# RWE Renewables UK Dogger Bank South (West) Limited

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# Dogger Bank South Offshore Wind Farms

**Preliminary Environmental Information Report**
**Appendix 14-1 – Navigational Risk Assessment**

**25/04/2023**

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Unrestricted

# Dogger Bank South Offshore Wind Farms Navigational Risk Assessment

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| | Aberdeen Office | Cambridge Office |
|---|---|---|
| **Address** | 10 Exchange Street, Aberdeen, AB11 6PH, UK | Braemoor, No. 4 The Warren, Witchford Ely, Cambs, CB6 2HN, UK |
| **Tel** | 01224 253700 | 01353 661200 |
| **Email** | aberdeen@anatec.com | cambs@anatec.com |

| Revision Number | Date | Summary of Change |
|---|---|---|
| 00 | 16th December 2022 | Initial draft for PEIR |
| 01 | 6th January 2023 | Updated following RHDHV review |
| 02 | 23rd January 2023 | Updated following RWE Renewables review |
| 03 | 23rd March 2023 | Updated following further RWE Renewables review |
| 04 | 4th April 2023 | Updated following further RWE Renewables review |
| 05 | 13th April 2023 | Final for PEIR |

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# Abbreviations Table

| Abbreviation | Definition |
|---|---|
| **AC** | Alternating Current |
| **AIS** | Automatic Identification System |
| **ALARP** | As Low as Reasonably Practicable |
| **ALB** | All-Weather Lifeboat |
| **ARPA** | Automatic Radar Plotting Aid |
| **ATBA** | Area to be Avoided |
| **BWEA** | British Wind Energy Association |
| **CAA** | Civil Aviation Authority |
| **CBA** | Cost Benefit Analysis |
| **CD** | Chart Datum |
| **COLREGs** | Convention on the International Regulations for Preventing Collisions at Sea |
| **CTV** | Crew Transfer Vessel |
| **DBS** | Dogger Bank South |
| **DC** | Direct Current |
| **DECC** | Department of Energy and Climate Change |
| **DfT** | Department for Transport |
| **dML** | Deemed Marine Licence |
| **DSC** | Digital Selective Calling |
| **EEZ** | Exclusive Economic Zone |
| **EIA** | Environmental Impact Assessment |
| **EMF** | Electromagnetic Field |
| **ERCoP** | Emergency Response Cooperation Plan |
| **ES** | Environmental Statement |
| **ESRI** | Environmental Systems Research Institute |
| **ETRS89** | European Terrestrial Reference System 1989 |
| **FLO** | Fisheries Liaison Officer |
| **FSA** | Formal Safety Assessment |
| **GIS** | Geographical Information System |
| **GLA** | General Lighthouse Authority |
| **GMDSS** | Global Maritime Distress and Safety System |
| **GPS** | Global Positioning System |
| **GRP** | Glass Reinforced Plastic |

| Abbreviation | Definition |
|---|---|
| **GT** | Gross Tonnage |
| **HF** | High Frequency |
| **HMCG** | His Majesty's Coastguard |
| **HRA** | Helicopter Refuge Area |
| **HVAC** | High Voltage Alternating Current |
| **HVDC** | High Voltage Direct Current |
| **IALA** | International Association of Marine Aids to Navigation and Lighthouse Authorities |
| **ILB** | Inshore Lifeboat |
| **IMO** | International Maritime Organization |
| **IPS** | Intermediate Peripheral Structure |
| **kt** | Knot |
| **kHz** | Kilohertz |
| **LAT** | Lowest Astronomical Tide |
| **LOA** | Length Overall |
| **m** | Metre |
| **MAIB** | Marine Accident Investigation Branch |
| **MCA** | Maritime and Coastguard Agency |
| **MDS** | Maximum Design Scenario |
| **Metocean** | Meteorological Ocean |
| **MF** | Medium Frequency |
| **MGN** | Marine Guidance Note |
| **MHWS** | Mean High Water Springs |
| **MMO** | Marine Management Organisation |
| **MoD** | Ministry of Defence |
| **MPCP** | Marine Pollution Contingency Plan |
| **MRCC** | Maritime Rescue Coordination Centre |
| **MSI** | Maritime Safety Information |
| **MSL** | Mean Sea Level |
| **NAVTEX** | Navigational Telex |
| **nm** | Nautical Mile |
| **$nm^2$** | Square Nautical Mile |
| **NPS** | National Policy Statement |
| **NRA** | Navigational Risk Assessment |
| **NSIP** | Nationally Significant Infrastructure Project |

| Abbreviation | Definition |
|---|---|
| **NUC** | Not Under Command |
| **OREI** | Offshore Renewable Energy Installation |
| **OSP** | Offshore Substation Platform |
| **OSPAR** | Convention for the Protection of the Marine Environment of the North-East Atlantic |
| **PEIR** | Preliminary Environmental Information Report |
| **PEXA** | Practice and Exercise Area |
| **PLL** | Potential Loss of Life |
| **PNT** | Positioning, Navigation, and Timing |
| **Racon** | Radar Beacon |
| **Radar** | Radio Detection and Ranging |
| **RAM** | Restricted in Ability to Manoeuvre |
| **RCP** | Reactive Compensation Platform |
| **RNLI** | Royal National Lifeboat Institution |
| **RoPax** | Roll-on / Roll-off Passenger |
| **RoRo** | Roll-on / Roll-off Cargo |
| **RYA** | Royal Yachting Association |
| **SAR** | Search and Rescue |
| **SCADA** | Supervisory Control and Data Acquisition |
| **SLoO** | Single Line of Orientation |
| **SOLAS** | International Convention for the Safety of Life at Sea |
| **SONAR** | Sound Navigation Ranging |
| **SOV** | Service Operations Vessel |
| **SPS** | Significant Peripheral Structure |
| **TSS** | Traffic Separation Scheme |
| **UK** | United Kingdom |
| **UKHO** | United Kingdom Hydrographic Office |
| **VHF** | Very High Frequency |
| **VTS** | Vessel Traffic Service |
| **WGS84** | World Geodetic System 1984 |

# 1 Introduction

## 1.1 Background

1. Anatec was commissioned by RWE Renewables ('RWE') to undertake a Navigational Risk Assessment (NRA) for the proposed Dogger Bank South (DBS) East and DBS West offshore wind farms, collectively referred to as DBS offshore wind farms (hereafter referred to as 'the Projects'). The Projects consist of the DBS array areas and offshore export cable corridor, with the latter potentially including a Reactive Compensation Platform (RCP) and electrical switching platform. This NRA presents information on the Projects relative to the existing and estimated future navigation activity and forms the technical appendix to **Chapter 14: Shipping and Navigation**.

## 1.2 Navigational Risk Assessment

2. An Environmental Impact Assessment (EIA) is a process which identifies the environmental effects of a proposed development, both negative and positive. An important requirement of the EIA for offshore projects is the NRA. Following the Maritime and Coastguard Agency's (MCA) Marine Guidance Note (MGN) 654 (MCA, 2021) including the methodology document (Annex 1), this NRA includes:

- Outline of methodology applied in the NRA;
- Summary of consultation undertaken with shipping and navigation stakeholders to date;
- Lessons learnt from previous offshore wind farm developments;
- Summary of the project description relevant to shipping and navigation;
- Baseline characterisation of the existing environment;
- Discussion of potential impacts on navigation, communication and position fixing equipment;
- Cumulative and transboundary overview;
- Future case vessel traffic characterisation;
- Assessment of navigational risk (following the Formal Safety Assessment (FSA) process);
- Outline of embedded mitigation measures; and
- Completion of the MGN 654 Checklist.

3. Potential hazards are considered for each phase of development as follows:

- Construction;
- Operation and maintenance; and
- Decommissioning.

4. Additional work to be completed to meet the requirements of MGN 654 is described in Section 18.5, and will be included in the NRA submitted as part of the Application (at the Environmental Statement (ES)) stage.

5. The assessment of the Projects is based on a parameter-based design envelope approach, which is recognised in the Overarching National Policy Statement (NPS) for Energy (EN-1) (Department of Energy and Climate Change (DECC), 2011 (b)), the NPS for Renewable Energy Infrastructure (EN-3) (DECC, 2011) (a))[1], and *Planning Inspectorate Advice Note Nine: Rochdale Envelope* (The Planning Inspectorate, 2018). The design envelope includes conservative assumptions to form a Maximum Design Scenario (MDS) which is considered and assessed for all risks. Further details on the design envelope are provided in Section 6.

6. The shipping and navigation baseline has been developed, and risk assessment, undertaken based upon the information available and responses received at the time of preparation, including the MDS as discussed above.

[1] Draft versions of a revised Overarching NPS for Energy (EN-1) (BEIS, 2021) and NPS for Renewable Energy Infrastructure (EN-3) (BEIS, 2021) were published for consultation in September 2021 but have not been finalised at the time of writing. There are no material changes in the revised documents which would alter the assessment undertaken.

# 2 Guidance and Legislation

## 2.1 Legislation

7. Planning policy on offshore renewable energy Nationally Significant Infrastructure Projects (NSIP) specific to shipping and navigation is contained in the NPS for Renewable Energy Infrastructure (EN-3) (DECC, 2011 (a)). Additionally, planning policy on NSIPs for ports is contained in the NPS for Ports (Department for Transport (DfT), 2012). **Chapter 14: Shipping and Navigation** summarises the relevant matters within NPS EN-3 and the NPS for Ports, and where they are considered in the Preliminary Environmental Information Report (PEIR).

## 2.2 Primary Guidance

8. The primary guidance documents used during the assessment are the following:

- *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 International Maritime Organization (IMO) Rule-Making Process* (IMO, 2018).

9. MGN 654 highlights issues that shall be considered when assessing the effect on navigational safety from offshore renewable energy developments proposed in United Kingdom (UK) internal waters, UK territorial sea or the UK Exclusive Economic Zone (EEZ).

10. The MCA require that their methodology (Annex 1 to MGN 654) is used as a template for preparing NRAs. It is centred on risk management and requires a submission that shows that sufficient controls are, or will be, in place for the assessed risk to be judged as broadly acceptable or tolerable with mitigation (see Section 3.2). Across **Chapter 14: Shipping and Navigation** and the NRA both base and future case levels of risk have been identified and the measures required to ensure the future case remains broadly acceptable or tolerable with mitigation.

## 2.3 Other Guidance

11. Other guidance documents used during the assessment are as follows:

- *MGN 372 Amendment 1 (Merchant and Fishing) Offshore Renewable Energy Installations (OREIs): Guidance to Mariners Operating in the Vicinity of UK OREIs* (MCA, 2022);
- *International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Guideline G1162 Guidance on the Marking of Offshore Man-Made Structures* (IALA, 2021 (a));
- *IALA Recommendation O-139 on The Marking of Man-Made Offshore Structures* (IALA, 2021 (b));

- *The Royal Yachting Association's (RYA) Position on Offshore Renewable Energy Developments: Paper 1 (of 4) – Wind Energy* (RYA, 2019);
- *Standard Marking Schedule for Offshore Installations* (DECC, 2011 (c)); and
- *UK Marine Policy Statement* (HM Government, 2011)

## 2.4 Lessons Learnt

12. There is considerable benefit for RWE in the sharing of lessons learnt within the offshore industry. The NRA, and in particular the risk assessment undertaken in Section 15, includes general consideration for lessons learnt and expert opinion from previous offshore wind farm developments and other sea users, capitalising upon the UK's position as a leading generator of offshore wind power. This includes the shipping and navigation chapters of the ES for the Round 3 Dogger Bank offshore wind farm developments.

