommissioning area encompassing the maximum extent of the array areas; > Presence of 500 m decommissioning safety zones and 50 m pre decommissioning safety zones around surface piercing structures; and > Up to 35 decommissioning vessels on-site simultaneously and up to 4,311 round trips to port.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on third-party with vessel and a project vessel.
Impact D4: Third-party with project vessel collision risk (offshore ECC)	> Single phase of decommissioning of up to three years; > Up to two export cables each of 53 nm length; > Indicative separation of between 50 and 200 m between export cables; and	

Potential effect	Maximum design scenario assessed	Justification
	> Up to 35 decommissioning vessels on-site simultaneously and up to 4,311 round trips to port.	
Impact D5: Reduced access to local ports and harbours and reduction in under keel clearance (array areas)	> Single phase of decommissioning of up to three years; > Full build out of the array areas; > Buoyed decommissioning area encompassing the maximum extent of the array areas; > Presence of 500 m decommissioning safety zones and 50 m pre decommissioning safety zones around surface piercing structures; > Up to 108 nm of array cables; > Indicative maximum proportion of array cable protection requirement of 20%; > Up to 26 array cable crossings; and > Indicative height of protection for array cables of 1.0 m and 1.4 m when including crossings; and > Up to 35 decommissioning vessels on-site simultaneously and up to 4,311 round trips to port.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on access to local ports and harbours and reduction in under keel clearance.
Impact D6: Reduced access to local ports and harbours and reduction in under keel clearance (offshore ECC)	> Single phase of decommissioning of up to three years; > Up to two export cables each of 53 nm length; > Indicative separation of between 50 and 200 m between export cables; > Indicative maximum proportion of export cable protection requirement of 10%; > Up to 30 export cable crossings; > Indicative height of protection for export cables of 1.1 m and 1.4 m when including crossings; and > Up to 35 decommissioning vessels on-site simultaneously and up to 4,311 round trips to port.	

9.9 MITIGATION

9.9.1 Mitigation measures that were identified and adopted as part of the evolution of the project design (embedded into the project design) and that are relevant to shipping and navigation are listed in Table 9.10. General mitigation measures, which would apply to all parts of the project, are set out first. Thereafter mitigation measures that would apply specifically to shipping and navigation issues associated with the array and offshore ECC are described separately.

9.9.2 The mitigation contained in Table 9.10 are mitigation measures or commitments that have been identified and adopted as part of the evolution of the project design of relevance to shipping and navigation; these include project design measures, compliance with elements of good practice and use of standard protocols. Where the assessment determined significance effects accounting for embedded mitigation, further measures may be required, which are presented as additional mitigation.

9.9.3 Table 9.11 presents additional mitigation measures. These have typically been put forward 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.

Table 9.10: Mitigation relating to shipping and navigation.

Project phase	Mitigation measures
General	
CBRA	A detailed CBRA to enable informed judgements regarding burial depth to optimise the chance of cables remaining buried whilst seeking to limit the amount of sediment disturbance to that which is necessary. An outline CBRA is provided within Volume 9, Report 9).
Charting of infrastructure	All infrastructure associated with VE (including subsea cables) will be shown on appropriately scaled UKHO admiralty charts.
Compliance with MGN 654	VE will be compliant with MGN 654 and its annexes including in relation to reductions of no more than 5% in under keel clearance and the SAR Checklist.
Guard vessel(s)	A guard vessel(s) will be deployed where deemed appropriate by risk assessment.
Lighting and marking	Lights, marks, sounds, signals, and other aids to navigation will be exhibited as required by Trinity House, MCA and CAA.
Marine coordination for project vessels	Marine coordination will be implemented to manage project vessels including in communication with cumulative project marine coordinators as required. The Applicant also commits to use of entry/ exit points and defined routes to and from construction/ decommissioning and O&M ports to mitigate interaction between

Project phase	Mitigation measures
	third-party and project vessels, and this will be conditioned in the deemed Marine Licence.
Marine Pollution planning	A Marine Pollution Contingency Plan (MPCP) will be developed outlining procedures to protect personnel working and to safeguard the marine environment in the event of a pollution event.
Project vessel compliance with international marine regulations	Project vessels will comply with international marine regulations as adopted by the Flag State, including COLREGs and SOLAS.
Construction	
Application for Safety Zones	An application will be made for safety zones post consent including up to 500 m around ongoing activities during construction and up to 50 m for installed structures pre commissioning.
Buoyed construction area	The array construction area will be marked by buoyage as required by Trinity House.
CSIP	Development of, and adherence to, a Cable Specification and Installation Plan (CSIP), relating to the offshore ECC, post consent. The CSIP will set out appropriate cable burial depth in accordance with industry good practice, minimising the risk of cable exposure. The CSIP will also ensure that cable crossings are appropriately designed to mitigate environmental effects, these crossings will be agreed with relevant parties in advance of CSIP submission. The CSIP will be conditioned in the deemed Marine Licence. An Outline CSIP has been provided as part of this DCO Application (Volume 9, Report 12).
NIP	A NIP will be developed to manage interactions between project vessels associated with export cable installation/ maintenance/ repair and third-party vessels in navigationally sensitive areas. The outline NIP is provided in Volume Report 20: Outline Navigation and Installation Plan.
Promulgation of information	Local Notifications to Mariners and Kingfisher Bulletins will be updated and reissued at weekly intervals during construction.
Traffic monitoring	Monitoring of vessel traffic will be undertaken for the duration of the construction phase.
Operation	
Application for Safety Zones	An application will be made for safety zones post consent including up to 500 m around ongoing activities during major maintenance.
Minimum blade clearance	There will be a minimum blade tip clearance of at least 28 m above Mean High Water Springs (MHWS).

Project phase	Mitigation measures
NIP	A NIP will be developed to manage interactions between project vessels associated with export cable maintenance/ repair and third-party vessels in navigationally sensitive areas. The outline NIP is provided in Volume 9, Report 20: Navigation and Installation Plan.
Promulgation of information	Local Notifications to Mariners and Kingfisher Bulletins will be updated and reissued at least five days prior to planned maintenance works.
Traffic monitoring	Monitoring of vessel traffic will be undertaken for three consecutive years following the completion of construction.
Decommissioning	
Application for Safety Zones	An application will be made for safety zones prior to decommissioning including up to 500 m around ongoing activities during decommissioning and up to 50 m for installed structures pre decommissioning.
Buoyed decommissioning area	The array decommissioning area will be marked by buoyage as required by Trinity House.
Promulgation of information	Local Notifications to Mariners and Kingfisher Bulletins will be updated and reissued at weekly intervals during decommissioning.

Table 9.11: Additional mitigation relating to shipping and navigation.

Additional mitigation measure	Description
Additional aids to navigation	Trinity House have indicated during consultation that additional aids to navigation (such as buoys) may be necessary to mitigate effects during the construction phase; this will be discussed as part of lighting and marking discussions for the final array layout post consent.

9.10 CUMULATIVE EFFECTS ASSESSMENT SCREENING

9.10.1 The CEA for shipping and navigation including the tiering of projects has been undertaken in accordance with the methodology provided in Volume 6, Part 1, Annex 3.1: Cumulative Effects Assessment Methodology and Section 3.3 of Volume 9, Report 10: Navigational Risk Assessment.

9.10.2 The projects and plans selected as relevant to the assessment of impacts to shipping and navigation are based upon an initial screening exercise undertaken on a long list. Each project, plan or activity has been considered and scoped in or out on the basis of effect-receptor pathway, data confidence and the temporal and spatial scales involved. An aggregate of these criteria is used to determine the tier of each project, outlined in Table 9.12. For the purposes of assessing the impact of VE on shipping and navigation in the region, a number of projects and plans have been screened in and are presented in Table 9.13.

Table 9.12: Description of Tiers of other developments considered for cumulative effect assessment.

Tiers	Criteria
Tier 1	Consented.
	> Offshore wind farms – up to 10 nm from the array areas or 2 nm from the offshore ECC. > Marine aggregate areas – up to 10 nm from the array areas or 2 nm from the offshore ECC. > Subsea cables – up to 2 nm from the array areas or offshore ECC.
	> May interact with a main commercial route passing within 1 nm of the array areas or offshore ECC. > Interacts with traffic which may be directly displaced by the array areas or offshore ECC.
	Raised as having a potential cumulative effect.
	High data confidence.
Tier 2	Scoped.
	> Offshore wind farms – between 10 and 25 nm from the array areas or between 2 and 5 m from the offshore ECC. > Marine aggregate areas – between 10 and 20 nm from the array areas or between 2 and 5 nm from the offshore ECC.
	> May interact with a main commercial route passing within 1 nm of the array areas or offshore ECC. > Interacts with traffic which may be directly displaced by the array areas or offshore ECC.
	Raised as having a potential cumulative effect.
	Medium data confidence.
Tier 3	Pre scoping or early development.
	> Offshore wind farms – between 25 and 50 nm from the array areas.
	> Does not impact a main commercial route passing within 1 nm of the array areas. > Does not interact with traffic which may be directly displaced by the array areas.
	No concerns raised.

Tiers	Criteria
	Low data confidence.

9.10.3 It is noted that projects which are operational, in production or active have been screened out of the CEA on the basis that they are included as part of the shipping and navigation baseline[2]. Nautilus has been screened out on the basis of insufficient information being available.

9.10.4 The 12 cumulative projects and plans screened in were welcomed by the MCA in their section 42 response.

Table 9.13: Projects considered within the shipping and navigation CEA.

Development type	Project	Status	Data confidence assessment/ phase	Tier
OWF	East Anglia One North	Consented	High	Tier 2
OWF	East Anglia Three	Consented	High	Tier 3
OWF	East Anglia Two	Consented	High	Tier 1
Marine aggregate area	East Orford Ness 1809	Exploration	High	Tier 1
OWF	Hollandse Kust (West)	Area of search	Low	Tier 3
OWF	Hollandse Kust F	Area of search	Low	Tier 3
Subsea cable	NeuConnect	Proposed	Medium	Tier 1
OWF	Norfolk Vanguard East	Consented	High	Tier 3
OWF	Norfolk Vanguard West	Consented	High	Tier 3
OWF/ subsea cable	North Falls	Scoped	High	Tier 1
Marine aggregate area	Outer OTE 528/2	Exploration	High	Tier 2

[2] In the case of offshore wind farms, a development is considered active at the point where construction buoyage is installed.

Development type	Project	Status	Data confidence assessment/ phase	Tier
Subsea cable	Sea Link	Scoped	Medium	Tier 1

9.10.5 The cumulative MDS for shipping and navigation has been identified based on parameters included in the project design envelope (see Volume 6, Part 2, Chapter 1: Offshore Project Description). The MDS for each potential cumulative effect is provided in Table 9.13.

Table 9.14: Cumulative MDS.

Impact	Scenario	Justification
Impact 1: Vessel displacement and increased collision risk (array areas)	VE together with East Anglia Two, East Orford Ness 1809, and Norfolk Vanguard West.	Main commercial route(s) identified for the in-isolation scenario interact with these cumulative projects.
Impact 2: Vessel displacement and increased collision risk (offshore ECC)	VE together with all screened in subsea cable projects.	Simultaneous installation/ removal or maintenance activities with VE will increase the spatial extent and exposure of the impact.
Impact 3: Third-party with project vessel collision risk (array areas)	VE together with NeuConnect and all screened in OWFs.	Simultaneous installation/ removal or maintenance activities for NeuConnect with VE will increase the spatial extent and exposure of the impact. Common base ports for VE, North Falls, and/ or East Anglia Two may increase collision risk.
Impact 4: Third-party with project vessel collision risk (offshore ECC)	VE together with North Falls and all screened in subsea cable projects.	Simultaneous installation/ removal or maintenance activities for subsea cable projects with VE will increase the spatial extent and exposure of the impact. Project vessels associated with North Falls may cross the Sunk TSS East and increase collision risk.
Impact 5: Reduced access to local port	VE together with East Anglia Two.	The combined north-south extent of VE and East Anglia

Impact	Scenario	Justification
and harbours and reduction in under keel clearance (array areas)		Two may affect port schedules for commercial vessels headed to/ from the numerous ports and harbours on the UK east coast.
Impact 6: Reduced access to local port and harbours and reduction in under keel clearance (offshore ECC)	VE together with all screened in subsea cable projects.	Simultaneous installation/ removal or maintenance activities for subsea cable projects with VE may affect port schedules and pilot boarding operations.
Impact 7: Creation of allision risk (array areas)	VE together with East Anglia Two.	The navigational corridor between VE and East Anglia Two may create additional allision risk.
Impact 8: Anchor interaction with subsea cables (array areas)	VE together with NeuConnect.	Should NeuConnect be installed in close proximity to the array cables then the spatial extent of the impact will be increased.
Impact 9: Anchor interaction with subsea cables (offshore ECC)	VE together with all screened in subsea cable projects.	Should subsea cable projects be installed in close proximity to the export cables then the spatial extent of the impact will be increased.
Impact 10: Reduction of emergency response capability (including SAR access)	VE together with all screened in projects.	Activities associated with cumulative projects will further increase the likelihood of an incident requiring an emergency response and subsequently increase the likelihood of multiple incidents occurring simultaneously.