# 3 Navigational Risk Assessment Methodology

## 3.1 Formal Safety Assessment Methodology

13. A shipping and navigation user may only be exposed to a risk caused by a hazard if there is a pathway through which a risk may be transmitted between the source activity and the user. In cases where a user is exposed to a risk, the overall significance of risk to the user is determined. This process incorporates a degree of subjectivity. The assessments presented herein for shipping and navigation users have considered the following criteria:

- Baseline data and assessment;
- Expert opinion;
- Level of stakeholder concern;
- Time and / or distance of any deviation;
- Number of transits of specific vessels and / or vessel types; and
- Lessons learnt from existing offshore developments.

14. It is noted that, with regards to commercial fishing vessels, the methodology and assessment has been applied to hazards considering commercial fishing vessels in transit. A separate methodology and assessment have been applied in **Chapter 13: Commercial Fisheries** to consider hazards on commercial fishing vessels including safety risks which are directly related to commercial fishing activity (rather than commercial fishing vessels in transit) and risks of a commercial nature.

## 3.2 Formal Safety Assessment Process

15. The IMO FSA process (IMO, 2018) as approved by the IMO in 2018 under Maritime Safety Committee – Marine Environment Protection Committee (MEPC).2/circ. 12/Rev.2 has been applied to the risk assessment within this NRA and informs **Chapter 14: Shipping and Navigation**.

16. The FSA process is a structured and systematic methodology based upon risk analysis and Cost Benefit Analysis (CBA) (if applicable) to reduce impacts to As Low as Reasonably Practicable (ALARP). There are five basic steps within this process as illustrated by Figure 3.1 and summarised in the following list:

- Step 1 – Identification of hazards (a list is produced of hazards prioritised by risk level specific to the problem under review);
- Step 2 – Risk assessment (investigation of the causes and initiating events and risks of the more important hazards identified in Step 1);
- Step 3 – Risk control options (identification of measures to control and reduce the identified risks);
- Step 4 – CBA (identification and comparison of the benefits and costs associated with the risk control options identified in Step 3); and

- Step 5 – Recommendations for decision-making (defining of recommendations based upon the outputs of Steps 1 to 4).


### Figure 3.1 Flow Chart of the FSA Methodology

### 3.2.1 Hazard Workshop Methodology

17. A key tool used in the NRA process is the Hazard Workshop which ensures that all hazards are identified, and the corresponding risks qualified in discussion with relevant consultees. Table 3.1 and Table 3.2 define the severity of consequence and the frequency of occurrence rankings that will be used to assess risks within the hazard log, completed based on the outputs of the Hazard Workshop (to be accounted for at the ES stage).

### Table 3.1 Severity of Consequence Ranking Definitions

| Rank | Description | Definition | | | |
|---|---|---|---|---|---|
| | | People | Property | Environment | Business |
| 1 | Negligible | No perceptible impact | No perceptible impact | No perceptible impact | No perceptible impact |
| 2 | Minor | Slight injury(s) | Minor damage to property i.e., superficial damage | Tier 1 local assistance required | Minor reputational risks – limited to users |

| Rank | Description | Definition | | | |
|---|---|---|---|---|---|
| | | People | Property | Environment | Business |
| 3 | Moderate | Multiple minor or single serious injury | Damage not critical to operations | Tier 2 limited external assistance required | Local reputational risks |
| 4 | Serious | Multiple serious injuries or single fatality | Damage resulting in critical impact on operations | Tier 2 regional assistance required | National reputational risks |
| 5 | Major | More than one fatality | Total loss of property | Tier 3 national assistance required | International reputational risks |

### Table 3.2 Frequency of Occurrence Ranking Definitions

| Rank | Description | Definition |
|---|---|---|
| 1 | Negligible | < 1 occurrence per 10,000 years |
| 2 | Extremely unlikely | 1 per 100 to 10,000 years |
| 3 | Remote | 1 per 10 to 100 years |
| 4 | Reasonably probable | 1 per 1 to 10 years |
| 5 | Frequent | Yearly |

18. The severity of consequence and frequency of occurrence are then used to define the significance of risk via a tolerability matrix approach as shown in Table 3.3. The significance of risk is defined as Broadly Acceptable (low risk), Tolerable (intermediate risk), or Unacceptable (high risk).

### Table 3.3 Tolerability Matrix and Risk Rankings

| Severity of Consequence | | | | | | |
|---|---|---|---|---|---|---|
| | 5 | | | | | |
| | 4 | | | | | |
| | 3 | | | | | |
| | 2 | | | | | |
| | 1 | | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| | | Frequency of Occurrence | | | | |

| | |
|---|---|
| | Unacceptable (high risk) |
| | Tolerable (intermediate risk) |
| | Broadly Acceptable (low risk) |

19. Once identified, the significance of risk will be assessed to ensure it is ALARP. Further risk control measures may be required to further mitigate a hazard in accordance with the ALARP principles. Unacceptable risks are not considered to be ALARP.

## 3.3 Methodology for Cumulative Risk Assessment

20. The hazards identified in the FSA will also be assessed for cumulative risks with the inclusion of other projects and proposed developments (at the ES stage). Given the varying type, status and location of developments, a tiered approach to cumulative risk assessment will be undertaken, which splits developments into tiers depending upon project status, proximity to the DBS array areas and the level to which they are anticipated to cumulatively impact relevant users. Data confidence will also be considered, most notably in terms of the level of certainty over the location and timescales for a development.

21. The tiers are summarised in Table 3.4, with the level of assessment to be undertaken for each tier included. It is noted that an aggregate of the criterion is used to determine the tier of each development. The maximum distance within which developments will be considered for the cumulative risk assessment is dependent upon the type of development:

- Offshore wind farms – up to 50 nautical miles (nm) from the array areas and up to 5nm from the offshore export cable corridor;
- Oil and gas infrastructure – up to 10nm from the array areas and up to 5nm from the offshore export cable corridor;
- Marine aggregate dredging areas – up to 25nm from the array areas and up to 5nm from the offshore export cable corridor; and
- Sub-sea cables – up to 2nm from the array areas and up to 2nm from the offshore export cable corridor.

22. These distances have been selected on the basis that at greater distances there is no direct pathway between the Projects and other developments.

23. Preliminary cumulative screening is provided in Section 13. It will be reviewed at the ES stage prior to the cumulative risk assessment being undertaken. In particular, project statuses may change (noting that preliminary cumulative screening was undertaken in December 2022, prior to the start of offshore construction for Dogger Bank B).

## Table 3.4 Cumulative Development Screening Summary

| Tier | Minimum Development Status | Criterion | Data Confidence Level | Level of Cumulative Risk Assessment |
|---|---|---|---|---|
| 1 | Under construction, consented or under determination | ▪ May impact a main commercial route passing within 1nm of the array areas and / or interacts with traffic which may be directly displaced by the array areas.<br>▪ Raised as having possible cumulative effect during consultation.<br>*Offshore wind farms:*<br>▪ Up to 25nm from the array areas; or<br>▪ Up to 2nm from the offshore export cable corridor.<br>*Oil and gas infrastructure:*<br>▪ Up to 5nm from the array areas; or<br>▪ Up to 2nm from the offshore export cable corridor.<br>*Marine aggregate dredging areas:*<br>▪ Up to 15nm from the array areas; or<br>▪ Up to 2nm from the offshore export cable corridor.<br>*Sub-sea cables:*<br>▪ Up to 2nm from the array areas; or<br>▪ Up to 2nm from the offshore export cable corridor. | High or medium | Quantitative cumulative re-routeing of main commercial routes |

| Tier | Minimum Development Status | Criterion | Data Confidence Level | Level of Cumulative Risk Assessment |
|---|---|---|---|---|
| 2 | Under construction, consented or under determination | ▪ May impact a main commercial route passing within 1nm of the array areas and / or interacts with traffic which may be directly displaced by the array areas.<br>*Offshore wind farms:*<br>▪ Between 25 and 50nm from the array areas; or<br>▪ Between 2 and 5nm from the offshore export cable corridor.<br>*Oil and gas infrastructure:*<br>▪ Between 5 and 10nm from the array areas; or<br>▪ Between 2 and 5nm from the offshore export cable corridor.<br>*Marine aggregate dredging areas:*<br>▪ Between 15 and 25nm from the array areas; or<br>▪ Between 2 and 5nm from the offshore export cable corridor.<br>*Sub-sea cables:*<br>▪ Up to 2nm from the array areas; or<br>▪ Up to 2nm from the offshore export cable corridor. | High or medium | Qualitative cumulative re-routeing of main commercial routes |
| 3 | Scoped or under examination | ▪ Does not impact a main commercial route passing within 1nm of the array areas and does not interact with traffic which may be directly displaced by the array areas.<br>*Offshore wind farms:*<br>▪ Up to 50nm from the array area; or<br>▪ Up to 5nm from the offshore export cable corridor.<br>*Oil and gas infrastructure:*<br>▪ Up to 10nm from the array areas; or<br>▪ Up to 5nm from the offshore export cable corridor.<br>*Marine aggregate dredging areas:*<br>▪ Up to 30nm from the array areas; or<br>▪ Up to 5nm from the offshore export cable corridor.<br>*Sub-sea cables:*<br>▪ Up to 2nm from the array areas; or<br>▪ Up to 2nm from the offshore export cable corridor. | Low | Qualitative assumptions of routeing only |

## 3.4 Study Areas

24. A separate 10nm buffer has been applied to each of the DBS array areas; the 10nm buffer applied to the DBS East array area is hereafter referred to as the 'DBS East study area' and the 10nm buffer applied to the DBS West array area is hereafter referred to as the 'DBS West study area'. Separate buffers have been defined due to coverage limitations for vessel traffic data collection from the on-site survey vessel (see Section 5.2).

25. The radius of 10nm is standard for shipping and navigation assessment and has been used in the majority of UK offshore wind farm NRAs. These study areas have been defined in order to provide local context to the analysis of risks by capturing the relevant routes, vessel traffic movements and historical incident data within and in proximity to the Projects. Navigational features wholly or partially outside the study area are considered where appropriate.

26. Additionally, a 2nm buffer has been applied to the offshore export cable corridor, hereafter referred to as the 'offshore export cable corridor study area'. This study area omits the portion of the offshore export cable corridor following the edge of the DBS array areas since these areas are characterised by the DBS East and DBS West study areas.

27. The study areas are presented in Figure 3.2.

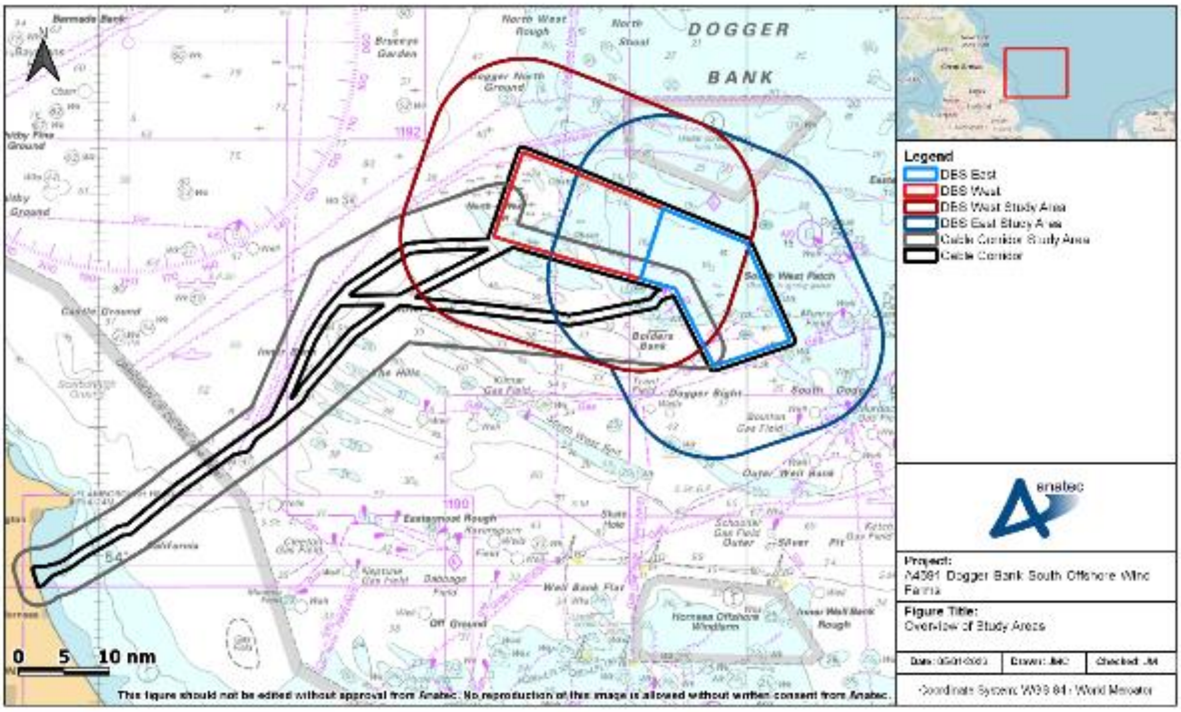



**Figure 3.2 Overview of Study Areas**

# 4 Consultation

28. Key shipping and navigation stakeholders have been consulted in the NRA process. The following stakeholders have been consulted via dedicated meetings:

- MCA;
- Trinity House;
- UK Chamber of Shipping; and
- Ministry of Defence (MoD) (Scoping Opinion).