9.11 ENVIRONMENTAL ASSESSMENT

IMPACT 1: VESSEL DISPLACEMENT AND INCREASED COLLISION RISK (ARRAY AREAS)

9.11.1 Construction/ decommissioning activities and the presence of surface structures within the array areas may result in the displacement of vessels from their existing routes and activities. This displacement may result in an increased risk of a collision between third-party vessels.

IN ISOLATION SCENARIO – ALL RECEPTORS

9.11.2 The potential for displacement of vessels due to the presence of the array areas and associated construction activities has been raised by stakeholders during consultation including Stena Line, CLdN, and Intrada Ship Management.

9.11.3 The potential for increased collision risk for third-party vessels as a consequence of displacement has also been raised by multiple stakeholders during consultation including the MCA, Trinity House, UK Chamber of Shipping, Stena Line and Intrada Ship Management. The MCA and Trinity House also highlighted the need for consideration of IMO routeing measures and the ability for vessels to abide by the COLREGs when navigating within and in proximity to such routeing measures.

MAIN COMMERCIAL ROUTE DISPLACEMENT

9.11.4 During the construction and decommissioning phases, a buoyed construction/ decommissioning area will be deployed around each array area accounting for the presence of the traffic routeing between the two array areas. No restrictions on entry will be enforced for the buoyed construction/ decommissioning areas or the arrays during the O&M phase outside of any statutory safety zones. However, based on experience at previously under construction and existing operational OWFs (including the neighbouring Greater Gabbard and Galloper), it is anticipated that commercial vessels will choose not to navigate internally within the buoyed construction/ decommissioning areas or the operational arrays. These assumptions have been supported during consultation with Regular Operators including Stena Line, A2B-online and Tarmac Marine. Therefore, some displacement of main commercial routes is expected during all phases, with less available sea room for navigation, as highlighted by CLdN and Intrada Ship Management during consultation.

9.11.5 Main commercial routes have been identified in line with the principles set out in MGN 654 (MCA, 2021) based primarily on vessel traffic data collected during dedicated surveys (28 days in winter and summer 2022) and from coastal receivers (12 months in 2019) but also Anatec's ShipRoutes database. Further details of the methodology for main commercial route identification is provided in Section 11.1 of Volume 9, Report 10: Navigational Risk Assessment, noting that the vessel traffic data has been agreed as appropriate by the MCA and Trinity House, as well as being discussed within the Hazard Workshop. As part of the future case considerations, increases of 10%, 20%, and 30% of all commercial traffic is assumed, in line with Section 9.7.

9.11.6 The full methodology for main commercial route deviations is provided in Section 15.6 of Volume 9, Report 10: Navigational Risk Assessment, with deviations established in line with MGN 654. A deviation may be required for six main commercial routes, as illustrated in Figure 15.5 of Volume 9, Report 10: Navigational Risk Assessment. The level of deviation varies between a decrease of 1 nm for Route 4 and an increase of 2.7 nm for Route 26, with the maximum percentage change in total route length being 1.4% (for Route 26).

9.11.7 The size of these deviations is small, particularly when considered relative to the length of the routes overall which range from 104 to 338 nm within the North Sea alone[3]. Effects on vessel approaches to IMO routeing measures in the region (such as the Sunk and North Hinder routeing measures) are therefore considered negligible. In some instances, these small deviations are resultant of the refinement of the array areas undertaken between the Scoping and PEIR stages which minimises the displacement to heavily trafficked commercial ferry routes, i.e., without this refinement the deviations would have been larger. This refinement has been well received by stakeholders including MCA, Trinity House, the UK Chamber of Shipping, Stena Line and DFDS Seaways (two of the key commercial ferry operators in the region).

9.11.8 Whilst vessel traffic on the deviated routes is regular the associated deviations are small. This aligns with consultation feedback from the MCA noting that the region features a number of regularly used routes and through traffic to major ports.

9.11.9 The most likely consequences of vessel displacement will be increased journey times and distances for affected third-party vessels, as indicated by Stena Line and CLdN during consultation. The impact will occur over a local spatial extent given that the buoyed construction/ decommissioning areas will be deployed around the maximum extent of the array areas.

9.11.10 As a worst case, there could be disruption to schedules, particularly for commercial ferry operators in the region. However, given the anticipated size of the deviations outlined above and the international nature of routeing in the region alongside the ability to passage plan, disruptions to schedule are expected to be minimal.

COLLISION RISK

9.11.11 Post wind farm modelling using the main commercial route deviations as input gives an estimated collision return period of one in 5.20 years for base case traffic levels, rising to one in 3.08 years for the highest tier of future case traffic levels (23%). The high level of collision risk is due to the high volume of vessel traffic in the area, particularly within the North Hinder routeing measures. However, the base case collision result represents a 0.32% increase compared to the pre wind farm base case result indicating that the influence of the array areas on the overall collision risk for commercial traffic is very low. This reflects historical incident data which indicates that no collision incidents between third-party vessels have occurred directly as a result of a UK OWF.

[3] Some main commercial routes in the region extend beyond the North Sea, such as into the English Channel and the Baltic Sea. Such routes have a wide variety of potential destinations and therefore determining an overall route length (to/from a specific port) beyond the North Sea is not feasible.

9.11.12 In poor visibility, third-party vessels may experience limitations regarding visual identification of other third-party vessels, either when passing on another side of the buoyed construction/ decommissioning areas and operational arrays, or when navigating internally within the operational arrays (small craft only). These limitations may increase the potential for an encounter. However, this will be mitigated by the application of the COLREGs (reduced speeds) in adverse weather conditions. Moreover, the minimum spacing between structures (830 m) will be sufficient to ensure any visual hindrance is very short-term in nature.

9.11.13 The extension of the Sunk TSS East has been considered as possible additional mitigation for reducing the likelihood of a collision risk. However, given the refinement of the array areas since the Scoping stage, and the subsequent positive effect on hotspots of collision risk (for further details see Section 16.4 of Volume 9, Report 10: Navigational Risk Assessment), the MCA have confirmed that they do not propose to pursue an extension to the Sunk TSS East, with this stance widely supported at the Hazard Workshop. Additionally, Stena Line suggested that the arrays form a natural corridor, thus mitigating any need for an extension to the Sunk TSS East. Only MSC have indicated any preference during consultation for an extension to the Sunk TSS East, although MSC also raised the option of using cardinal buoys to mark the array areas.

9.11.14 The most likely consequences in the event of an encounter between two or more third-party vessels is the implementation of avoidance action in line with the COLREGs, with the vessels involved able to resume their respective passages with no long-term consequences.

9.11.15 Should an encounter develop into a collision incident, it is most likely to involve minor contact resulting in minor damage to the vessels with no harm to people and no substantial reputational effects. As a worst case with very low frequency of occurrence one of the vessels could receive substantial damage or founder with Potential Loss of Life (PLL) and pollution, with this outcome more likely where one of the vessels is a small craft (e.g., fishing vessel, recreational vessel or Crew Transfer Vessel (CTV)).

9.11.16 It is acknowledged that vessel traffic monitoring will be undertaken throughout the construction phase to characterise changes to routeing patterns. These will be compared against the anticipated deviations determined in the NRA to allow a comprehensive review of the mitigation applied at the time.

ADVERSE WEATHER ROUTEING

9.11.17 The need to consider commercial routeing in adverse weather conditions was highlighted by the MCA, Hanson Aggregates, and Intrada Ship Management during consultation.

9.11.18 From the long-term vessel traffic data, two cases of alternative routeing characteristic of possible adverse weather routeing were observed, featuring navigation between Grimsby/ Hull and Zeebrugge which passes through the northern array area. These cases are analysed further in Section 12.2 of Volume 9, Report 10: Navigational Risk Assessment, noting that neither of the vessels featured remain present in the region. During consultation CLdN acknowledged that the alternative routeing is likely a result of Master preference but may have limited benefits.

9.11.19 As with displacement to standard routeing, the refinement of the array areas undertaken between the Scoping and PEIR stages has increased the available sea room for such adverse weather routeing, such that it is anticipated that this routeing may safely continue during all phases.

9.11.20 In terms of frequency, during consultation the UK Chamber of Shipping and DFDS Seaways noted that adverse weather routeing represents a very small portion of all routeing in the region.

9.11.21 The most likely consequences of displacement of adverse weather routeing are similar to that of displacement of standard weather routeing, i.e., slightly increased journey times and distances for affected third-party vessels with the impact occurring over a local spatial extent given that the buoyed construction/ decommissioning areas and infrastructure will be deployed around the maximum extent of the array areas.

9.11.22 As a worst case, the deviated route may be considered unsafe for navigation in adverse weather conditions resulting in the vessel being unable to make the transit. It is considered highly unlikely that the vessel would proceed on an unsafe transit and therefore the effect on the vessel and/ or crew is negligible due to the frequency of occurrence.

PROMULGATION OF INFORMATION AND PASSAGE PLANNING

9.11.23 All vessels operating in the area are expected to comply with international flag state regulations (including the COLREGs and SOLAS) and will have a raised level of awareness of construction and decommissioning activities given the promulgation of information relating to VE including the charting of the construction/ decommissioning areas on relevant nautical charts and the use of safety zones. The buoyed construction/ decommissioning areas will also serve to maximise awareness. Likewise, during the O&M phase, infrastructure will be appropriately marked on relevant nautical charts and awareness of the operational arrays will be very high and continue to increase with the longevity of VE.

9.11.24 All vessels are expected to comply with flag state regulations including Regulation 34 of SOLAS Chapter V – which states that *"the voyage plan shall identify a route which… anticipates all known navigational hazards and adverse weather conditions"* (IMO, 1974) – and IMO Resolution A.893(21) on the Guidelines for Voyage Planning (IMO, 1999). The promulgation of information relating to VE will assist such passage planning.

SMALL CRAFT DISPLACEMENT

9.11.25 From the vessel traffic survey data (which incorporates Radar and visual observations in addition to AIS) regular transits by commercial fishing vessels and recreational vessels through the northern array area are infrequent (noting that displacement of commercial fishing vessels engaged in fishing activity is assessed in Volume 6, Part 2, Chapter 8: Commercial Fisheries). However, sailing vessels participating in the annual Royal Ocean Racing Club (RORC) North Sea Race do pass through the northern array area. There are more regular transits in a north-east – south-west direction through the southern array area, with the course of the RORC North Sea Race also passing through. It is anticipated that sailing vessels participating in the RORC North Sea Race will be displaced by the array areas, although the RORC have not engaged in consultation.

9.11.26 Based on experience at previously under construction OWFs it is anticipated that commercial fishing vessels and recreational vessels will choose not to navigate internally within the buoyed construction/ decommissioning areas. Therefore, some displacement of transits by small craft will be required during the construction and decommissioning phases.

9.11.27 For regular transits through the southern array area, there is again sufficient sea room available for deviations to the south-east. The distance between the southern array area and the North Hinder South TSS is approximately 5.4 nm and therefore it is not anticipated that this displacement will result in any substantial increase in interaction between small craft and larger commercial vessels utilising this routeing measure.

9.11.28 For the O&M phase, based on experience at existing operational OWFs, it is anticipated that commercial fishing vessels and recreational vessels may choose to navigate internally within the operational arrays, particularly in favourable weather conditions and as awareness of the array increases throughout the O&M phase. However, the Cruising Association indicated during consultation that sailing vessels would likely avoid the array areas. In situations where small craft do navigate internally, the level of displacement is considered negligible.

COLLISION RISK INVOLVING SMALL CRAFT

9.11.29 From the vessel traffic survey data (which incorporates Radar and visual observations in addition to AIS) regular transits by commercial fishing vessels and recreational vessels through the northern array area are infrequent.

9.11.30 Since the changes in highest collision risk areas for commercial vessels are minor there is not anticipated to be a substantial shift in the interaction of small craft with commercial vessels. The annual RORC North Sea Race, which may be displaced east of the northern array area, may be subject to greater exposure, although race participants are familiar navigating in busy areas and information relating to the race itself is highly promulgated.

9.11.31 In relation to the Sunk TSS East, Stena Line recommended during consultation that the implementation of a recommended route for small craft to offer segregation from larger commercial vessels would be beneficial. The vessel traffic survey data indicates that small craft movements typically occur directly south of the eastbound lane, resulting in a natural segregation between small craft and commercial vessels. Therefore, it is not considered necessary to implement a recommended route for small craft.

9.11.32 In the event of a collision incident involving a small craft with comparatively weaker structural integrity (due to hull materials) compared to a larger commercial vessel, the likelihood of a worst case outcome (the small craft foundering with PLL and pollution) will be greater.

CUMULATIVE SCENARIO – ALL RECEPTORS

TIER 1

9.11.33 Four of the main commercial routes identified for the in isolation scenario interact with East Anglia Two (and will be permanently displaced) and one with East Orford Ness 1809 (and could be temporarily displaced due to the presence of a marine aggregate dredger). The level of permanent cumulative deviation varies between a decrease of 1.3 nm for Route 4 and an increase of 2.3 nm for Route 19, with the maximum percentage change in total route length being 1.1% (for Route 19). All four routes are also displaced by the array areas.

9.11.34 As with the in isolation scenario, the size of these deviations is small, particularly when considered relative to the length of the routes overall. Again, effects on vessel approaches to IMO routeing measures in the region (such as the Sunk and North Hinder routeing measures) are therefore considered negligible. Although the size of the deviations is small, vessel traffic volumes associated with the deviated routes are high, with the busiest route requiring a deviation featuring an average of 11 vessels per day (Route 3).

9.11.35 Noting the size of the deviations, additional increases in collision risk due to the presence of East Anglia Two and East Orford Ness 1809 will be limited, i.e., comparable with the in isolation scenario. For routeing through the navigational corridor between VE and East Anglia Two (Route 3), a safety case has been undertaken in Section 17 of Volume 9, Report 10: Navigational Risk Assessment and includes consideration of vessels overtaking, collision avoidance, crossing commercial traffic, and the effect of non-transit receptors (including marine aggregate dredgers associated with East Orford Ness 1809. The safety case concluded that the corridor's design (including width) meets safety of navigation expectations.

TIER 2

9.11.36 For this impact there is no direct link between the array areas and any Tier 2 developments and therefore no additional assessment of effects has been undertaken.

TIER 3

9.11.37 One of the main commercial routes identified for the in isolation scenario interacts with Norfolk Vanguard West and will be permanently displaced (Route 10). However, this route is not displaced by the array areas; the minimum passing distance of this route from the array areas is approximately 7.8 nm which is great enough that the presence of the array areas is not anticipated to have any additional effects in terms of vessel displacement and subsequent collision risk.

MITIGATION

9.11.38 Mitigation identified as relevant to reducing the significance of effect are as follows:

- Application for safety zones;
- Buoyed construction areas;
- Charting of infrastructure;
- Compliance with MGN 654;
- Guard vessels as required;
- Lighting and marking;
- NIP;
- Promulgation of information;
- Pollution planning; and
- Vessel traffic monitoring.

POTENTIAL SIGNIFICANCE OF EFFECT

9.11.39 The frequency of occurrence and severity of consequence due to vessel displacement and increased collision risk associated with the array areas for each phase of VE is presented in Table 9.15 alongside the resulting significance of effect.

Table 9.15: Significance of effect for vessel displacement and increased collision risk (array areas).

Scenario	Phase	Worst case consequences	Frequency of occurrence	Severity of consequence	Significance of effect
VE in isolation	Construction	Displacement with effects on schedule and collision incident occurs with vessel damage, PLL, and/ or pollution.	Extremely Unlikely	Moderate	Broadly Acceptable
	O&M		Negligible	Moderate	Broadly Acceptable
	Decommissioning		Extremely Unlikely	Moderate	Broadly Acceptable
Cumulative	Construction		Remote	Moderate	Tolerable with Mitigation
	O&M		Extremely Unlikely	Moderate	Broadly Acceptable

Scenario	Phase	Worst case consequences	Frequency of occurrence	Severity of consequence	Significance of effect
	Decommissioning		Remote	Moderate	Tolerable with Mitigation

9.11.40 An additional mitigation has been identified relevant to this impact: Trinity House have indicated during consultation that additional aids to navigation (such as buoys) may be necessary to mitigate effects during the construction phase; this will be discussed as part of lighting and marking discussions for the final array layout post consent.

IMPACT 2: VESSEL DISPLACEMENT AND INCREASED COLLISION RISK (OFFSHORE EXPORT CABLE CORRIDOR)

9.11.41 Construction, maintenance, and decommissioning activities associated with the offshore ECC may result in the displacement of vessels from their existing routes and activities. Vessel displacement may subsequently result in an increased risk of a collision between third-party vessels.

IN ISOLATION SCENARIO – ALL RECEPTORS

9.11.42 Once installed the presence of the export cables will not directly result in vessel displacement (noting that impacts associated with port/ harbour access and under keel clearance are assessed separately). Therefore, this impact is considered only in relation to export cable installation and maintenance activities.

9.11.43 Given the complexity of the area in terms of vessel activity and cable installation, this hazard is mitigated by the inclusion of an Outline NIP as a consent requirement secured as condition of the transmission dML (see Volume 9, Report 20: Outline Navigation Installation Plan).

9.11.44 The spatial extent of the impact will be limited to where installation/ removal or maintenance activities are ongoing, with routeing vessels required to make small deviations to pass around installation/ removal or maintenance works. Although the offshore ECC passes through the Sunk routeing measure, the Applicant is committed to working with regulators and interested parties to minimize the displacement of third-party vessels through agreement and dissemination of the NIP.

9.11.45 Additionally, mariners navigating in proximity to the offshore ECC will have a raised level of awareness given the complexity of the region in terms of navigational features. This will be heightened further by the promulgation of information relating to VE including the publication of Notifications to Mariners as export cable installation progresses and maintenance activities are required, as well as regular engagement with the Sunk VTS in line with the NIP. Tarmac Marine indicated during consultation that they have a preference to be informed via a Notification to Mariners when installation works commence.

9.11.46 The most likely and worst case consequences of vessel displacement due to installation/ removal or maintenance activities for the offshore ECC are generally analogous to those outlined for the array areas, although the likelihood of disruption to vessel schedules is likely to be lower than for the array areas given the operation of the Sunk VTS and the agreement and dissemination of the NIP. As a worst case there could be potential for increased encounters and congestion at areas of the offshore ECC with less available sea room (i.e., within the Sunk Inner Precautionary Area) and subsequently a risk of collision with PLL, pollution and vessel damage as outcomes. However, the NIP will include planned protocols and actions in the event of any close encounters.

CUMULATIVE SCENARIO – ALL RECEPTORS

TIER 1

9.11.47 North Falls (export cables), NeuConnect, and Sea Link are expected to intersect the offshore ECC including crossings. In the unlikely event that simultaneous operations occur during installation/ removal or maintenance activities for VE and subsea cable developments, the NIP will be expanded to include project vessel management procedures and planned protocols to minimize disruption to third-party vessels.

9.11.48 Additionally, it is assumed that other developments will suitably promulgate information including via Notifications to Mariners as cable installation progresses and maintenance activities are required. Therefore, mariners may have an even greater level of awareness of ongoing activities than for the in isolation scenario.

TIER 2

9.11.49 For this impact there is no direct link between the offshore ECC and any Tier 2 developments and therefore no additional assessment of effects has been undertaken.

TIER 3

9.11.50 For this impact there is no direct link between the offshore ECC and any Tier 3 developments and therefore no additional assessment of effects has been undertaken.

MITIGATION

9.11.51 Mitigation identified as relevant to reducing the significance of effect are as follows:

- Charting of infrastructure;
- Compliance with MGN 654;
- Guard vessels as required;
- NIP;
- Pollution planning; and
- Promulgation of information.

POTENTIAL SIGNIFICANCE OF EFFECT

9.11.52 The frequency of occurrence and severity of consequence due to vessel displacement and increased collision risk associated with the offshore ECC for each phase of VE is presented in Table 9.16 alongside the resulting significance of effect.

Table 9.16: Significance of effect for vessel displacement and increased collision risk (offshore ECC).

Scenario	Phase	Worst case consequences	Frequency of occurrence	Severity of consequence	Significance of effect
VE in isolation	Construction	Displacement with effects on schedule and collision incident occurs with vessel damage, PLL, and/ or pollution	Remote	Moderate	Tolerable with Mitigation
	O&M		Extremely Unlikely	Moderate	Broadly Acceptable
	Decommissioning		Remote	Moderate	Tolerable with Mitigation
Cumulative	Construction		Reasonably Probable	Moderate	Tolerable with Mitigation
	O&M		Negligible	Moderate	Broadly Acceptable
	Decommissioning		Reasonably Probable	Moderate	Tolerable with Mitigation

IMPACT 3: THIRD-PARTY WITH PROJECT VESSELS COLLISION RISK (ARRAY AREAS)

9.11.53 The presence of vessels associated with construction, O&M, and decommissioning activities for the array areas may result in increased risk of a collision between a third-party vessel and a project vessel.

IN ISOLATION SCENARIO – ALL RECEPTORS

9.11.54 The construction phase may last for up to five years and the decommissioning phase up to three years. For both phases, up to 35 construction/ decommissioning vessels may be located on-site simultaneously, in turn making a maximum of 4,311 round trips to port. The O&M phase may last for up to 40 years with up to 27 O&M vessels located on-site simultaneously, in turn making a maximum of 1,776 annual round trips to port. Some project vessels may be RAM and it is anticipated that project vessels will generally undertake construction/ decommissioning or O&M works associated with the array areas within the buoyed construction/ decommissioning areas or operational arrays, both of which third-party vessels are generally expected to avoid.

9.11.55 From historical incident data, there has been one instance of a third-party vessel colliding with a project vessel associated with a UK OWF. In this incident, occurring in 2011, moderate vessel damage was reported with no harm to persons. Since then, awareness of OWF developments and the application of the measures outlined below has improved or been refined considerably in the interim, with no further collision incidents reported since. This was reflected in feedback from CLdN during consultation that the presence of project vessels does not represent a notable concern since third-party vessels can comfortably and safely operate around construction activities.

9.11.56 Project vessels will be managed by a marine coordination facility which will work in communication with the Sunk VTS. The coordinators will consider the need for entry/ exit points to and from the array areas to account for heavily trafficked areas. Entry/ exit points will be designated post consent once construction/ decommissioning and O&M ports have been identified. This has been suggested by the UK Chamber of Shipping and Stena Line as suitable mitigation to control interaction with commercial traffic. Project vessels will also carry AIS and be compliant with Flag State regulations including the COLREGs.

9.11.57 Authorised safety zones around active construction/ decommissioning and major maintenance works will also serve to protect third party and project vessels. These will be particularly effective in the event of smaller craft such as commercial fishing vessels and recreational vessels choosing to navigate internally within the operational arrays, where a project vessel may be undertaking major maintenance at a structure. Details of authorised safety zones will be promulgated alongside details of ongoing activities, thus maximising awareness for all third-party receptors, including in both day and night conditions.

9.11.58 In poor visibility, third-party vessels may experience limitations regarding visual identification of project vessels entering and exiting the buoyed construction/ decommissioning areas and operational arrays. However, this will be mitigated by the application of the COLREGs (reduced speeds) in adverse weather conditions and project vessel compulsory AIS carriage.

9.11.59 The most likely consequences (during any phase) in the event of an encounter between a third-party and project vessel is the implementation of avoidance action in line with the COLREGs, with the vessels involved able to resume their respective passages with no long-term consequences.

9.11.60 Should an encounter develop into a collision incident, it is most likely to involve minor contact resulting in minor damage to the vessels with no harm to people (as noted in incidents occurred to date) and no substantial reputational effects. As a worst case, one of the vessels could founder with PLL and pollution, with this outcome more likely where one of the vessels is a small craft (e.g., fishing vessel, recreational vessel, or CTV) with comparatively weaker structural integrity given the hull materials used.