29. The key issues raised including via dedicated meetings and the Scoping Opinion (Planning Inspectorate, 2022) and where they are addressed are provided in **Chapter 14: Shipping and Navigation**.

## 4.1 Regular Operators

30. As part of the consultation process, Regular Operators identified from the vessel traffic surveys that would be required to deviate their routes due to the presence of the Projects will be consulted post-PEIR.

## 4.2 Hazard Workshop

31. A key element of the consultation phase is the Hazard Workshop – a meeting of local and national marine stakeholders to identify and discuss the potential shipping and navigation hazards of relevance to the Projects. This will be undertaken post-PEIR document authoring with relevant stakeholders, including Regular Operators.

# 5 Data Sources

32. This section summarises the main data sources used to characterise the shipping and navigation baseline relative to the Projects.

## 5.1 Summary of Data Sources

33. The main data sources used to characterise the shipping and navigation baseline relative to the Projects are outlined in Table 5.1.

### Table 5.1 Data Sources Used to Inform the Shipping and Navigation Baseline

| Data | Source(s) | Purpose |
|---|---|---|
| Vessel traffic | Summer vessel traffic survey data consisting of Automatic Identification System (AIS), Radio Detection and Ranging (Radar) and visual observations for the DBS East study area (14 days, 3 to 17 July 2022) recorded from a dedicated survey vessel on-site. | Characterising vessel traffic movements within and in proximity to the DBS array areas in line with MGN 654 (MCA, 2021) requirements. |
| | Summer vessel traffic survey data consisting of AIS, Radar and visual observations for the DBS West study area (14 days, 17 to 31 July 2022) recorded from a dedicated survey vessel on-site. | |
| | Winter vessel traffic survey data consisting of AIS, Radar and visual observations for the DBS East study area (14 days, 16 to 30 October 2022) recorded from a dedicated survey vessel on-site. | |
| | Winter vessel traffic survey data consisting of AIS, Radar and visual observations for the DBS West study area (14 days, 30 October to 13 November 2022) recorded from a dedicated survey vessel on-site. | |
| | Summer vessel traffic data consisting of AIS for the offshore export cable corridor study area (14 days, 17 to 31 July 2022) recorded from shore based receivers and a dedicated survey vessel at DBS West. | |
| | Winter vessel traffic data consisting of AIS for the offshore export cable corridor study area (14 days, 30 October to 13 November 2022) recorded from shore based receivers and a dedicated survey vessel at DBS West. | |
| | Anatec’s ShipRoutes database (2022). | |

| Data | Source(s) | Purpose |
|---|---|---|
| | Winter vessel traffic survey data consisting of AIS, Radar and visual observations for the DBS East study area (14 days, 13 to 27 January 2022) recorded from a dedicated survey vessel on-site. | Secondary source for characterising marine traffic movements including cumulatively within and in proximity to the DBS array areas. |
| | Winter vessel traffic survey data consisting of AIS, Radar and visual observations for the DBS West study area (14 days, 28 January to 13 February 2022) recorded from a dedicated survey vessel on-site. | |
| | Vessel traffic data consisting of AIS for the DBS East and DBS West study areas (six months, April to October 2022) recorded from a survey vessel on-site. | |
| Maritime incidents | Maritime Accident Investigation Branch (MAIB) marine accidents database (2000 to 2019). | Review of maritime incidents within and in proximity to the DBS array areas. |
| | Royal National Lifeboat Institution (RNLI) incident data (2010 to 2019). | |
| | DfT UK civilian Search and Rescue (SAR) helicopter taskings (2015 to 2022). | |
| Marine aggregate dredging | Marine aggregate dredging areas (licenced and active) (The Crown Estate, 2022). | Characterising marine aggregate dredging areas within and in proximity to the array areas. |
| Other navigational features | Admiralty Charts 266, 1187, 1191, and 1192 (United Kingdom Hydrographic Office (UKHO), 2022). | Characterising other navigational features in proximity to the DBS array areas. |
| | *Admiralty Sailing Directions North Sea (West) Pilot NP54* (UKHO, 2021). | |

## 5.2 Vessel Traffic Surveys

34. Three vessel traffic surveys have been undertaken for the DBS array areas, consisting of two winter surveys (14 days at each array area in January / February 2022 and October / November 2022) and one summer survey (14 days at each array area in July 2022). Further vessel traffic surveys will be undertaken in relation to the RCP and/or electrical switching platform post-PEIR in winter and summer 2023.

35. The first winter vessel traffic survey and summer vessel traffic survey were undertaken by the guard vessel *Star of Hope*, while the second winter vessel traffic survey was undertaken by the guard vessel *Karima*. For each survey, the survey vessel was situated at the DBS East array area for 14 full days and the DBS West array area for 14 full days.

36. The first winter vessel traffic survey was undertaken prior to the start of offshore construction works for the Dogger Bank A offshore wind farm (see Section 7.1) and will have been undertaken more than 24 months prior to the time of the Application (ES). Therefore, this survey is considered as a secondary source only, with the summer and second winter vessel traffic surveys (totalling 28 days at each of the DBS array areas) serving as the MGN 654 compliant vessel traffic data.

37. A number of vessel tracks recorded during the survey periods were deemed as temporary (non-routine) in nature, such as the tracks of the survey vessels themselves and the tracks of vessels associated with the ongoing construction of Dogger Bank A, and these vessels were therefore excluded from the vessel traffic baseline. Other temporary traffic excluded from the analysis included the tracks of a vessel undertaking a geophysical survey.

38. The vessel traffic survey data collected for the DBS array areas is assessed in full in Section 9.1.

## 5.3 Data Limitations

### 5.3.1 Automatic Identification System Data

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

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

41. Throughout the summer surveys, approximately 96% of vessel tracks were recorded via AIS with the remaining 4% recorded via Radar. Throughout the winter surveys, approximately 98% of vessel tracks were recorded via AIS with the remaining 2% recorded via Radar.

### 5.3.2 Historical Incident Data

42. Although all UK commercial vessels are required to report accidents to the Marine Accident Investigation Branch (MAIB), non-UK vessels do not have to report unless they are in a UK port or within 12nm territorial waters (noting that the shipping and navigation study area is not located within 12nm 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.

43. The Royal National Lifeboat Institution (RNLI) incident data cannot be considered comprehensive of all incidents in the shipping and navigation study area. Although hoaxes and false alarms are excluded, any incident to which an RNLI resource was not mobilised has not been accounted for in this dataset.

### 5.3.3 United Kingdom Hydrographic Office Admiralty Charts

44. The United Kingdom Hydrographic Office (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 baseline.

# 6 Project Description Relevant to Shipping and Navigation

45. The NRA reflects the design envelope which is detailed in full in **Chapter 5: Project Description**. The following subsections outline the maximum extent of the Projects for which any shipping and navigation hazards are assessed.

## 6.1 Dogger Bank South Array Areas

46. The DBS array areas are located approximately 55nm east of the Yorkshire coast. The total area covered by the DBS array areas is 288 square nautical miles (nm$^2$), with each of the individual array areas covering 144nm$^2$. Charted water depths within the DBS array areas range between 12 and 36m below Chart Datum (CD). The total area covered by the offshore export cable corridor (inclusive of the DBS array areas) is approximately 792nm$^2$, with charted water depths ranging between zero (nearshore) and 69m below CD.

47. The key coordinates defining the boundary of the Offshore Development Area are illustrated in Figure 6.1 and provided in Table 6.1 using World Geodetic System 1984 (WGS84).