CUMULATIVE SCENARIO – ALL RECEPTORS

TIER 1

9.11.61 NeuConnect is expected to intersect the northern array area. Should installation/ removal or maintenance activities for VE and NeuConnect occur simultaneously then there is potential for additional project vessels associated with both developments to be located within or in proximity to the array areas, as noted by the UK Chamber of Shipping during consultation. However, this is considered highly unlikely.

9.11.62 In the unlikely event that there is simultaneous installation/ removal or maintenance activities, the likelihood of an encounter between a third-party vessel and a project vessel will be greater.

9.11.63 On-site project vessel activities associated with North Falls and East Anglia Two are not expected to create a cumulative effect with VE. However, at the time of writing, the base ports for VE and these developments (for construction/ decommissioning and O&M) are not known. If the developments have a common base port, there may be an increased collision risk when vessels are entering/ exiting the port and enroute to/ from the arrays. However, the marine coordination facility will take account of this, and it is assumed that a similar facility will be in place for East Anglia Two and North Falls.

TIER 2

9.11.64 Again, on-site activities associated with East Anglia One North are not expected to create a cumulative effect with VE. However, at the time of writing, the base ports for VE and East Anglia One North (for construction/ decommissioning and O&M) are not known and therefore the same points raised for Tier 1 developments are again applicable.

TIER 3

9.11.65 Again, on-site activities associated with East Anglia Three, Norfolk Vanguard East, and Norfolk Vanguard West are not expected to create a cumulative effect with VE. However, at the time of writing, the base ports for VE and these developments (for construction/ decommissioning and O&M) are not known and therefore the same points raised for Tier 1 developments are again applicable.

MITIGATION

9.11.66 Mitigation identified as relevant to reducing the significance of effect are as follows:

- Application for safety zones;
- Buoyed construction areas;
- Guard vessels as required;
- Marine coordination for project vessels;
- Pollution planning;
- Project vessel compliance with international marine regulations; and
- Promulgation of information.

POTENTIAL SIGNIFICANCE OF EFFECT

9.11.67 The frequency of occurrence and severity of consequence due to third-party with project vessel collision risk associated with the array areas for each phase of VE is presented in Table 9.17 alongside the resulting significance of effect.

Table 9.17: Significance of effect for third-party with project vessel collision risk (array areas).

Scenario	Phase	Worst case consequences	Frequency of occurrence	Severity of consequence	Significance of effect
VE in isolation	Construction	Collision incident occurs with vessel damage, PLL, and/ or pollution.	Extremely Unlikely	Moderate	Broadly Acceptable
	O&M		Negligible	Moderate	Broadly Acceptable
	Decommissioning		Extremely Unlikely	Moderate	Broadly Acceptable
Cumulative	Construction		Reasonably Probable	Moderate	Tolerable with Mitigation
	O&M		Extremely Unlikely	Moderate	Broadly Acceptable
	Decommissioning		Reasonably Probable	Moderate	Tolerable with Mitigation

IMPACT 4: THIRD-PARTY WITH PROJECT VESSELS COLLISION RISK (OFFSHORE EXPORT CABLE CORRIDOR)

9.11.68 The presence of vessels associated with construction, maintenance, and decommissioning activities for the offshore ECC may result in increased risk of a collision between a third-party vessel and a project vessel.

IN ISOLATION SCENARIO – ALL RECEPTORS

9.11.69 Once installed the presence of the export cables will not directly result in third-party with project vessel collision risk. Therefore, this impact is considered only in relation to export cable installation/ removal and maintenance activities.

9.11.70 Given the complexity of the area in terms of vessel activity and cable installation, this hazard is mitigated by the inclusion of a NIP as a consent requirement secured through the conditions of the transmission deemed marine licence (see Volume 9, Report 20: Outline Navigation and Installation Plan).

9.11.71 The level of exposure to this impact for third-party vessels will depend upon the location of export cable installation/ removal or maintenance at any given time, with the PLA confirming during consultation that there are ‘pinch points’ along the offshore ECC where effective traffic management will be critical. An area of interest reflecting this will be identified in the NIP.

9.11.72 The most likely and worst case consequences of third party to project vessel collision risk will be due to installation/ removal and maintenance activities for the offshore ECC are generally analogous to those outlined for the array area, although the presence of larger commercial vessels accessing local ports via the Sunk routeing measure is noted, with these vessels likely to have less manoeuvrability to take collision avoidance action in the event of an encounter. This will be mitigated by implementation of the NIP which includes planned protocols and actions in the event of any close encounters.

CUMULATIVE SCENARIO – ALL RECEPTORS

TIER 1

9.11.73 North Falls OWF, NeuConnect, and Sea Link are expected to intersect the offshore ECC including crossings. In the unlikely event that simultaneous operations occur during installation/ removal or maintenance activities for VE and these subsea cable developments, the NIP will be expanded to include project vessel management procedures and planned protocols to minimize collision risk between third-party vessels and project vessels.

9.11.74 Additionally – and as highlighted by the Sunk VTS during consultation – project vessels associated with North Falls may cross the Sunk TSS East, adding to existing crossing project vessel traffic from Greater Gabbard and Galloper and future crossing project vessel traffic from VE. Where installation/ removal or maintenance activities are ongoing for the export cables this additional crossing traffic may further exacerbate collision risk, although it is assumed that marine coordination for project vessels associated with North Falls will be in place, including consideration of crossing the Sunk TSS East.

TIER 2

9.11.75 For this impact there is no direct link between the offshore ECC and any Tier 2 developments and therefore no additional assessment of effect has been undertaken.

TIER 3

9.11.76 For this impact there is no direct link between the offshore ECC and any Tier 3 developments and therefore no additional assessment of effect has been undertaken.

MITIGATION

9.11.77 Mitigation identified as relevant to reducing the significance of risk are as follows:

- Guard vessels as required;
- Marine coordination for project vessels;
- NIP;
- Pollution planning;
- Project vessel compliance with international marine regulations; and
- Promulgation of information.

POTENTIAL SIGNIFICANCE OF EFFECT

9.11.78 The frequency of occurrence and severity of consequence due to third-party with project vessel collision risk associated with the offshore ECC for each phase of VE is presented in Table 9.18 alongside the resulting significance of effect.

Table 9.18: Significance of effect for third-party with project vessel collision risk (offshore ECC).

Scenario	Phase	Worst case consequences	Frequency of occurrence	Severity of consequence	Significance of effect
VE in isolation	Construction	Collision incident occurs with vessel damage, PLL, and/ or pollution.	Negligible	Moderate	Broadly Acceptable
	O&M		Negligible	Moderate	Broadly Acceptable
	Decommissioning		Negligible	Moderate	Broadly Acceptable
Cumulative	Construction		Extremely Unlikely	Moderate	Broadly Acceptable
	O&M		Negligible	Moderate	Broadly Acceptable
	Decommissioning		Extremely Unlikely	Moderate	Broadly Acceptable

IMPACT 5: REDUCED ACCESS TO LOCAL PORTS AND HARBOURS AND REDUCTION IN UNDER KEEL CLEARANCE (ARRAY AREAS)

9.11.79 Construction/ decommissioning activities and the presence of surface structures within the array areas may result in reduced access to local ports and harbours for vessels. The presence of cable protection associated with the array cables may result in reductions to water depth and the creation of an under keel clearance risk for vessels, again limiting access to ports, harbours, terminals, and marinas.

9.11.80 These two impacts (reduced access to local ports and harbours/ reduction in under keel clearance) are considered together given the links between reduced under keel clearance and access to local ports, etc.

IN ISOLATION SCENARIO – ALL RECEPTORS

9.11.81 There are numerous ports and harbours located west of the array areas, on the UK east coast. However, given the distance of the array areas offshore, the presence of the buoyed construction/ decommissioning areas and operational arrays is not anticipated to directly interfere with mariners from their preferred approach to local ports and harbours. Furthermore, given that the size of main commercial route deviations due to the presence of the buoyed construction/ decommissioning areas and operational arrays (as outlined for the vessel displacement impact) are small, the effects on any port/ pilot arrivals times are expected to be limited and therefore schedules will not be impacted.

9.11.82 The construction phase for the array area may last for up to five years and the decommissioning phase up to three years. For both phases, up to 35 construction/ decommissioning vessels may be located on-site simultaneously, in turn making a maximum of 1,776 round trips to port. The O&M phase may last for up to 40 years with up to 27 O&M vessels located on-site simultaneously, in turn making a maximum of 1,776 annual round trips to port. Some project vessels may be RAM and it is anticipated that project vessels will generally undertake construction/ decommissioning or O&M works associated with the array areas within the buoyed construction/ decommissioning areas or operational arrays, both of which third-party vessels are generally expected to avoid. Given that the volume of project vessel movements will be substantially lower during the O&M phase than the construction/ decommissioning phases, the likelihood of disruption is lower for the O&M phase.

9.11.83 Project vessels will also be managed by a marine coordination facility which may include traffic management procedures such as defined routes to and from construction/ decommissioning and O&M ports. Project vessels will also carry AIS and be compliant with all Flag State regulations including the COLREGs. Given the presence of Greater Gabbard and Galloper OWF, whose O&M vessels are operated out of Harwich Haven and Port of Lowestoft, respectively, there is relevant experience of managing project vessel movements in and out of local ports which will be drawn upon.

9.11.84 Up to 108 nm of array cables will be located within the array areas including up to 26 crossings. Where available, the primary means of cable protection will be by seabed burial, with no material effect on under keel clearance. Indicatively, up to 20% of array cables may require alternative cable protection with a height of 1.0 m, or 1.4 m for crossings. This will be fully determined by the CBRA (see Volume 9, Report 9: Outline Cable Burial Risk Assessment), noting that deep-draughted commercial vessels are not expected to navigate internally within the arrays.

9.11.85 In relation to under keel clearance the Applicant intends to follow the guidance contained in MGN 654 in relation to cable protection, namely that cable protection will not change the charted water depth by more than 5%. This was reaffirmed by the MCA during consultation.

9.11.86 This aligns with the RYA's recommendation that the *"minimum safe under keel clearance over submerged structures and associated infrastructure should be determined in accordance with the methodology set out in MGN 543 [since superseded by MGN 654]"* (RYA, 2019). Noting that water depths within the array areas vary between 31 and 57 m below CD, this should be achievable throughout and therefore the likelihood of an underwater allision incident is very low.

9.11.87 The most likely consequences of reduced port access in relation to the array areas will be limited effects on port schedules. As a worst case, there could be disruption to port schedules, but with no safety issues.

9.11.88 Should a vessel navigate over an area of reduced under keel clearance within the array area the most likely consequence is that no contact occurs and the vessel's passage is able to continue unaffected. As a highly unlikely worst case, the vessel could ground on the cable protection with pollution and vessel damage as potential outcomes.

COMMERCIAL EFFECT

9.11.89 There are not anticipated to be any commercial effects associated with the array areas.

CUMULATIVE SCENARIO – ALL RECEPTORS

TIER 1

9.11.90 The presence of East Anglia Two in addition to VE may interfere with mariners planning their preferred approach to local ports and harbours. The northern array area and East Anglia Two span a north-south extent of approximately 24 nm, and therefore together may affect port schedules for commercial vessels headed to/ from the numerous ports and harbours on the UK east coast. Only one main commercial route (Route 3) is expected to be affected, although features high vessel traffic volumes.

9.11.91 However, a navigational corridor with minimum width of 2.86 nm separates the two arrays and provides a means of access to the aforementioned ports and harbours. As previously noted, a safety case has been undertaken in Section 17 of Volume 9, Report 10: Navigational Risk Assessment for the navigational corridor and concluded that the corridor's design (including width) meets safety of navigation expectations. Therefore, this corridor will minimise the cumulative effect for vessels heading to/ from ports on the UK east coast, including on Route 3.

TIER 2

9.11.92 For this impact there is no direct link between the array areas and any Tier 2 developments and therefore no additional assessment of effects has been undertaken.

TIER 3

9.11.93 For this impact there is no direct link between the array areas and any Tier 3 developments and therefore no additional assessment of effects has been undertaken.

MITIGATION

9.11.94 Mitigation identified as relevant to reducing the significance of effect are as follows:

- CBRA;
- Compliance with MGN 654;
- Marine coordination for project vessels;
- Pollution planning;
- Project vessel compliance with international marine regulations;
- Promulgation of information; and
- Vessel traffic monitoring.