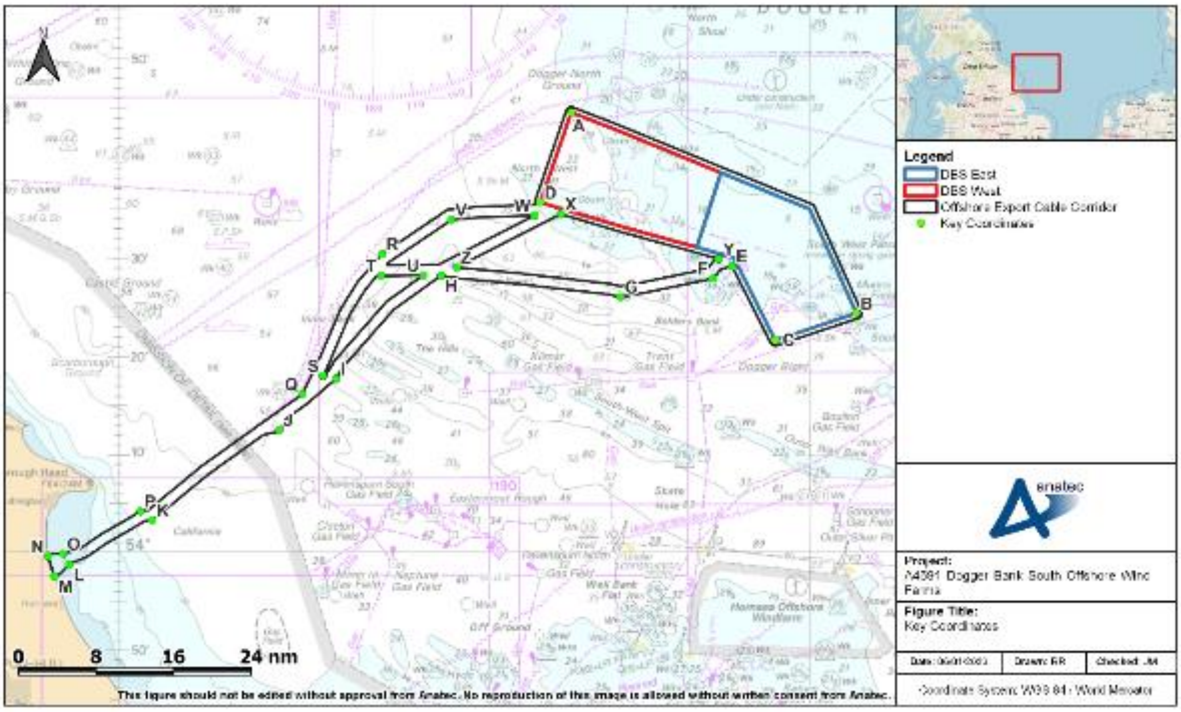



**Figure 6.1 Key Coordinates for the Offshore Development Area**

### Table 6.1 Key Coordinates for the Offshore Development Area

| Point | Latitude | Longitude | | Point | Latitude | Longitude |
|---|---|---|---|---|---|---|
| A | 54° 44′ 35.65″ N | 001° 18′ 32.96″ E | | N | 53° 59′ 35.38″ N | 000° 12′ 24.37″ W |
| B | 54° 24′ 19.83″ N | 002° 08′ 05.61″ E | | O | 53° 59′ 50.41″ N | 000° 09′ 47.22″ W |
| C | 54° 21′ 35.80″ N | 001° 53′ 59.58″ E | | P | 54° 04′ 11.12″ N | 000° 03′ 40.65″ E |
| D | 54° 35′ 32.32″ N | 001° 13′ 09.27″ E | | Q | 54° 16′ 08.10″ N | 000° 31′ 47.58″ E |
| E | 54° 29′ 05.84″ N | 001° 46′ 29.86″ E | | R | 54° 30′ 19.47″ N | 000° 45′ 39.44″ E |
| F | 54° 27′ 50.94″ N | 001° 43′ 06.43″ E | | S | 54° 17′ 59.32″ N | 000° 35′ 26.06″ E |
| G | 54° 25′ 59.05″ N | 001° 27′ 06.18″ E | | T | 54° 28′ 07.89″ N | 000° 45′ 26.04″ E |
| H | 54° 28′ 09.03″ N | 000° 55′ 55.60″ E | | U | 54° 28′ 11.10″ N | 000° 52′ 49.84″ E |
| I | 54° 17′ 42.19″ N | 000° 37′ 41.28″ E | | V | 54° 33′ 45.83″ N | 000° 57′ 42.56″ E |
| J | 54° 12′ 28.93″ N | 000° 27′ 49.40″ E | | W | 54° 34′ 14.83″ N | 001° 12′ 13.67″ E |
| K | 54° 03′ 17.09″ N | 000° 05′ 44.14″ E | | X | 54° 34′ 21.94″ N | 001° 16′ 43.23″ E |
| L | 53° 58′ 43.74″ N | 000° 08′ 41.43″ W | | Y | 54° 29′ 49.41″ N | 001° 44′ 11.11″ E |
| M | 53° 57′ 32.62″ N | 000° 11′ 18.41″ W | | Z | 54° 28′ 59.66″ N | 000° 58′ 38.79″ E |

## 6.2 Surface Infrastructure

### 6.2.1 Indicative Worst Case Array Layout

48. Up to 209 surface structures would be installed, across the two Projects, consisting of 200 wind turbines and nine platforms, with an additional two platforms potentially located on the offshore export cable route.

49. Although the final locations of infrastructure have not yet been defined, two indicative array layout options are considered in this NRA – one incorporating a full build out of the array areas, and another which demonstrates the minimum spacing. The full build out array layout is generally considered in the risk assessment in Section 15; where the non-full build out array layout is considered the worst case for a hazard this is flagged in the risk assessment.

50. The full build out and non-full build out array layouts are presented in Figure 6.2 and Figure 6.3, respectively.

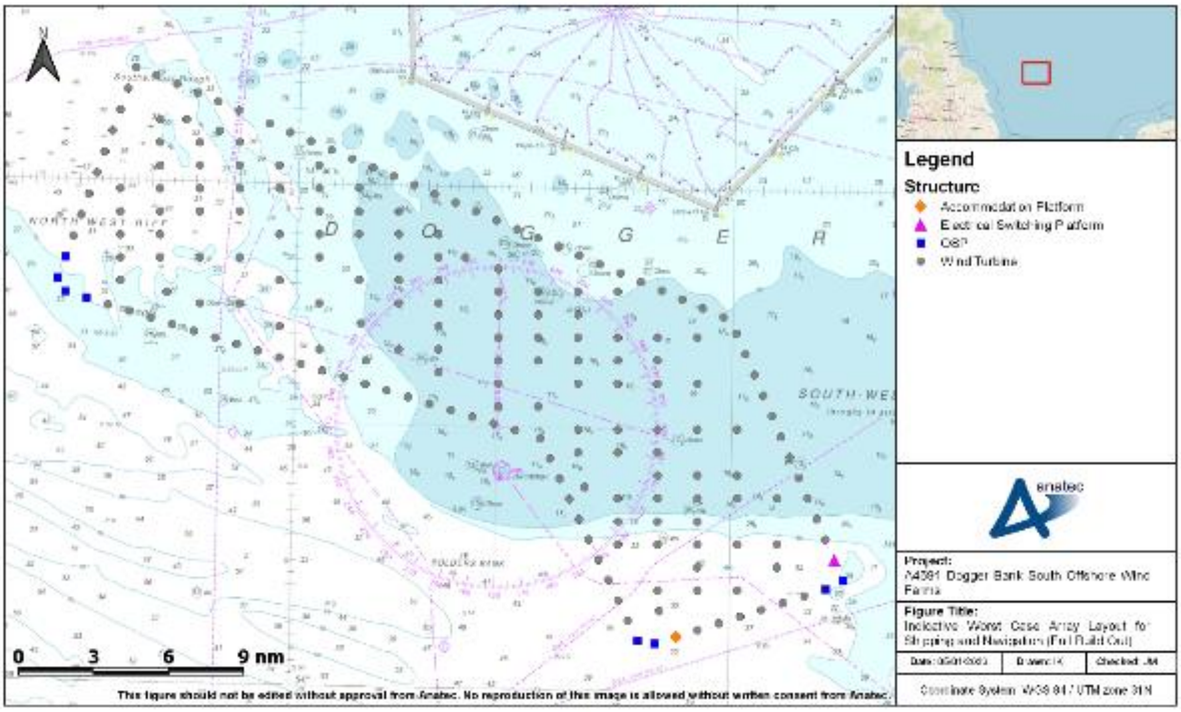



**Figure 6.2** **Indicative Worst Case Array Layout for Shipping and Navigation (Full Build Out)**

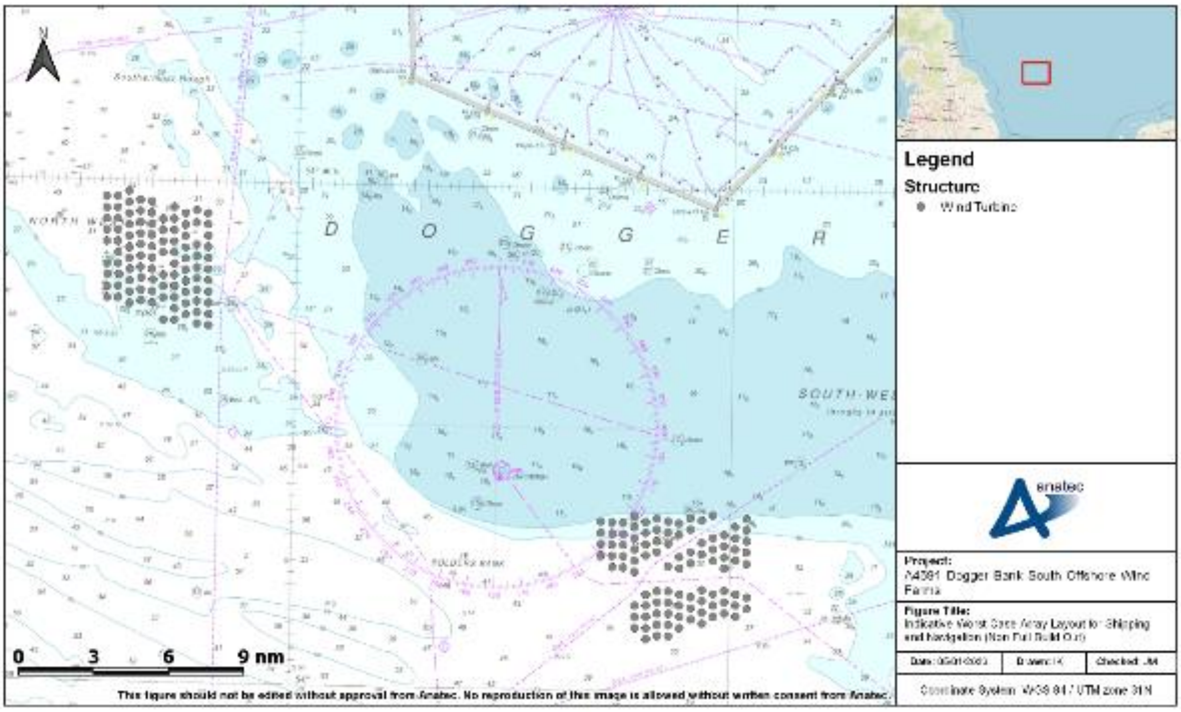



**Figure 6.3** **Indicative Worst Case Array Layout for Shipping and Navigation (Non-Full Build Out)**

51. The worst case scenario for shipping and navigation would use either layout option as deemed appropriate to incorporate:

- Full build out of the array areas;
- Minimum spacing of 830m (measured centre-to-centre) between structures;
- Other structures located in proximity to areas where exposure to vessel to structure allision risk is deemed to be greatest; and
- Single line of orientation (SLoO).

52. The final array layout will be MGN 654 compliant (inclusive of a safety justification for a SLoO should this be brought forward) and will be agreed with the MCA and Trinity House post consent. An allowance for micrositing within a 50m radius of any wind turbine will be included. There are no plans to designate the array areas as Areas to be Avoided (ATBA).

### 6.2.2 Wind Turbines

53. The wind turbines within the indicative array layouts each have an indicative rotor diameter of 375m and a minimum blade tip height of 34m above Mean Sea Level (MSL), noting that these values represent the worst case for shipping and navigation.

54. Four-legged piled jacket foundations have been considered as the MDS for shipping and navigation as this foundation type provides the maximum structure dimensions at the sea surface. The MDS wind turbine measurements assuming use of four-legged piled jacket foundations are provided in Table 6.2.

**Table 6.2 MDS for Shipping and Navigation – Wind Turbines**

| Parameter | MDS for shipping and navigation |
|---|---|
| Foundation type | Four-legged piled jacket |
| Dimensions at sea surface | 40×40m |
| Maximum upper blade tip height (MHWS) | 450m |
| Minimum air gap (above MSL) | 34m |
| Indicative rotor diameter | 375m |

55. Other foundation types under consideration include monopiles and four-legged jackets on suction buckets. Descriptions of each foundation type under consideration are provided in **Chapter 5: Project Description**.

### 6.2.3 Platforms

56. The OSPs, electrical switching platform, accommodation platform, and RCP may be installed on up to eight-legged jacket, suction bucket jacket, or monopile foundations, but would have maximum topside dimensions of 125x100m.

## 6.3 Sub-sea Cables

57. Various types of sub-sea cables would be installed and may be categorised as either array cables, inter-platform cables, or offshore export cables. Each of these is summarised in the following subsections, noting that sub-sea cables may carry either High Voltage Alternating Current (HVAC) or High Voltage Direct Current (HVDC).

### 6.3.1 Array Cables

58. The array cables would connect individual wind turbines to OSPs. Up to 350nm of array cables would be required, with the final length dependent on the final array layout. There would be no array cable crossings of other sub-sea cables, although there would be up to 40 pipeline crossings. All array cables would be installed within the DBS array areas.

### 6.3.2 Inter-Platform Cables

59. The inter-platform cables would connect the OSPs to each other with a combined length of up to 208nm. There would be up to 24 cable or pipeline crossings per inter-platform cable.