POTENTIAL SIGNIFICANCE OF EFFECT

9.11.95 The frequency of occurrence and severity of consequence due to reduced port and harbour access and reduction in under keel clearance associated with the array areas for each phase of VE is presented in Table 9.19 alongside the resulting significance of effect.

Table 9.19: Significance of effect for reduced access to local ports and harbours and reduction in under keel clearance (array areas).

Scenario	Phase	Worst case consequences	Frequency of occurrence	Severity of consequence	Significance of effect
VE in isolation	Construction	Disruption to port schedules and vessel grounding on cable protection with vessel damage and/ or pollution.	Remote	Minor	Broadly Acceptable
	O&M		Remote	Moderate	Tolerable with Mitigation
	Decommissioning		Remote	Minor	Broadly Acceptable
Cumulative	Construction		Remote	Minor	Broadly Acceptable
	O&M		Remote	Moderate	Tolerable with Mitigation
	Decommissioning		Remote	Minor	Broadly Acceptable

IMPACT 6: REDUCED ACCESS TO LOCAL PORTS AND HARBOURS AND REDUCTION IN UNDER KEEL CLEARANCE (OFFSHORE EXPORT CABLE CORRIDOR)

9.11.96 Construction, maintenance, and decommissioning activities associated with the offshore ECC may result in some reduced access to local ports and harbours for vessels without effective mitigation.

9.11.97 These two impacts (reduced access to local ports and harbours/ reduction in under keel clearance) are again considered in unison given the links between reduced under keel clearance and access to local ports, etc. The hazard does not consider the presence of cable protection reducing under keel clearance within sensitive areas since the Applicant has committed to burial of export cables, or use of low profile protection material, to maintain suitable under keel clearance within such areas.

IN ISOLATION SCENARIO – ALL RECEPTORS

9.11.98 The offshore ECC crosses the exit of the Sunk TSS East, passes alongside the eastbound lane of the Sunk TSS East and crosses the Sunk Outer and Inner Precautionary Areas before making landfall east of Holland-on-Sea (see Figure 9.2). At the Hazard Workshop, stakeholders generally agreed that the final portion of the offshore ECC inshore of the Rough Sands did not raise any concerns for shipping and navigation receptors, noting that from the vessel traffic survey data, crossing vessels in this area were primarily recreational vessels with shallower draughts.

9.11.99 The other portions of the offshore ECC have been the subject of detailed consultation throughout the Scoping, PEIR, and ES stages given that deep draught vessels do cross the offshore ECC, particularly when accessing local ports through the Sunk Inner Precautionary Area. For smaller craft impacts on water depth are not as substantial, as indicated by the Cruising Association during consultation.

9.11.100 The offshore ECC crosses the Trinity and Sunk deep water routes and passes in proximity to the Harwich Deep Water Channel. These are key navigational routes for vessels accessing ports in the region, including at Harwich Haven, the Port of Felixstowe, and Thames and Medway ports. These routes are required to give deep water access for the current maximum draught (up to 17.5 m) and realistic future worst case draught (up to 20 m) so that they can avoid shallower areas within the Sunk Inner Precautionary Area and provide reassurance as to depth maintained channels. There is no alternative approach available for these larger vessels to access such ports.

9.11.101 A CSIP and a CBRA – see Volume 9, Report 12: Outline Cable Specification and Installation Plan and Volume 9, Report 9: Outline Cable Burial Risk Assessment) will set out the proposed burial depths and cable protection (where necessary and permitted), taking into account areas where deep draught vessels transit and therefore areas where water depth cannot be compromised by more than 5%. Alongside the CSIP, the NIP will be developed to ensure that installation or maintenance methodologies (further considered below) do not compromise safe vessel access to local ports. Furthermore, where appropriate, export cables will be buried or protected sufficiently to ensure there is no interaction with any foreseeable future spot dredging associated with London Gateway operations around the Sunk and Trinity deep water routes. The CSIP and NIP will be conditioned in the deemed Marine Licence.

INSTALLATION AND MAINTENANCE ACTIVITIES

9.11.102 The offshore ECC may interact with mariners' preferred approach to local ports and harbours during periods of installation and maintenance. This element of the impact will apply when export cable installation/ removal activities are ongoing.

9.11.103 In terms of reduced port access for vessels in relation to the offshore ECC the most likely consequences will be limited effects on port schedules. As a worst case, there could be disruption to port schedules, with congestion caused and subsequent potential for safety issues including collision and grounding (influenced by tidal streams). However, the implementation of the NIP is anticipated to reduce the likelihood of these consequences to tolerable levels. Further details pertaining to the NIP are provided in Section 21.4 of Volume 9, Report 10: Navigational Risk Assessment and the outline NIP is provided in Volume 9, Part 5, Annex 19: Navigation Installation Plan.

PILOTAGE OPERATIONS

9.11.104 A key element of port access in the region is pilotage services and therefore any disruption to pilotage operations may reduce access to local ports.

9.11.105 From the vessel traffic survey data, all pilot vessels operating in the Sunk Inner Precautionary Area do so out of Harwich Haven, with this confirmed by HHA during consultation. Only a small portion of the offshore ECC is crossed enroute to the Sunk pilot boarding station, which is the primary boarding location for pilots.

9.11.106 Pilot vessels are small and have greater flexibility than large commercial vessels. This is evidenced in the vessel traffic survey data which indicates that pilot vessels are not as constrained by the navigational features in the region such as the Harwich Deep Water Channel. Therefore, the presence of installation/ removal and maintenance activities associated with the offshore ECC are unlikely to create a substantial access constraint for pilot vessels but could result in minor disruption to pilot boarding operations due to the temporary location of project vessels. This issue will be specifically considered in the NIP, noting that the content of the NIP will be agreed with HHA, PLA, and Sunk VTS to ensure that pilot boarding remains safe and commercially viable.

SUNK VESSEL TRAFFIC SERVICE

9.11.107 The MCA requested during consultation that effects upon operation of the Sunk VTS are considered, i.e., man power. This will also require consideration in relation to pilot boarding operations conducted by HHA. Given the rate of export cable installation, the short-term duration of the works are unlikely to have any substantial effect upon the operation of the Sunk VTS.

9.11.108 The movements of project vessels to/ from construction ports (if located within the Sunk VTS area) is another potential cause of impacting Sunk VTS resources. However, project vessels will be managed by a marine coordination facility which may include traffic management procedures such as the NIP and defined routes to and from construction ports. Such procedures will ensure effects on the operation of the Sunk VTS is minimised.

EXISTING AIDS TO NAVIGATION

9.11.109 The offshore ECC avoids most aids to navigation but does overlap with the North Galloper north cardinal mark and Dynamo special mark. The Sunk Inner Light vessel is not impacted directly although HHA noted during consultation that it may nevertheless need to be moved.

9.11.110 For those overlapping aids to navigation there is potential that their movement may be required. Trinity House have indicated a preference during consultation to avoid moving existing aids to navigation but acknowledged that during installation there may be opportunities to do so. Any movements during export cable installation/ removal and maintenance works would be of short-term duration given the nature of the works and have limited effect on a vessel's ability to safely navigate to/ from port, especially when a pilot with local knowledge is on board.

COMMERCIAL EFFECT

9.11.111 Based on consultation with local port and harbour operators, there is a potential commercial effect posed by the presence of the offshore ECC due to reduced under keel clearance and installation/ removal and maintenance activities. This is specifically related to deep-draught vessels (container vessels) that visit several ports, terminals, and harbours through the Sunk VTS. This subsection considers this element of the impact, separate from elements relating to navigational safety.

9.11.112 As already noted, the key restricting factor to vessel access is under keel clearance reduction caused by cable crossings, cable burial, and cable protection. However, this is currently acceptable within base case traffic levels given current dredged limits and vessel sizes. However, stakeholders have raised concerns about limitations within the future case whereby cable crossings, cable burial, and cable protection may restrict the size of vessels that are able to use these facilities and therefore meaning vessels choose or have to use other ports, i.e., in mainland Europe.

9.11.113 A detailed review of the future case has been undertaken in Section 15 of Volume 9, Report 10: Navigational Risk Assessment including consideration of relevant consultation feedback, vessel trends, the influence of the Suez Canal, and under keel clearance calculations. The realistic maximum draught of 20 m was identified based on this and will be used to inform the CSIP (which will include a CBRA – see Volume 9, Report 12: Outline Cable Specification and Installation Plan and Volume 9, Report 9: Outline Cable Burial Risk Assessment), noting that the CSIP will set out the proposed burial depths and installation methods, taking into account areas where deep draught vessels transit and therefore areas where water depth cannot be compromised by more than 5%. This will ensure that the use of the area by the largest vessels will not be compromised by underwater allision risk created by rock protection. The CSIP will be conditioned in the deemed Marine Licence.

9.11.114 Installation activities may also have impacts on vessel access, but it is considered that these can be mitigated by implementation of the NIP including liaison between the Applicant, Sunk VTS and the port/ harbour operators noting the limited temporal duration of this impact.

9.11.115 The commercial effect posed during the O&M phase by the presence of the offshore ECC is largely aligned with the equivalent construction phase impact, noting that during the O&M phase maintenance activities is again expected to be limited in terms of spatial and temporal extent.

CUMULATIVE SCENARIO – ALL RECEPTORS

TIER 1

9.11.116 This impact has been highlighted by stakeholders during consultation, with MCA, Trinity House, HHA, and PLA raising concerns relating to the cumulative presence of activities for VE and other subsea cable developments.

9.11.117 North Falls (export cables), NeuConnect, and Sea Link are expected to intersect the offshore ECC including crossings. Should installation/ removal or maintenance activities for VE and these subsea cable developments occur simultaneously then the spatial extent of the impact will be increased, although the likelihood of this is very low. In the highly unlikely event of simultaneous operations this will be managed through cooperation within the parameters of the NIP.

9.11.118 Since the CSIP and maximum indicative cable protection height of 1.4 m for VE is also applicable to crossings, the reduction in under keel clearance associated with VE together with the subsea cable developments is analogous to that assessed for the in isolation scenario.

TIER 2

9.11.119 For this impact there is no direct link between the offshore ECC and any Tier 2 developments and therefore no additional assessment of effects has been undertaken.

TIER 3

9.11.120 For this impact there is no direct link between the offshore ECC and any Tier 3 developments and therefore no additional assessment of effects has been undertaken.

MITIGATION

9.11.121 Mitigation identified as relevant to reducing the significance of effect are as follows:

- CBRA;
- Compliance with MGN 654;
- Marine coordination for project vessels;
- NIP;
- Pollution planning;
- Promulgation of information; and
- Vessel traffic monitoring.

POTENTIAL SIGNIFICANCE OF EFFECT

9.11.122 The frequency of occurrence and severity of consequence due to reduced access to local ports and harbours and reduction in under keel clearance associated with the offshore ECC for each phase of VE is presented in Table 9.20 alongside the resulting significance of effect.

Table 9.20: Significance of effect for reduced access to local ports and harbours and reduction in under keel clearance (offshore ECC).

Scenario	Phase	Worst case consequences	Frequency of occurrence	Severity of consequence	Significance of effect
VE in isolation	Construction	Disruption to port schedules and vessel grounding on cable protection with vessel damage and/ or pollution.	Reasonably Probable	Moderate	Tolerable with Mitigation
	O&M		Reasonably Probable	Moderate	Tolerable with Mitigation
	Decommissioning		Reasonably Probable	Moderate	Tolerable with Mitigation
Cumulative	Construction		Reasonably Probable	Moderate	Tolerable with Mitigation
	O&M		Reasonably Probable	Moderate	Tolerable with Mitigation
	Decommissioning		Reasonably Probable	Moderate	Tolerable with Mitigation

IMPACT 7: CREATION OF ALLISION RISK (ARRAY AREAS)

9.11.123 The presence of surface structures within the array areas may result in the creation of a risk of allision for vessels.

9.11.124 This impact is considered only in relation to the array areas since there are no surface structures associated with the offshore ECC (underwater allision risk due to reduction in under keel clearance is considered in a separate impact).

IN ISOLATION SCENARIO – ALL RECEPTORS

9.11.125 The main commercial route deviations and future case considerations described for the vessel displacement impact have also been assumed for this impact, noting that a full build out of the array areas is assumed and internal navigation by commercial vessels is not anticipated. However, commercial fishing vessels and recreational vessels may choose to navigate internally within the arrays, particularly in favourable weather conditions.