### 6.3.3 Offshore Export Cables

60. The offshore export cables would carry the energy generated by the wind turbines from the array areas to shore. Up to six offshore export cables would be required with a length of up to 85nm per offshore export cable for DBS West, and up to 107nm per offshore export cable for DBS East, with these cables to be installed within the offshore export cable corridor. There would be up to 70 cable or pipeline crossings per offshore export cable. There would be an indicative separation between offshore export cables of 50m.

### 6.3.4 Cable Burial

61. Where available, the primary means of cable protection would be by seabed burial. The extent and method by which the sub-sea cables would be buried will depend on the results of a detailed seabed survey of the final sub-sea cable routes and associated cable burial risk assessment. For all sub-sea cables, the target burial depth is between 0.5 and 1m.

62. Cable burial would involve either jet-trenching, ploughing, mechanical trenching, dredging, mass flow excavation, rock cutting, surface laid / self-burying, or vertical injection techniques.

63. Where cable burial is not possible, alternative cable protection methods may be deployed which would again be determined within the cable burial risk assessment.

64. Cable protection includes either one of, or a combination of, rock or gravel burial, concrete mattresses, flow energy dissipation devices, dredged material, protective

aprons or coverings, bagged solutions, cable installed in pipe / duct, and / or surface laid / self-burying.

65. The indicative proportion of protection required is up to 20% for each type of sub-sea cable. The indicative height of cable protection is 1.0m for the array cables and 1.4m for the export and inter-platform cables, including for all cable crossings.

## 6.4 Construction Phase

66. The DBS array areas may be built out sequentially or concurrently. A sequential build out would last for approximately up to five years for each DBS array area inclusive of site preparation, with up to a two-year lag between the start of construction for each. Therefore, the maximum offshore construction phase duration would be seven years. A concurrent build out would last for approximately five years inclusive of site preparation.

67. An application for safety zones would be sought during the construction phase, including 500m around ongoing construction activities and 50m around installed structures pre commissioning (see Section 17).

68. A maximum of 132 construction vessels may be located on-site simultaneously, with a maximum of 11,489 round trips to port throughout the construction phase. Table 6.3 provides a breakdown of the installation activities and vessel types during the construction phase.

## Table 6.3 Breakdown of Construction Vessel Peak Numbers

| Construction Element | Detailed Activity (Where Applicable) | Number of Spreads | Vessel Type | Peak Number On-Site Simultaneously Per Spread | Max Return Trips |
|---|---|---|---|---|---|
| Foundation installation | Site preparation | N/A | Site preparation vessels | 4 | 78 |
| | Wind turbine foundation installation | 3 | Noise mitigation vessels | 2 | 267 |
| | | | Installation vessels | 1 | |
| | | | Pre-piling vessels | 1 | |
| | | | Anchor handling vessels | 2 | |
| | | | Feeder vessels | 1 | |
| | | | Other vessels | 1 | |
| | OSP foundation installation | 1 | Noise mitigation vessels | 2 | 64 |
| | | | Installation vessels | 1 | |
| | | | Pre-piling vessels | 1 | |
| | | | Anchor handling vessels | 2 | |
| | | | Feeder vessels | 1 | |
| | | | Other vessels | 1 | |
| | Wind turbine transition piece installation | 3 | Installation vessels | 1 | 16 |
| | | | Anchor handling vessels | 2 | |
| | Scour protection | N/A | Installation vessels | 2 | 1,574 |
| | Gravity base ballast | N/A | Installation vessels | 2 | 1,261 |
| **Subtotal** | | | | **49** | **3,260** |
| Wind turbine installation | N/A | 4 | Installation vessels | 1 | 148 |
| | | | Anchor handling vessels | 2 | |
| | | | Barges | 1 | |
| | | | Tugs | 1 | |
| **Subtotal** | | | | **20** | **148** |
| Array cable installation | N/A | 4 | Cable lay vessels | 1 | 506 |
| | | | Cable support vessels | 1 | |

| Construction Element | Detailed Activity (Where Applicable) | Number of Spreads | Vessel Type | Peak Number On-Site Simultaneously Per Spread | Max Return Trips |
|---|---|---|---|---|---|
| | | | Seabed preparation vessels | 1 | |
| | | | Rock dumping vessels | 1 | |
| | | | Tugs | 2 | |
| **Subtotal** | | | | **24** | **506** |
| Export cable installation | N/A | 2 | Cable lay vessels | 1 | 3,085 |
| | | | Cable support vessels | 1 | |
| | | | Seabed preparation vessels | 1 | |
| | | | Rock dumping vessels | 1 | |
| | | | Tugs | 2 | |
| **Subtotal** | | | | **12** | **3,085** |
| Other installation vessels | N/A | N/A | Commissioning vessels | 3 | 78 |
| | | | OSP topside installation vessels | 4 | 32 |
| | | | Other vessels | 20 | 4,380 |
| **Subtotal** | | | | **27** | **4,490** |
| **Total** | | | | **132** | **11,489** |

69. Additionally, a maximum of 730 return trips per year per Project may be made by helicopters during the construction phase.

## 6.5 Operations and Maintenance Phase

70. The maximum operational life of the Projects is 32 years (associated with a sequential build out of DBS West and DBS East). Throughout the operation and maintenance phase, a maximum of 21 operation and maintenance vessels may be located on-site simultaneously with a maximum of 473 annual round trips to port. Table 6.4 provides a breakdown of the installation activities and vessel types during the operation and maintenance phase.

**Table 6.4 Breakdown of Operation and Maintenance Vessel Peak Numbers**

| Vessel Type | Peak Number On-Site Simultaneously | Maximum Annual Round Trips to Port |
|---|---|---|
| Jack-up vessels | 3 | 16 |
| Service Operations Vessels (SOV) | 2 | 104 |
| Accommodation vessels | 2 | 104 |
| Crew Transfer Vessels (CTV) | 2 | 104 |
| Lift vessels | 2 | 16 |
| Cable maintenance vessels | 2 | 1 |
| Auxiliary vessels | 8 | 128 |
| **Total** | **21** | **473** |

71. Additionally, a maximum of 20 return trips annually may be made by helicopters during the operation and maintenance phase.

## 6.6 Decommissioning Phase

72. Decommissioning works would generally be the reverse of the construction works and involve similar types and numbers of vessels. The decommissioning duration of the offshore infrastructure may take up to five years, and it is assumed as a worst case that all sub-sea cables would be left *in situ*.

## 6.7 Maximum Design Scenario

73. The MDS for each shipping and navigation hazard is provided in Table 6.5 and is based on the parameters described in the previous subsections.

### Table 6.5 MDS for Shipping and Navigation by Hazard

<table>
<tr><th>Potential Hazard</th><th>Phase(s)</th><th>MDS for Shipping and Navigation</th><th>Justification</th></tr>
<tr><td rowspan="2">Vessel displacement and increased vessel to vessel collision risk between third-party vessels</td><td>Construction / decommissioning</td><td>▪ Concurrent construction of DBS East and DBS West of up to five years and decommissioning of up to five years or if sequential build of DBS East and DBS West then up to seven year period for construction and decommissioning of up to seven years;<br>▪ Full build out of the array areas;<br>▪ Buoyed construction / decommissioning area encompassing the maximum extent of the array areas;<br>▪ Presence of 500m construction safety zones and 50m pre commissioning safety zones;<br>▪ Up to six offshore export cables each of 85nm length;<br>▪ Indicative separation of 50m between offshore export cables; and<br>▪ Up to 132 construction / decommissioning vessels on-site simultaneously.</td><td rowspan="2">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 vessel to vessel collision risk.</td></tr>
<tr><td>Operation and maintenance</td><td>▪ Maximum operational life of 32 years;<br>▪ Full build out of the array areas;<br>▪ Presence of 500m safety zones during major maintenance; and<br>▪ Up to 21 operation and maintenance vessels on-site simultaneously and up to 473 annual round trips to port.</td></tr>
</table>

| Potential Hazard | Phase(s) | MDS for Shipping and Navigation | Justification |
|---|---|---|---|
| Increased vessel to vessel collision risk between a third-party vessel and a project vessel | Construction / decommissioning | ▪ Concurrent construction of DBS East and DBS West of up to seven years and decommissioning of up to five years;<br>▪ Full build out of the array areas;<br>▪ Buoyed construction / decommissioning area encompassing the maximum extent of the array areas;<br>▪ Presence of 500m construction safety zones and 50m pre commissioning safety zones;<br>▪ Up to six offshore export cables each of 85nm length;<br>▪ Indicative separation of 50m between offshore export cables; and<br>▪ Up to 132 construction / decommissioning vessels on-site simultaneously and up to 6,778 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. |
| | Operation and maintenance | ▪ Maximum operational life of 32 years;<br>▪ Full build out of the array areas;<br>▪ Presence of 500m safety zones during major maintenance; and<br>▪ Up to 21 operation and maintenance vessels on-site simultaneously and up to 473 annual round trips to port. | |
| Vessel to structure allision risk | Operation and maintenance | ▪ Maximum operational life of 32 years;<br>▪ Full build out of the array areas;<br>▪ Minimum spacing of 830m between array structures;<br>▪ OSP, electrical switching platform, accommodation platform, and RCP locations as per Figure 6.2;<br>▪ Up to 200 wind turbines on four-legged piled jackets with sea surface dimensions of 21×21m; and<br>▪ Up to 11 platforms with topside dimensions of 125×110m. | 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. |

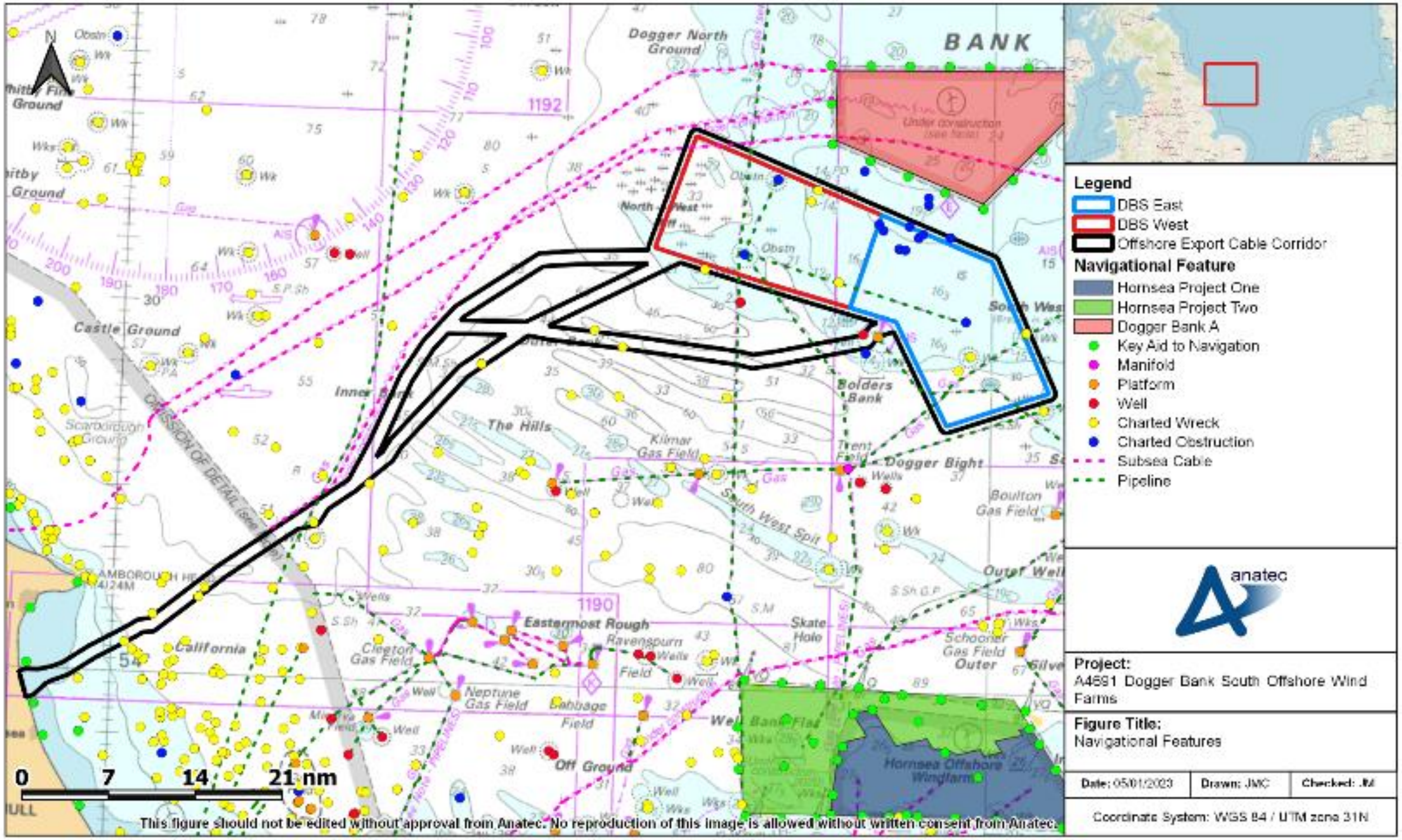
| Potential Hazard | Phase(s) | MDS for Shipping and Navigation | Justification |
|---|---|---|---|
| Reduction of under keel clearance due to cable protection | Operation and maintenance | ▪ Maximum operational life of 32 years;<br>▪ Up to 350nm of array cables;<br>▪ Up to 208nm of inter-platform cables;<br>▪ Up to six offshore export cables each of 85nm length;<br>▪ Indicative separation of 50m between offshore export cables;<br>▪ Indicative maximum proportion of array cable protection requirement of 20%;<br>▪ Indicative maximum proportion of inter-platform cable protection requirement of 20%;<br>▪ Indicative maximum proportion of export cable protection requirement of 20%;<br>▪ Up to 40 crossings of array cables;<br>▪ Up to 24 crossings per inter-platform cable;<br>▪ Up to 70 crossings per offshore export cable;<br>▪ Indicative height of protection for array cables (including crossings) of 1.0m;<br>▪ Indicative height of protection for inter-platform cables (including crossings) of 1.4m; and<br>▪ Indicative height of protection for offshore export cables (including crossings) of 1.4m. | Largest possible extent of sub-sea infrastructure and greatest duration resulting in the maximum spatial and temporal effect on under keel clearance. |

| Potential Hazard | Phase(s) | MDS for Shipping and Navigation | Justification |
|---|---|---|---|
| Anchor interaction with sub-sea cables | Operation and maintenance | ▪ Maximum operational life of 32 years;<br>▪ Up to 350nm of array cables;<br>▪ Up to 208nm of inter-platform cables;<br>▪ Up to six offshore export cables each of 85nm length;<br>▪ Indicative separation of 50m between offshore export cables;<br>▪ Indicative maximum proportion of array cable protection requirement of 20%;<br>▪ Indicative maximum proportion of inter-platform cable protection requirement of 20%;<br>▪ Indicative maximum proportion of export cable protection requirement of 20%;<br>▪ Up to 40 crossings of array cables;<br>▪ Up to 24 crossings per inter-platform cable;<br>▪ Up to 70 crossings per offshore export cable;<br>▪ Indicative height of protection for array cables (including crossings) of 1.0m;<br>▪ Indicative height of protection for inter-platform cables (including crossings) of 1.4m; and<br>▪ Indicative height of protection for offshore export cables (including crossings) of 1.4m. | Largest possible extent of sub-sea infrastructure and greatest duration resulting in the maximum spatial and temporal effect on anchor interaction with sub-sea cables. |

| Potential Hazard | Phase(s) | MDS for Shipping and Navigation | Justification |
|---|---|---|---|
| Reduction of emergency response capability (including SAR access) | Operation and maintenance | ▪ Maximum operational life of 32 years;<br>▪ Full build out of the array areas;<br>▪ Up to 200 wind turbines;<br>▪ Up to 11 platforms;<br>▪ Array layout as per Figure 6.2 or Figure 6.3;<br>▪ Minimum spacing of 830m between array structures;<br>▪ Single line of orientation in array layout; and<br>▪ Up to 21 operation and maintenance vessels on-site simultaneously and up to 473 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. |

# 7 Navigational Features

74. The navigational features within and in proximity to the DBS array areas are presented in Figure 7.1.




## Figure 7.1 Navigational Features

## 7.1 Other Offshore Wind Farms

75. Dogger Bank A is located approximately 4nm to the north-east of the DBS array areas and is currently under construction, with offshore works commencing in May 2022 (Dogger Bank Wind Farm, 2022). It covers an area of approximately 150nm$^2$ and will comprise 95 wind turbines once commissioned, with this anticipated in 2024.

76. Other offshore wind farms further from the DBS array areas, including those yet to enter construction phase (as of December 2022), are presented in Figure 7.2. These include the Dogger Bank developments and the Hornsea developments.

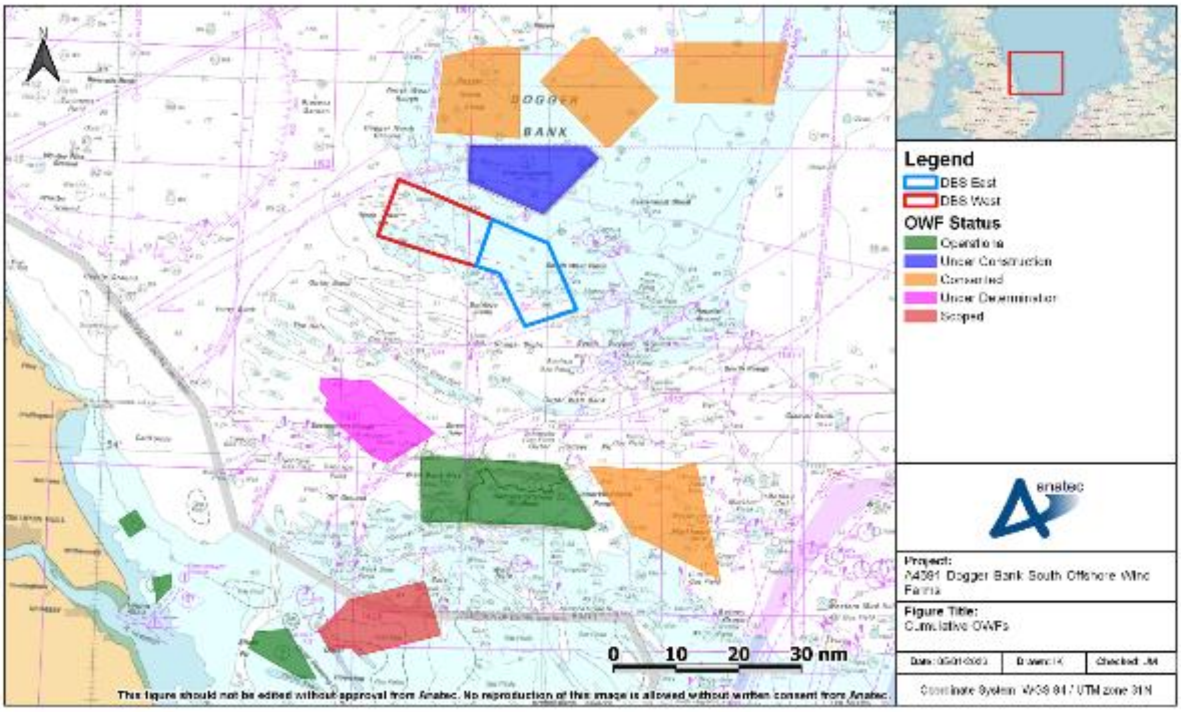



**Figure 7.2 Planned and Existing Offshore Wind Farms (as of December 2022)**

## 7.2 Key Aids to Navigation

77. Dogger Bank A is marked with a buoyed construction area, featuring various cardinal marks and special marks. These will be removed following commissioning of the development, anticipated in 2024. A special mark is also located at the Munro Gas Field, marking the location of a well.

## 7.3 Oil and Gas Infrastructure

78. Various oil and gas infrastructure associated with the nearby gas fields, including wells, platforms and manifolds, are located in proximity to the DBS array areas. The closest platform to the DBS array areas is Cavendish, located approximately 1.6nm south of the DBS East array area and within the offshore export cable corridor.

79. Other nearby oil and gas infrastructure include the:

- Munro platform approximately 6.0nm east of the DBS East array area;
- Cygnus platforms approximately 6.7nm and 8.9nm north-east of the DBS East array area;
- Trent platform approximately 9.3nm south-west of the DBS East array area; and
- Boulton platform approximately 9.6nm south-east of the DBS East array area.

80. It is acknowledged that some of the fields these platforms are associated with could be decommissioned prior to the start of construction, although the Cygnus gas field is a recent development and therefore is expected to remain *in situ* during the Project's life.

## 7.4 Sub-sea Pipelines

81. Sub-sea pipelines connect the oil and gas infrastructure in proximity to the DBS array areas. A sub-sea pipeline connecting the Shearwater gas field and Bacton Gas Terminal (the SEAL pipeline) passes north-south through the DBS West array area. Three additional sub-sea pipelines are also located within DBS West array area but are disused; one of these also runs through the DBS East array area and is one of three sub-sea pipelines within DBS East array area, with two of these disused.

82. Two of the disused sub-sea pipelines also intersect the offshore export cable corridor.

## 7.5 Sub-sea Cables

83. Currently under installation sub-sea cables are located to the north and north-west of the DBS West array area, connecting to Dogger Bank A. These sub-sea cables pass alongside the DBS offshore export cable corridor for much of its length and intersect over a distance of approximately 6.2nm. There is also a disused sub-sea cable passing through Dogger Bank A which stops approximately 0.8nm short of the DBS West array area. A sub-sea cable is also located approximately 8.4nm east of the DBS array areas, connecting the Cygnus and Murdoch platforms.

## 7.6 Charted Wrecks and Obstructions

84. Various charted wrecks and obstructions are located in proximity to the DBS array areas. There are 14 charted obstructions located within the DBS array areas - five within the DBS West array area, and nine within the DBS East array area. The shallowest of these features is a charted wreck at 15m below CD.

85. There are also six charted wrecks located within the offshore export cable corridor (excluding overlap with the DBS array areas), with the shallowest of these features a charted wreck at 23m below CD.

## 7.7 Other Navigational Features

### 7.7.1 Marine Aggregate Dredging Areas

Marine aggregate dredging areas in the southern North Sea are located well south of the Offshore Development Area, with the closest approximately 25nm south of the offshore export cable corridor.

### 7.7.2 Designated Anchorage Areas

There are no designated anchorage areas located within or in proximity to the Offshore Development Area.

### 7.7.3 Military Practice and Exercise Areas

The offshore export cable corridor overlaps with a submarine exercise area. This area is used to for training by submarines operated by the Royal Navy. There are also practice and exercise areas (PEXA) for aircraft overlapping the DBS array areas.

### 7.7.4 Spoil Ground and Other Dumping Grounds

There no spoil grounds or other dumping grounds located within, or in proximity to, the Offshore Development Area.

# 8 Emergency Response and Incident Overview

86. This section summarises the existing Search and Rescue (SAR) resources in the region, and issues being considered in relation to the Projects.

## 8.1 Search and Rescue Helicopters

87. In July 2022, the Bristow Group were awarded a new ten-year contract by the MCA (as an executive agency of the DfT) beginning in September 2024 to provide helicopter SAR operations in the UK. Bristow have been operating the service since April 2015.

88. The SAR helicopter service is currently operated out of ten base locations around the UK, with the closest to the DBS array areas located approximately 83nm south-west at Humberside. This base operates two Sikorsky S92 helicopters.