9.11.126 Vessels operating in the region will be familiar with navigating in proximity to OWFs, including Greater Gabbard, Galloper, East Anglia One, and various developments within Belgian waters. However, the presence of new surface structures does introduce new allision risk which can be considered across three forms, all of which are localised in nature given that a vessel must be in close proximity to a structure for an allision incident to occur:

- Powered allision risk;
- Drifting allision risk; and
- Internal allision risk.

POWERED ALLISION RISK

9.11.127 Post wind farm modelling using the main commercial route deviations as input gives an estimated powered allision return period of one in 746 years for base case traffic levels, rising to one in 574 years for future case traffic levels (30%). This is a low to moderate return period compared to that estimated for other UK OWF developments and is reflective of the shape of the array areas (following site refinement) being sympathetic to the most heavily trafficked routes as well as the comparatively low number of surface structures. The greatest allision risk was associated with:

- Structures at the south-eastern extent of the southern array area where a high volume of traffic from multiple main commercial routes associated with the North Hinder TSS pass; and
- Structures at the northern extent of the northern array area where a heavily trafficked commercial ferry route between Harwich and Rotterdam passes in close proximity (1nm), noting that this includes an indicative OSP location.

9.11.128 From historical incident data, there have been three instances of a third-party vessel alliding with an operational wind farm structure in the UK. These incidents all involved a fishing vessel, with a RNLI lifeboat attending on each occasion and a helicopter deployed in one case. Given the navigational measures present in the region (including the Sunk TSS East) and subsequent heightened mariner alertness, it is unlikely that such an incident will occur at VE.

9.11.129 Additionally, vessels are expected to comply with international flag state regulations (including the COLREGs and SOLAS) and will be able to effectively passage plan a route which minimises effects given the promulgation of information relating to VE including the charting of infrastructure on relevant nautical charts and the use of safety zones (for major maintenance). On approach, the operational lighting and marking of the arrays will also assist in maximising marine awareness and project vessels will as required alert a vessel on a closing approach with a structure.

9.11.130 Should a powered allision incident occur, the consequences will depend on multiple factors including the energy of the contact, structural integrity of the vessel involved, type of structure contacted, and the sea state at the time of the contact. Small craft including commercial fishing vessels and recreational vessels are considered most vulnerable to the impact given the potential for a non-steel construction.

9.11.131 With consideration of lessons learned the most likely consequences are minor damage with the vessel involved able to resume passage and undertake a full inspection at the next port of call. As a worst case, the vessel could allide with an OSP, resulting in foundering with PLL and pollution.

DRIFTING ALLISION RISK

9.11.132 A vessel adrift may only develop into an allision situation where the vessel is in proximity to a structure and the direction of the wind and/ or tide is such as to direct the vessel towards the structure. In the case of VE – and accounting for local metocean conditions – the direction of the peak flood tide is highlighted as potentially sensitive given that:

- Heavily trafficked east-west routeing north of the northern array could be set on an allision course with structures on the northern edge of the northern array area; and
- Moderately trafficked east-west routeing through the Sunk TSS East could be set on an allision course with structures on the northern edge of the southern array area.

9.11.133 Post wind farm modelling using the main commercial route deviations as input gives an estimated drifting allision return period of one in 584 years for base case traffic levels, rising to one in 449 years for future case traffic levels (30%). This is a moderate to high return period compared to that estimated for other UK OWF developments and is reflective of the high volume of vessel traffic in the region and the unsympathetic direction of drift (described above) relative to the shape of the array areas.

9.11.134 From historical incident data, there have been no instances of a third-party vessel alliding with an operational wind farm structure in the UK whilst Not Under Command (NUC). However, there is some potential for a vessel to run adrift in this region; this is reflected in the number of machinery failure incidents[4] reported locally to the MAIB (22% of all reported incidents within the array traffic study area).

9.11.135 In circumstances where a vessel drifts towards a structure, there are actions which may be taken to prevent the incident developing into an allision situation. For a powered vessel, the ideal and likely solution would be regaining power prior to reaching the arrays (by rectifying any fault). Failing this, the vessel's emergency response procedures would be implemented – this may include an emergency anchoring event following a check of the relevant nautical charts to ensure the deployment of the anchor will not lead to other effects (such as anchor snagging on a subsea cable).

9.11.136 Where the deployment of the anchor is not possible (such as for small craft) then project vessels on-site may be able to render assistance including under SOLAS obligations (IMO, 1974) and this response will be managed via marine coordination and depends on the type and capability of vessels on site. This would be particularly relevant for sailing vessels whose propulsion is dictated solely by the metocean conditions, although if the vessel becomes adrift in proximity to a structure there may be limited time to render assistance.

[4] An incident reported as a 'machinery failure' may not be so severe as to result in the vessel losing power and becoming NUC.

9.11.137 Should a drifting allision incident occur, the consequences will be similar to those outlined for a powered allision incident, including the determining factors. However, the speed at which the contact occurs will likely be lower than for a powered allision, resulting in the contact energy being lower.

9.11.138 It is acknowledged that as per the assessment of powered allision risk, an allision with an OSP is likely to create higher consequence given the size of the structure. This is particularly relevant given the peak flood tide scenario outlined above since both of the highest exposure portions of the arrays include an OSP.

INTERNAL ALLISION RISK

9.11.139 As described for the vessel displacement impact, commercial vessels are not anticipated to navigate internally within the arrays and therefore the likelihood of an internal allision risk for such vessels is negligible.

9.11.140 Post wind farm modelling using the vessel traffic survey data as input gives an estimated commercial fishing allision return period of one in 3.43 years for base case traffic levels, rising to one in 2.86 years for future case traffic levels (20%)[5]. This is a high return period compared to that estimated for other UK OWF developments and is reflective of the high volume of fishing vessel activity in the region, noting that this is largely characteristic of fishing vessels engaged in fishing rather than in transit.

9.11.141 The minimum spacing between structures (830 m) is sufficient for safe internal navigation and is greater than that associated with many other UK OWF, some of which are navigated by commercial fishing vessels in favourable conditions. The minimum spacing between structures is also similar to that present at the neighbouring Greater Gabbard and Galloper. The final array layout will be agreed with the MCA and Trinity House post consent but will be compliant with the requirements of MGN 654 (MCA, 2021), including the completion of a safety justification for a SLoO layout should this be taken forward.

9.11.142 As with any passage, a vessel navigating internally within the arrays is expected to passage plan in accordance with SOLAS Chapter V (IMO, 1974). The lighting and marking of the arrays as required by Trinity House, MCA, and CAA and MGN 654 compliant unique identification marking of structures in an easily identifiable pattern will assist with minimising the likelihood of a mariner becoming disoriented whilst navigating internally within the arrays.

9.11.143 For recreational vessels under sail navigating internally within the arrays, there is also potential for effects such as wind shear, masking, and turbulence to occur. From previous studies of offshore wind developments, it has been concluded that WTGs do reduce wind velocity downwind of a WTG (MCA, 2022) but that no negative effects on recreational craft have been reported on the basis of the limited spatial extent of the effect and its similarity to that experienced when passing a large vessel or close to other large structures (such as bridges) or the coastline. In addition, no practical issues have been raised by recreational receptors to date when operating in proximity to existing offshore wind developments.

[5] These results are highly conservative since the model cannot account in detail for how fishing vessels will adapt to the presence of the arrays.

9.11.144 An additional allision risk associated with the WTG blades applies for recreational vessels with a mast when navigating internally within the arrays. However, the minimum blade tip clearance will be 28 m above MHWS which is greater than the minimum clearance the RYA recommend for localised allision risk (RYA, 2019) and which is also noted in MGN 654.

9.11.145 Should an internal allision incident occur, the consequences will be similar to those outlined for a powered allision incident, including the determining factors. However, as with a drifting allision incident, the speed at which the contact occurs will likely be lower than for an external allision, resulting in the contact energy being lower.

CUMULATIVE SCENARIO – ALL RECEPTORS

TIER 1

9.11.146 Although allision risk is localised in nature, there remains a cumulative effect associated with routeing through the navigation corridor between VE and East Anglia Two (Route 3) which has a minimum width of 2.86 nm. A safety case has been undertaken in Section 17 of Volume 9, Report 10: Navigational Risk Assessment and includes consideration of the suitable width for the corridor based on various guidance including the MGN 654 Shipping Route Template. The safety case concluded that the corridor's design (including width) meets safety of navigation expectations.

9.11.147 Nevertheless, it is recognized that there is a clear narrowest point of the navigation corridor which may increase allision exposure for a WTG located at or close to the northern tip of the northern array area. However, the corridor may be viewed as a trapezium allowing for a straight east-west transit – this is illustrated in Figure 17.1 in Volume 9, Report 10: Navigational Risk Assessment. This form of the corridor, which incorporates alignment with Galloper, provided comfort to the UK Chamber of Shipping and DFDS Seaways during consultation.

9.11.148 There remains the possibility that a WTG may be located at or close to the northern tip of the northern array area, thus encroaching upon the alignment with Galloper. Should this occur, this WTG would be subject to greater allision risk exposure from navigation corridor users. Trinity House have identified during consultation that enhanced marking could be implemented for this WTG if considered necessary. Both MCA and Trinity House have confirmed that this issue can be resolved (if required) as part of discussions relating to the final array layout undertaken post consent.

TIER 2

9.11.149 For this impact there is no direct link between the array areas and any Tier 2 developments and therefore no additional assessment of effects has been undertaken.

TIER 3

9.11.150 For this impact there is no direct link between the array areas and any Tier 3 developments and therefore no additional assessment of effects has been undertaken.

MITIGATION

9.11.151 Mitigation identified as relevant to reducing the significance of effect are as follows:

- Application for safety zones (major maintenance only);
- Charting of infrastructure;
- Compliance with MGN 654;
- Lighting and marking;
- Marine coordination for project vessels;
- Minimum blade tip clearance;
- Pollution planning;
- Project vessel compliance with international marine regulations; and
- Promulgation of information.

POTENTIAL SIGNIFICANCE OF EFFECT

9.11.152 The frequency of occurrence and severity of consequence due to creation of allision risk associated with the array areas for the O&M phase of VE is presented in Table 9.21 alongside the resulting significance of effect.

Table 9.21: Significance of effect for creation of allision risk (array areas).

Scenario	Phase	Worst case consequences	Frequency of occurrence	Severity of consequence	Significance of effect
VE in isolation	O&M	Allision incident occurs with an OSP with the vessel foundering, PLL, and/ or pollution.	Negligible	Major	Tolerable with Mitigation
Cumulative	O&M		Extremely Unlikely	Major	Tolerable with Mitigation

IMPACT 8: ANCHOR INTERACTION WITH SUBSEA CABLES (ARRAY AREAS)

9.11.153 The presence of array cables may result in the creation of a risk of a vessel anchor making contact with an array cable.

IN ISOLATION SCENARIO – ALL RECEPTORS

9.11.154 Up to 108 nm of array cables will be located within the array areas. Where available, the primary means of cable protection will be by seabed burial, with a target burial depth of 0.5 m. Indicatively, up to 20% of array cables may require alternative cable protection with a height of 1.0 m, or 1.4 m for crossings. The burial depth will be informed by the CBRA which is provided in Volume 9, Report 9: Outline Cable Burial Risk Assessment.

9.11.155 There are three anchoring scenarios which are considered for this impact:

- Planned anchoring – most likely as vessel awaits a berth to enter port but may also result from adverse weather conditions, machinery failure, or subsea operations;
- Unplanned anchoring – generally resulting from an emergency situation where the vessels has experienced steering failure; and

- Anchor dragging – caused by anchor failure.

9.11.156 Since the array cables will be fully contained within the array areas, it is considered unlikely that a vessel will choose to anchor in close proximity to an array cable. Moreover, from the vessel traffic data, anchoring activity within and in proximity to the array areas is limited, with vessels instead choosing to use designated anchorage areas in the region.

9.11.157 In any anchoring scenario, an interaction risk exists only where the anchoring occurs in proximity to an array cable and it is anticipated that the charting of infrastructure including the array cables will inform the decision to anchor, as per Regulation 34 of SOLAS (IMO, 1974). Feedback from Mariners indicated that this will also occur in an emergency situation, even where time for decision-making is limited – a key priority for Bridge crew whilst the anchor is being readied would be to check charts.

9.11.158 The most likely consequences in the event of a vessel anchoring over an array cable is that no interaction occurs given the protection applied to the cable (by burial or other means). Should an interaction occur, historical incident data suggests that the consequences would be negligible, with no damage caused to the vessel or cable. As a worst case, a snagging incident could occur to a commercial fishing vessel with damage caused to the anchor and/ or the cable, compromising the stability of the vessel.