89. The DfT has produced data on civilian SAR helicopter activity in the UK by the Bristow Group on behalf of the MCA between April 2015 and March 2022.

90. The locations of SAR helicopter taskings within both the DBS array areas and offshore export cable corridor study areas are presented in Figure 8.1, colour-coded by tasking type, along with the location of the Humberside helicopter base.

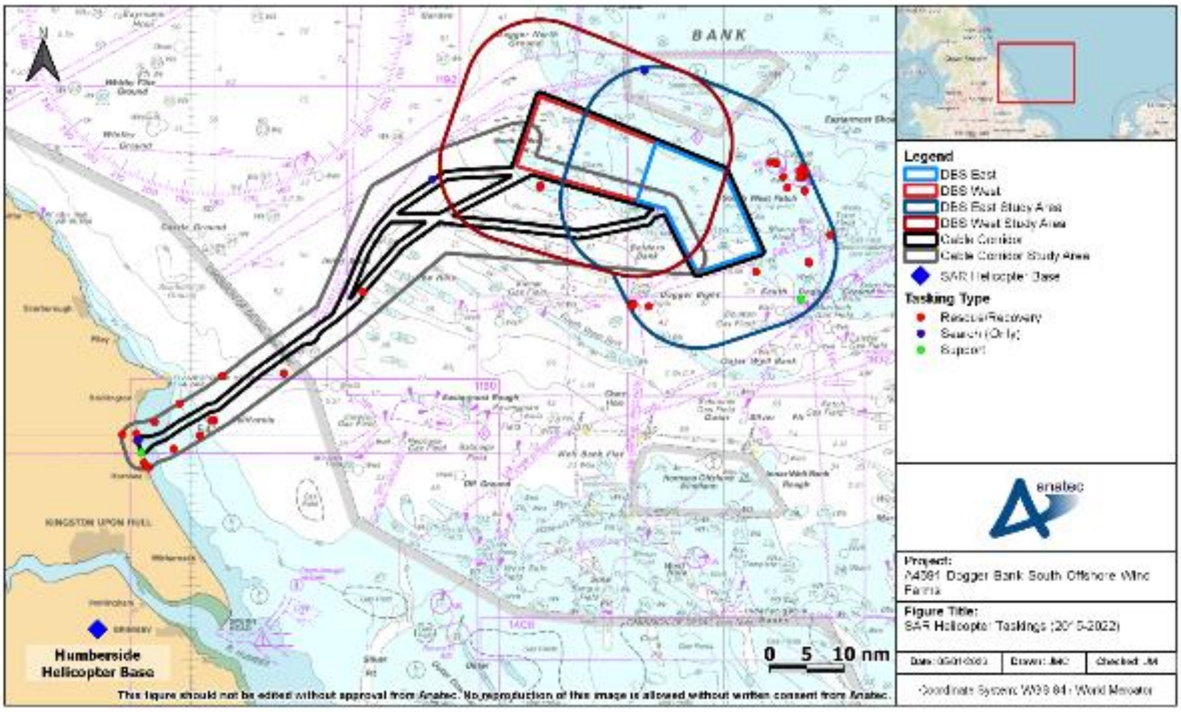



**Figure 8.1 SAR Helicopter Taskings Within Study Areas (April 2015 to March 2022)**

91. There were 36 SAR taskings within the DBS East study area between April 2015 and March 2022, corresponding to an average of five SAR taskings per year. Two were

search, two were support and the remaining 32 were rescue / recovery. Most of the rescue / recovery incidents occurred in close proximity to the Cygnus gas field. No helicopter taskings were located within the DBS East array area itself. All taskings originated from the Humberside base.

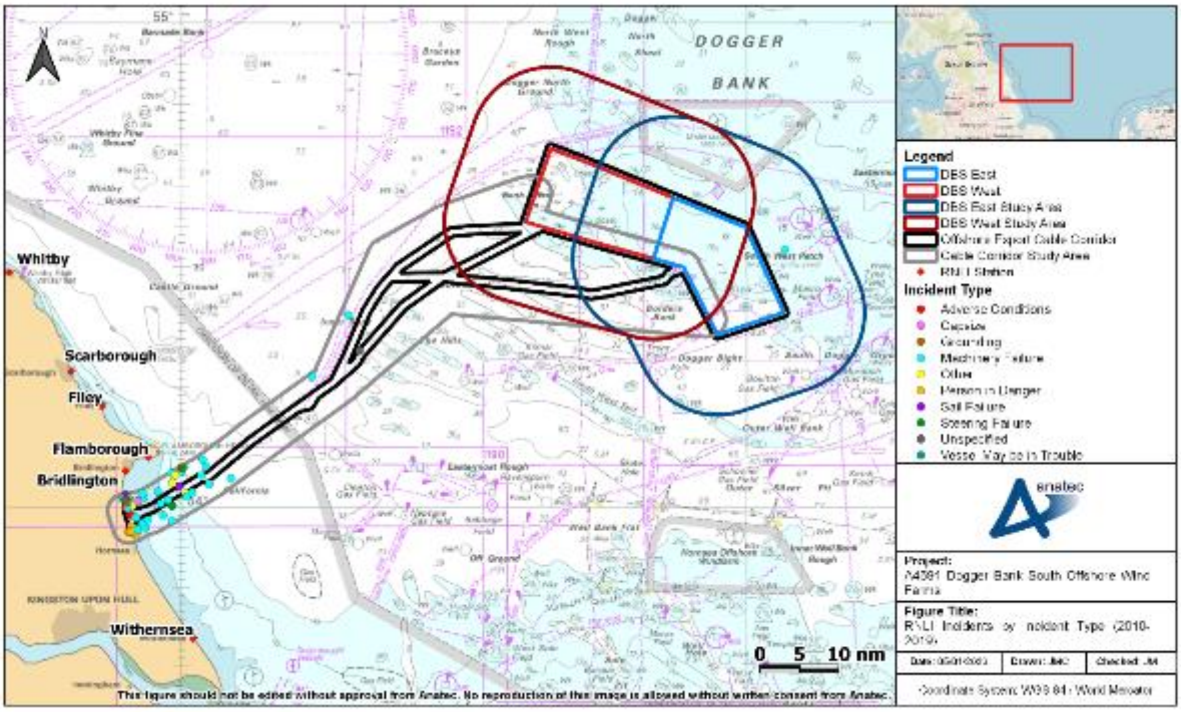
92. There were four SAR taskings within the DBS West study area between April 2015 and March 2022, corresponding to an average of one SAR tasking every one to two years. Two were search, while the other two were rescue / recovery to the south of the DBS West array area. No helicopter taskings were located within the DBS West array area itself. All taskings originated from the Humberside base.

93. There were 21 SAR taskings within the offshore export cable corridor study area between April 2015 and March 2022, corresponding to an average of three SAR taskings per year. Two were search, one was support and the remaining 18 were rescue / recovery. Seventeen of the 21 taskings were located within 22nm of the landfall. Three were located within the offshore export cable corridor itself. All taskings originated from the Humberside base.

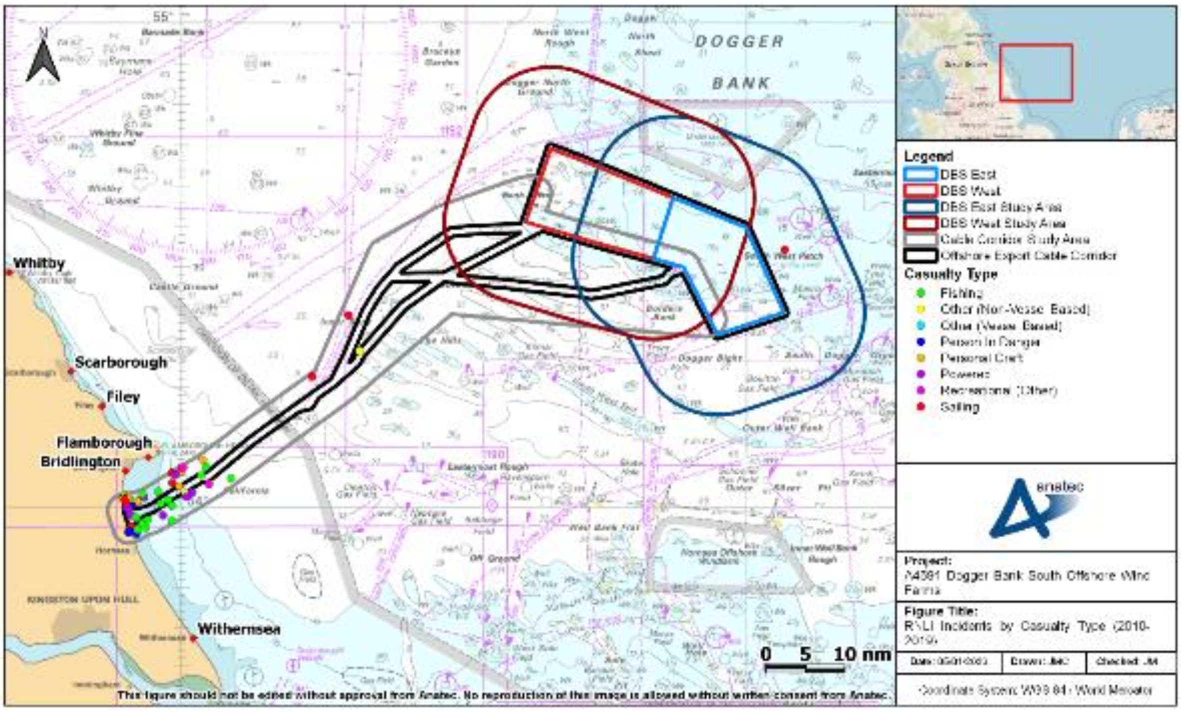
## 8.2 Royal National Lifeboat Institution

94. The RNLI is organised into six regions, with the relevant region for the DBS array areas being the ‘North and East’. Based out of more than 230 stations, there are over 400 active lifeboats across the RNLI fleet, including both All-Weather Lifeboats (ALB) and Inshore Lifeboats (ILB).

95. Figure 8.2 presents the RNLI stations in proximity to the DBS array areas as well as the incidents documented by the RNLI that occurred within the DBS array areas during the period 2010 to 2019 (inclusive), colour-coded by incident type. Figure 8.3 presents the same data, colour-coded by casualty type. It is noted that incidents which were deemed hoaxes or false alarms have been excluded from the analysis.




## Figure 8.2 RNLI Incidents by Incident Type (2010 to 2019)




## Figure 8.3 RNLI Incidents by Casualty Type (2010 to 2019)

96. The closest RNLI station to the DBS array areas is at Flamborough (approximately 55nm south-west of the array areas), where an ILB is available. Bridlington, located 3.3nm further south-west, also has an RNLI station, where both an ALB and ILB are

available; this station is also the closest to the offshore export cable corridor, located approximately 4.8nm north. Other RNLI stations on this stretch of the UK east coast include Filey, Scarborough, Withernsea, and Whitby. Given that the RNLI have an operational limit of 100nm, it is anticipated that an incident occurring in proximity to the DBS array areas could result in a response from an RNLI asset, although the distribution of the reported RNLI incidents suggests that only incidents occurring within the 15nm of the offshore export cable corridor closest to shore are likely to result in an RNLI response.

97. There was a single documented incident responded to by the RNLI within the DBS East study area between 2010 and 2019, occurring approximately 3.3nm to the east of the DBS East array area. This incident occurred in 2019, involving a sailing vessel that experienced machinery failure, and was responded to by the Scarborough RNLI station.