CUMULATIVE SCENARIO – ALL RECEPTORS

TIER 1

9.11.159 NeuConnect is expected to intersect the northern array area. Should a vessel anchor within the northern array area the likelihood of a snagging incident will be greater given the wider spatial extent compared to the in isolation scenario. However, the impact remains localised in nature and the likelihood of a vessel anchoring within the array areas is low, as discussed for the in isolation scenario.

9.11.160 It is assumed that, as with the export cables, NeuConnect will be subject to a CBRA and will be shown on relevant nautical charts.

TIER 2

9.11.161 For this impact there is no direct link between the array areas and any Tier 2 developments and therefore no additional assessment of effects has been undertaken.

TIER 3

9.11.162 For this impact there is no direct link between the array areas and any Tier 3 developments and therefore no additional assessment of effects has been undertaken.

MITIGATION

9.11.163 Mitigation identified as relevant to reducing the significance of effect are as follows:

- CBRA;
- Charting of infrastructure;
- Guard vessels as required; and

- Promulgation of information.

POTENTIAL SIGNIFICANCE OF EFFECT

9.11.164 The frequency of occurrence and severity of consequence due to anchor interaction with subsea cables associated with the array areas for the O&M phase of VE is presented in Table 9.22 alongside the resulting significance of effect.

Table 9.22: Significance of effect for anchor interaction with subsea cables (array areas).

Scenario	Phase	Worst case consequences	Frequency of occurrence	Severity of consequence	Significance of effect
VE in isolation	O&M	Anchor snagging incident occurs with anchor and/ or cable damage and compromised vessel stability.	Extremely Unlikely	Minor	Broadly Acceptable
Cumulative	O&M		Negligible	Moderate	Broadly Acceptable

IMPACT 9: ANCHOR INTERACTION WITH SUBSEA CABLES (OFFSHORE EXPORT CABLE CORRIDOR)

9.11.165 The presence of export cables may result in the creation of a risk of a vessel anchor making contact with an export cable.

IN ISOLATION SCENARIO – ALL RECEPTORS

9.11.166 The cable protection methodology for array cables is again applicable, although the indicative cable protection height (excluding crossings) is 1.4 m. The burial depth will be informed by the CBRA which is provided in Volume 9, Report 9: Outline Cable Burial Risk Assessment.

9.11.167 There is general agreement among stakeholders that the burial depth for export cables will be important, particularly in higher risk areas and with consideration of potential vessel traffic growth in the future case scenario. HHA have indicated during consultation that a burial depth of 0.5 m would likely be insufficient in some areas, and may need to be substantially more. As noted, the CBRA will inform the cable burial depth, with particular consideration given to the types and numbers of vessels crossing the offshore ECC at the higher risk locations and the maintenance and monitoring of the burial depth deployed. This latter point was raised as an important consideration by London Gateway during consultation. In the event of an export cable exposure a guard vessel may need to be deployed (depending upon a dynamic risk assessment) as a precaution whilst awaiting the reburial works alongside a Notification to Mariners.

9.11.168 The most likely and worst case consequences are analogous to those outlined for the array areas, although further assessment is provided below in relation to the three anchoring scenarios outlined for the array cables which are again applicable for the export cables.

PLANNED ANCHORING

9.11.169 Following consultation the offshore ECC avoids and does not overlap with any designated anchorage areas. The Sunk Inner anchorage is located directly south of the offshore ECC and the Sunk DW anchorage is located approximately 1.5 nm north of the offshore ECC (see Figure 10.37 in Volume 9, Report 10: Navigational Risk Assessment which shows these designated anchorage areas alongside vessels within the offshore ECC study area). Both of these designated anchorage areas were noted by the UK Chamber of Shipping during consultation and HHA indicated that deeper burial will be required where there is an increased interaction risk from anchorage areas. From the vessel traffic data, anchoring activity in proximity to the offshore ECC is substantial but limited to these two anchorage areas. Therefore, planned anchoring within the offshore ECC is considered unlikely, particularly given that the offshore ECC passes through the Sunk VTS area.

9.11.170 With suitable metocean conditions, an anchor dragging event could cause an interaction incident, particularly out of the Sunk Inner anchorage given its proximity. Commercial vessel sizes utilising this anchorage area are relatively small (average 112 m) compared to those utilising the Sunk DW anchorage (average 257 m), with concerns raised by Stena Line during consultation relating primarily to the largest commercial vessels which use the Sunk DW anchorage. Again, it is noted that vessels at anchor will be monitored by Sunk VTS.

UNPLANNED ANCHORING

9.11.171 The location of unplanned anchoring cannot be pinpointed to any specific locations within the offshore ECC given the nature of this activity. This element of this impact was a key topic of discussion during the Hazard Workshop, with specific locations noted as higher risk including the Sunk Inner Precautionary Area (given the shifting seabed) and where the offshore ECC crosses the Sunk Outer Precautionary Area. For the latter, Stena Line indicated that the burial depth would need to be greater than where the offshore ECC follows the Sunk TSS East. Any unplanned anchoring is highly likely to be undertaken in consultation with Sunk VTS.

ANCHOR DRAGGING

9.11.172 With suitable metocean conditions, an anchor dragging event could cause an interaction incident, particularly out of the Sunk Inner anchorage given its proximity. To investigate this further, a dedicated anchor dragging risk assessment was undertaken for the preferred option presented at the PEIR stage. This involved application of Anatec's anchor dragging model based on long-term AIS data, metocean data, and holding ground conditions.

9.11.173 The total annual frequency of vessels dragging anchor over the export cables, assuming that they are unburied (worst case) and based upon the preferred option presented at the PEIR stage, was estimated to be 5.5×10^{-3}, corresponding to a return period of approximately one in 180 years.

9.11.174 The risk was greatest for sections of the preferred option close to the charted anchorages, and in particular the Sunk Inner anchorage (87% of the anchor dragging risk). The majority of the risk was associated with cargo vessels and tankers between 1,000 and 30,000 Dead Weight Tonnage (DWT), which again relate to the Sunk Inner anchorage.

CUMULATIVE SCENARIO – ALL RECEPTORS

TIER 1

9.11.175 This impact has been highlighted by stakeholders during consultation, with HHA, PLA, London Gateway, and Stena Line raising concerns relating to the cumulative presence of activities for VE and other subsea cable developments.

9.11.176 North Falls (export cables), NeuConnect, and Sea Link are expected to intersect the offshore ECC including crossings. Should a vessel anchor in a location where VE and other subsea cable developments are in close proximity, the level of exposure to anchor snagging will be greater.

9.11.177 However, the application of good seamanship is anticipated, with mariners checking the relevant nautical charts prior to making the decision to drop the anchor. Dropping the anchor over a subsea cable would only occur as a last resort to prevent an incident with potentially greater consequences such as a collision or allision, especially given the increased difficulty which would be presented to the mariner in recovering a snagged anchor. Additionally, the likelihood of a vessel requiring to drop anchor at a location where the export cables and other subsea cable developments are in close proximity is very low, with the assessment of vessel traffic data provided for the in isolation scenario again applicable.

9.11.178 It is assumed that, as with the export cables, North Falls, NeuConnect, and Sea Link will be subject to a CBRA and will be shown on relevant nautical charts.

TIER 2

9.11.179 For this impact there is no direct link between the offshore ECC and any Tier 2 developments and therefore no additional assessment of effect has been undertaken.

TIER 3

9.11.180 For this impact there is no direct link between the offshore ECC and any Tier 3 developments and therefore no additional assessment of effect has been undertaken.

MITIGATION

9.11.181 Mitigation identified as relevant to reducing the significance of effect are as follows:

- CBRA;
- Charting of infrastructure;
- Guard vessels as required; and
- Promulgation of information.

POTENTIAL SIGNIFICANCE OF EFFECT

9.11.182 The frequency of occurrence and severity of consequence due to anchor interaction with subsea cables associated with the offshore ECC for the O&M phase of VE is presented in Table 9.23 alongside the resulting significance of effect.

Table 9.23: Significance of effect for anchor interaction with subsea cables (offshore ECC).

Scenario	Phase	Worst case consequences	Frequency of occurrence	Severity of consequence	Significance of effect
VE in isolation	O&M	Anchor snagging incident occurs with anchor and/ or cable damage and compromised vessel stability.	Remote	Minor	Broadly Acceptable
Cumulative	O&M		Remote	Moderate	Tolerable with Mitigation

IMPACT 10: REDUCTION OF EMERGENCY RESPONSE CAPABILITY (ARRAY AREAS AND OFFSHORE EXPORT CABLE CORRIDOR)

9.11.183 The presence of surface structures within the array areas and O&M activities associated with the array areas and offshore ECC 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.

9.11.184 The MCA have noted during consultation that particular consideration is needed of the implications due to the presence of VE on SAR resources, with a SAR Checklist requiring completion post consent in consultation with the MCA.

9.11.185 The array areas and offshore ECC are considered collectively for this impact since the assessment undertaken is considered relevant to VE as a whole.

IN ISOLATION SCENARIO – ALL RECEPTORS

EMERGENCY RESPONSE RESOURCES

9.11.186 The O&M phase may last for up to 40 years with up to 27 O&M vessels located on-site simultaneously and making up to 1,776 annual round trips. With a full build out of the array areas, these vessels will increase the likelihood of an incident requiring an emergency response and subsequently increase the likelihood of multiple incidents occurring simultaneously, diminishing emergency response capability.

9.11.187 There are various emergency response resources serving the region, including RNLI stations (closest at Aldeburgh approximately 21 nm to the north-west) and SAR helicopter bases (closest at Lydd approximately 63 nm to the south-west). Given the distances which would be travelled in the event of an emergency response incident in proximity to VE, this impact covers a regional spatial extent.

9.11.188 From historical incident data, there is a moderate rate of incidents in the region, although the likelihood of an incident relating to VE occurring at the same time is low. Additionally, based on the number of collision and allision incidents[6] associated with UK OWF reported to date, there is an average of one incident per 1,680 operational WTG years (as of November 2023). Therefore, VE itself is not expected to result in a marked increase in the frequency of incidents requiring an emergency response.

9.11.189 Additionally, should an incident occur in proximity to the array areas, it is likely that a project vessel would be well equipped to assist under SOLAS obligations (IMO, 1974) and in liaison with the MCA, potentially as the first responder. This is reflected in past experience, with 12 known instances of a vessel (or persons on a vessel) being assisted by an industry vessel for a nearby UK OWF.

9.11.190 The most likely consequences in the event of an incident in the region requiring an emergency response is that emergency responders are able to assist without any limitations on capability. As a worst case, there could be a delay to a response request due to a simultaneous incident associated with VE leading to PLL, pollution, and vessel damage. However, this worst case scenario is highly unlikely.

SEARCH AND RESCUE ACCESS

9.11.191 With a full build out of the array areas, its physical presence may restrict access for SAR responders, either due to the incident in question occurring within the arrays or the arrays obstructing the most effective path to each an incident (likely further offshore). This is more likely to be an issue in adverse weather conditions. The Applicant is committed to working within the parameters of MGN 654 to minimise impacts.

9.11.192 From recent SAR helicopter taskings data, the frequency of UK SAR operations in proximity to the array areas is relatively low. Those incidents reported primarily occurred inshore of the array areas, with only one incident occurring east of the array areas.

9.11.193 The total area covered by the array areas is approximately 37 square nautical miles (nm^2), which represents a low to moderate area to search compared to other OWF. It is unlikely that a SAR operation will require both array areas to be searched; it is much more likely that a search could be restricted to the northern array area or southern array area exclusively depending upon the information available regarding the casualty location (inclusive of any assumptions on the drift of the casualty).

[6] Although other types of incidents are acknowledged, collision and allision incidents have the potential to be among the most serious and give a reasonable indication of the rate of incidents requiring an emergency response.

9.11.194 The minimum spacing between WTGs (measured centre-to-centre) is 830 m which is greater than that associated with many other UK OWFs and similar to that present at the neighbouring Greater Gabbard and Galloper. The northern array area includes a SLoO but given the size of the array area this is not expected to compromise the effectiveness of a SAR operation noting that the longest SAR access lane for the indicative array layout is less than 5 nm length. As per MGN 654 requirements, a setback of at least 1 nm (measured tip-to-tip) will be maintained from the neighbouring Galloper for both array areas, assuming the array layouts do not align. This will allow a SAR asset to safely exit one array without entering the other. If the layout does align with Galloper a smaller setback may be applied.

9.11.195 The final array layout will be agreed with the MCA and Trinity House post consent but will be compliant with the requirements of MGN 654 (MCA, 2021), including:

- Completion of a safety justification for a SLoO layout should this be taken forward;
- Completion of a SAR Checklist;
- Completion of an ERCoP; and
- Application of unique identification marking of structures in an easily identifiable pattern.

9.11.196 The SAR Checklist and ERCoP will remain live documents throughout the O&M phase.

9.11.197 The most likely consequences in the event of a SAR operation is that SAR assets are able to fulfil their objectives without any limitations on capability. As a worst case, it may not be possible to undertake an effective search. However, given compliance with MGN 654 for the final array layout, this is considered highly unlikely.

CUMULATIVE SCENARIO – ALL RECEPTORS

TIER 1

9.11.198 Activities associated with East Anglia Two, North Falls, NeuConnect, and Sea Link will further increase the likelihood of an incident requiring an emergency response and could subsequently increase the likelihood of multiple incidents occurring simultaneously, diminishing emergency response capability.

9.11.199 However, as with VE, it is assumed that these developments will have suitable mitigation in place to reduce the likelihood of a reduction in emergency response capability including marine coordination for project vessels and ERCoPs. Furthermore, SOLAS obligations (IMO, 1974) are applicable to all developments and may have a positive effect on a cumulative level, e.g., a project vessel for East Anglia Two may be able to assist with an incident associated with VE.

9.11.200 Given that the array areas are not immediately adjacent to East Anglia Two (minimum separation of 2.86 nm), there is not considered to be any cumulative effect associated with SAR access, noting that this separation distance exceeds the 1 nm distance required by MGN 654.

TIER 2

9.11.201 Activities associated with East Anglia One North will further increase the likelihood of an incident requiring an emergency response and subsequently could increase the likelihood of multiple incidents occurring simultaneously, diminishing emergency response capability.

9.11.202 Again, it is assumed that East Anglia One North will have suitable mitigation in place to reduce the likelihood of a reduction in emergency response capability. However, given the distance from VE (minimum 18 nm), it is unlikely that SOLAS obligations would be as relevant for project vessels associated with East Anglia One North in the event of an incident associated with VE (compared with Tier 1 developments).

TIER 3

9.11.203 Activities associated with East Anglia Three, Norfolk Vanguard East, Norfolk Vanguard West, Hollandse Kust (West), and Hollandse Kust F will further increase the likelihood of an incident requiring an emergency response and subsequently could increase the likelihood of multiple incidents occurring simultaneously, diminishing emergency response capability.

9.11.204 Again, it is assumed that these developments will have suitable mitigation in place to reduce the likelihood of a reduction in emergency response capability. However, given the distance from VE (minimum 35 nm for East Anglia Three), it is unlikely that SOLAS obligations would be as relevant for project vessels associated with these developments in the event of an incident associated with VE.

9.11.205 Moreover, it is likely that differing emergency response resources may respond to an incident associated with these developments compared to VE, including Dutch resources (for Hollandse Kust (West) and Hollandse Kust F) and the Humber Maritime Rescue Coordination Centre (MRCC) (for Norfolk Vanguard East and Norfolk Vanguard West). Therefore, the likelihood of this impact arising is not substantially higher than with the Tier 2 developments *in situ*.

MITIGATION

9.11.206 Mitigation identified as relevant to reducing the significance of effect are as follows:

- Compliance with MGN 654;
- Lighting and marking;
- Marine coordination for project vessels;
- Pollution planning; and
- Project vessel compliance with international marine regulations.

POTENTIAL SIGNIFICANCE OF EFFECT

9.11.207 The frequency of occurrence and severity of consequence due to reduction of emergency response capability for the O&M phase of VE is presented in Table 9.24 alongside the resulting significance of effect.

Table 9.24: Significance of effect for reduction of emergency response capability.

Scenario	Phase	Worst case consequences	Frequency of occurrence	Severity of consequence	Significance of effect
VE in isolation	O&M	Delay to a response request and inability to undertake an effective search leading to vessel damage, PLL, and pollution.	Negligible	Serious	Broadly Acceptable
Cumulative	O&M		Extremely Unlikely	Serious	Tolerable with Mitigation

9.12 CLIMATE CHANGE

9.12.1 It is possible that climate change and measures taken to slow the effects of climate change could have both a negative and positive effect on shipping and navigation receptors. This section assesses the following aspects:

- The effect of climate change on the local area in which the proposed development will take place; and
- The likely impacts of climate change and the project in-combination on the receiving environment.
- The information provided in this section will be drawn upon and summarised in Volume 6, Part 4, Chapter 1: Climate Change. As outlined in Volume 6, Part 4, Chapter 1: Climate Change, the operational phase of VE would enable the use of renewable electricity which would result in a positive greenhouse gas impact, resulting in a significant beneficial effect.

EFFECT OF CLIMATE CHANGE ON THE LOCAL ENVIRONMENT

9.12.2 Given the temporal nature of climate change, any effects are expected to develop in the long-term (likely post operational life of VE) rather than the short- or medium-term. As it is not possible to be fully cognisant of future case climate change parameters, any assessment of positive or negative effects is not considered reasonable nor will it provide a conclusive assessment. However, it is likely that changes to international conventions regulating the shipping industry will mitigate impacts associated with increased journey time and/or distance (noting this is minimal for the array areas) and that any changes to sea level or storm frequency are not likely to have a direct effect within the lifetime of VE.

EFFECT OF CLIMATE CANGE AND THE PROJECT ON THE LOCAL ENVIRONMENT

9.12.3 The project is not predicted to contribute to the impacts of climate change in the local area to any significant extent.

9.13 INTER-RELATIONSHIPS

9.13.1 Potential effects may arise on receptors from different aspects. For shipping and navigation, the following inter-related impact has been identified:

- Commercial fisheries – displacement of commercial fishing vessels from fishing grounds due to the presence of the buoyed construction/ decommissioning area during the construction and decommissioning phases.

9.13.2 Inter-related impacts are addressed in Volume 6, Part 4, Chapter 3: Inter-relationships.

9.14 TRANSBOUNDARY EFFECTS

9.14.1 Given the international nature of routeing by commercial vessels – particularly in the region containing VE given the proximity to international maritime boundaries with the Netherlands and Belgium – a transboundary effect relating to the displacement of commercial vessels undertaking international voyages has been identified.

9.14.2 Since the use of AIS transceivers (the primary data source for characterisation of commercial vessel movements) is international, the characterisation of the existing environment in Section 9.7 is suitable for identifying relevant other European Economic Areas (EEA). Other EEAs with port(s) which feature in the main commercial routes include the Netherlands, Belgium, northern Europe, Germany, and the Baltic. Additionally, various routes in/ out of the Dover Strait have been identified and lead to further EEAs and beyond.

9.14.3 This aligns with the transboundary screening undertaken by the Planning Inspectorate which identified the Dutch, Belgian and French international maritime boundaries as closest to VE and displacement from existing routes as a potential impact (Planning Inspectorate, 2021).

9.14.4 Since such international commercial routeing is captured in the existing baseline environment, the environmental assessment for both VE in isolation and cumulatively with other projects and plans suitably considers this effect in transboundary terms.

9.15 SUMMARY OF EFFECTS

9.15.1 Based on the established existing environment, outputs of consultation with key stakeholders and consideration of the future case scenario including the outputs of collision and allision risk modelling, the following impacts have been assessed:

- Vessel displacement and increased collision risk (array areas and offshore ECC);
- Third-party with project vessel collision risk (array areas and offshore ECC);
- Reduced access to local ports and harbours and reduction in under keel clearance (array areas and offshore ECC);
- Creation of allision risk (array areas);
- Anchor interaction with subsea cables (array areas and offshore ECC); and
- Reduction of emergency response capability (including SAR access) (array areas and offshore ECC).

9.15.2 Overall, the environmental assessment concludes that there will be no significant effects arising from VE – both in isolation and cumulative with other projects – during the construction, O&M, and decommissioning phases..

9.15.3 Table 9.25 presents a summary of effects for shipping and navigation.

Table 9.25: Summary of effects for shipping and navigation.

Description of impact	Significance of effect	Additional mitigation measures	Residual effect
Construction			
Impact C1: Vessel displacement and increased collision risk (array areas)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact C2: Vessel displacement and increased collision risk (offshore ECC)	Tolerable with Mitigation	None proposed	Tolerable with Mitigation
Impact C3: Third-party with project vessel collision risk (array areas)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact C4: Third-party with project vessel collision risk (offshore ECC)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact C5: Reduced access to local ports and harbours and reduction in under keel clearance (array areas)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact C6: Reduced access to local ports and harbours and reduction in under keel clearance (offshore ECC)	Tolerable with Mitigation	None proposed	Tolerable with Mitigation
O&M			
Impact O1: Vessel displacement and increased collision risk (array areas)	Broadly Acceptable	None proposed	Broadly Acceptable

Description of impact	Significance of effect	Additional mitigation measures	Residual effect
Impact O2: Vessel displacement and increased collision risk (offshore ECC)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact O3: Third-party with project vessel collision risk (array areas)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact O4: Third-party with project vessel collision risk (offshore ECC)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact O5: Reduced access to local port and harbours and reduction in under keel clearance (array areas)	Tolerable with Mitigation	None identified	Tolerable with Mitigation
Impact O6: Reduced access to local port and harbours and reduction in under keel clearance (offshore ECC)	Tolerable with Mitigation	None proposed	Tolerable with Mitigation
Impact O7: Creation of allision risk (array areas)	Tolerable with Mitigation	None proposed	Tolerable with Mitigation
Impact O8: Anchor interaction with subsea cables (array areas)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact O9: Anchor interaction with subsea cables (offshore ECC)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact O10: Reduction of emergency response capability	Broadly Acceptable	None proposed	Broadly Acceptable

Description of impact	Significance of effect	Additional mitigation measures	Residual effect
(including SAR access)			
Decommissioning			
Impact D1: Vessel displacement and increased collision risk (array areas)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact D2: Vessel displacement and increased collision risk (offshore ECC)	Tolerable with Mitigation	None proposed	Tolerable with Mitigation
Impact D3: Third-party with project vessel collision risk (array areas)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact D4: Third-party with project vessel collision risk (offshore ECC)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact D5: Reduced access to local ports and harbours and reduction in under keel clearance (array areas)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact D6: Reduced access to local ports and harbours and reduction in under keel clearance (offshore ECC)	Tolerable with Mitigation	None proposed	Tolerable with Mitigation
Cumulative effects			

Description of impact	Significance of effect	Additional mitigation measures	Residual effect
Impact 1: Vessel displacement and increased collision risk (array areas)	Tolerable with Mitigation[7]	Discussion of additional aids to navigation with Trinity House during discussions for final array layout post consent	Tolerable with Mitigation
Impact 2: Vessel displacement and increased collision risk (offshore ECC)	Tolerable with Mitigation[5]	None proposed	Tolerable with Mitigation
Impact 3: Third-party with project vessel collision risk (array areas)	Tolerable with Mitigation[5]	None proposed	Tolerable with Mitigation
Impact 4: Third-party with project vessel collision risk (offshore ECC)	Broadly Acceptable	None proposed	Broadly Acceptable
Impact 5: Reduced access to local port and harbours and reduction in under keel clearance (array areas)	Tolerable with Mitigation[5]	None proposed	Tolerable with Mitigation
Impact 6: Reduced access to local port and harbours and reduction in under keel clearance (offshore ECC)	Tolerable with Mitigation	None proposed	Tolerable with Mitigation
Impact 7: Creation of allision risk (array areas)	Tolerable with Mitigation	None proposed	Tolerable with Mitigation
Impact 8: Anchor interaction with	Broadly Acceptable	None proposed	Broadly Acceptable

[7] Associated with construction and decommissioning phases – significance of effect is Broadly Acceptable for the O&M phase.

Description of impact	Significance of effect	Additional mitigation measures	Residual effect
subsea cables (array areas)			
Impact 9: Anchor interaction with subsea cables (offshore ECC)	Tolerable with Mitigation	None proposed	Tolerable with Mitigation
Impact 10: Reduction of emergency response capability (including SAR access)	Tolerable with Mitigation	None proposed	Tolerable with Mitigation

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FIVE ESTUARIES
OFFSHORE WIND FARM

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