98. There were no documented incidents responded to by the RNLI within the DBS West study area between 2010 and 2019.

99. A total of 57 incidents were responded to by the RNLI within the offshore export cable corridor study area between 2010 and 2019. This corresponds to an average of five to six incidents per year; however, as noted above the majority of incidents (approximately 93%) occurred within 15nm of the coast whilst the number of incidents further offshore was much lower. The most common incident types recorded were "*machinery failure*" (51%) and "*person in danger*" (14%). Excluding "*person in danger*" and non-vessel based incidents, the most common vessel types recorded were fishing vessels (39%) followed by personal craft (20%) and sailing vessels (20%). Eight incidents were responded to by the RNLI within the offshore export cable corridor itself.

## 8.3 Maritime Rescue Coordination Centres and Joint Rescue Coordination Centres

100. His Majesty's Coastguard (HMCG), a division of the MCA, is responsible for requesting and tasking SAR resources made available to other authorities and for coordinating the subsequent SAR operations (unless they fall within military jurisdiction).

101. The HMCG coordinates SAR operations through a network of 11 Maritime Rescue Coordination Centres (MRCC), including a Joint Rescue Coordination Centre (JRCC) based in Hampshire.

102. All of the MCA's operations, including SAR, are divided into 18 geographical regions. Area 6 – 'East of England (Yorkshire, Humberside & Lincolnshire)' – covers the east coast of England between Yorkshire and The Wash and therefore covers the area encompassing the Offshore Development Area. The Humber MRCC is located within Area 6 approximately 57nm south-west of the DBS West array area, as illustrated in

Figure 8.4, and coordinates the SAR response for maritime and coastal emergencies within the district boundary.

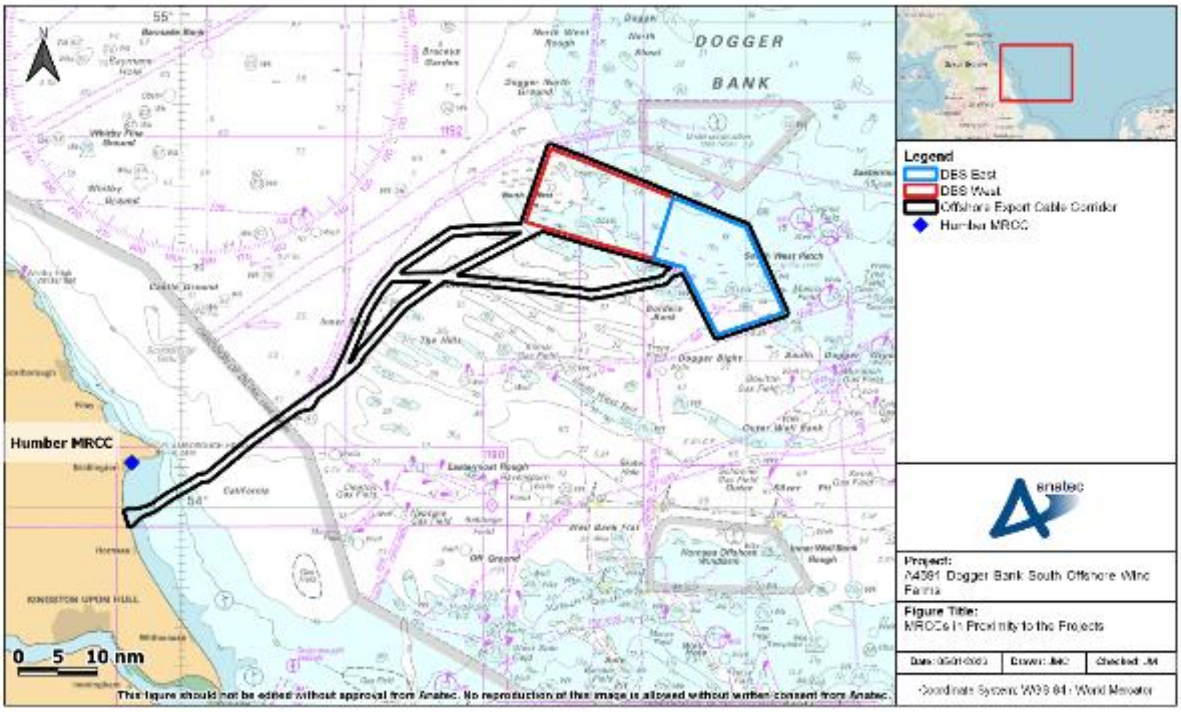
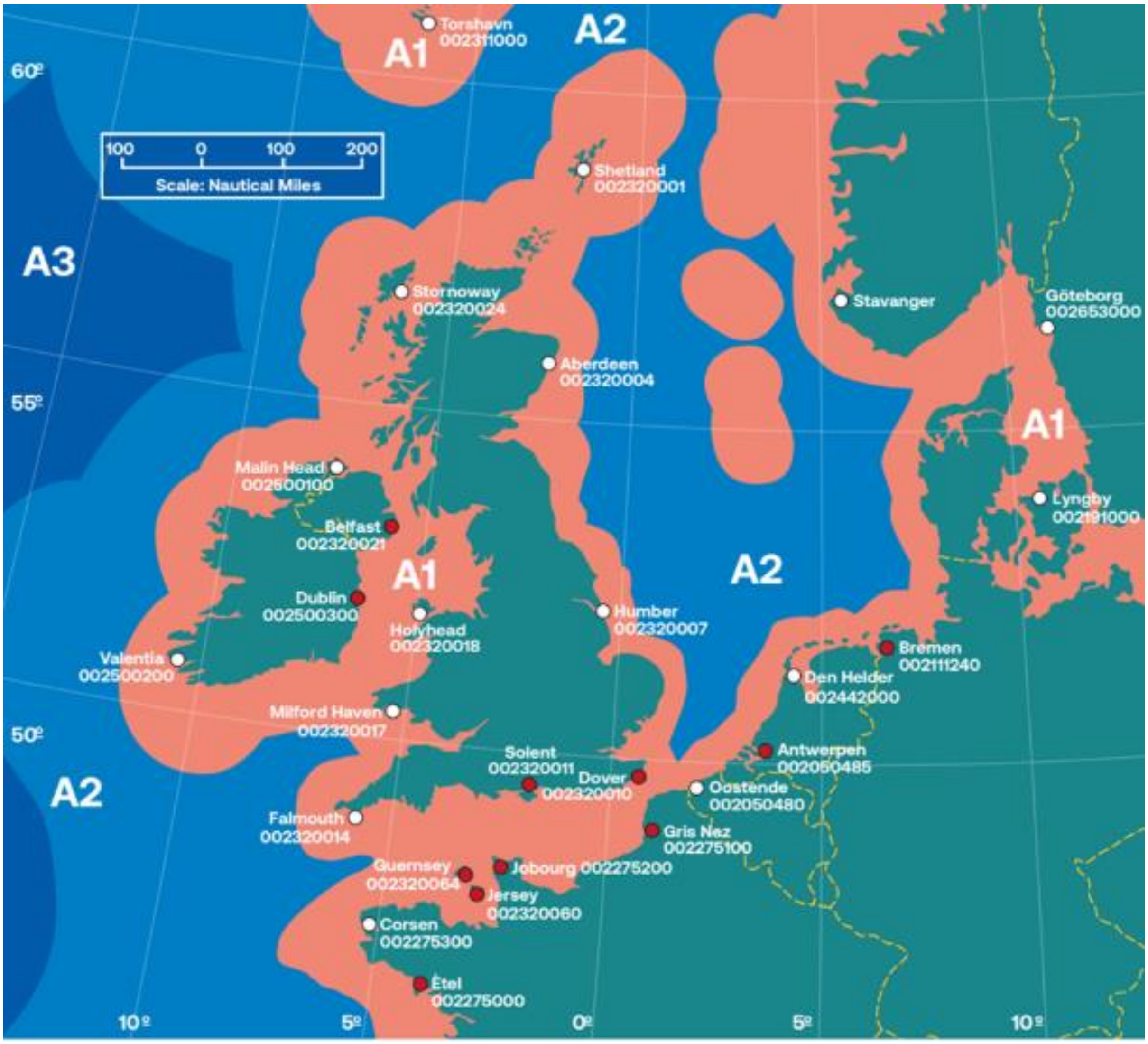



**Figure 8.4 MRCC Location in Proximity to the Offshore Development Area**

## 8.4 Global Maritime Distress and Safety System

103. The Global Maritime Distress and Safety System (GMDSS) is a maritime communications system used for emergency and distress messages, vessel to vessel routeing communications and vessel to shore routine communications. It is implemented globally and vessels engaged in international voyages are obliged to carry GMDSS certified communication equipment.

104. There are four GMDSS sea areas, with the areas applicable in proximity to the UK shown in Figure 8.5. Vessels in proximity to the DBS array areas would be located within sea area A2.



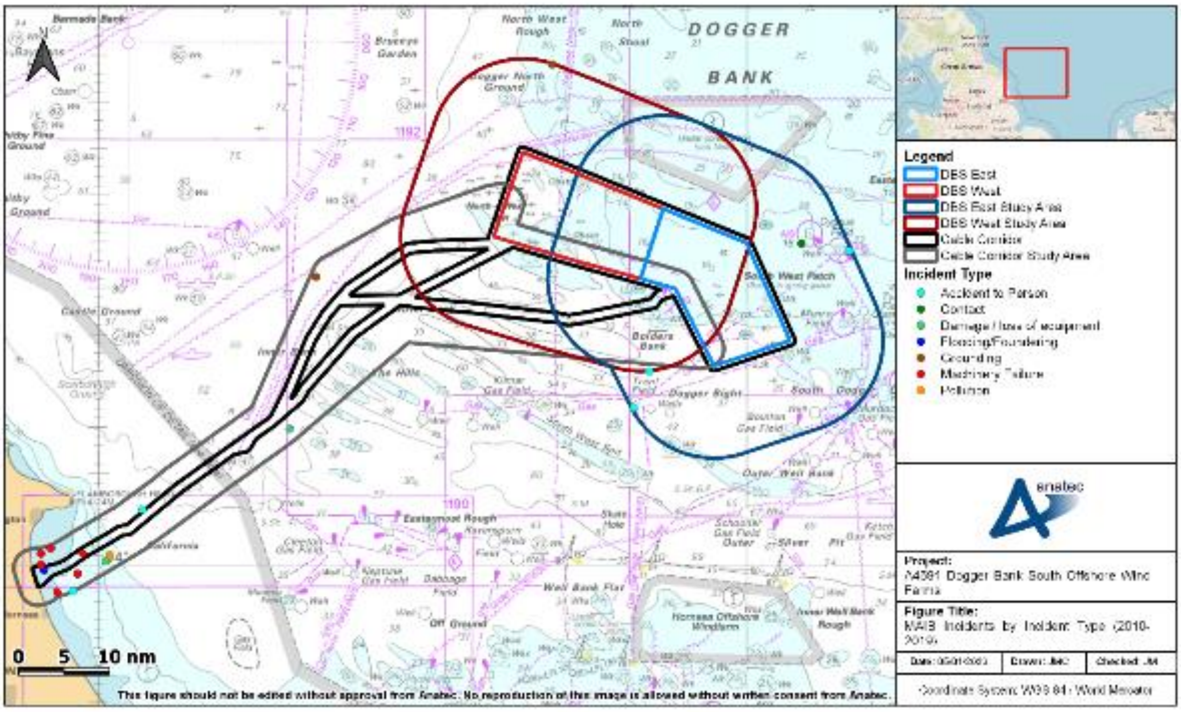

## Figure 8.5 GMDSS Sea Areas (MCA, 2021)

105. In the event of an emergency involving a vessel located further offshore within sea area A2, vessels are able to contact coastal stations using High Frequency (HF) or Medium Frequency (MF) radio or otherwise contact other offshore resources.

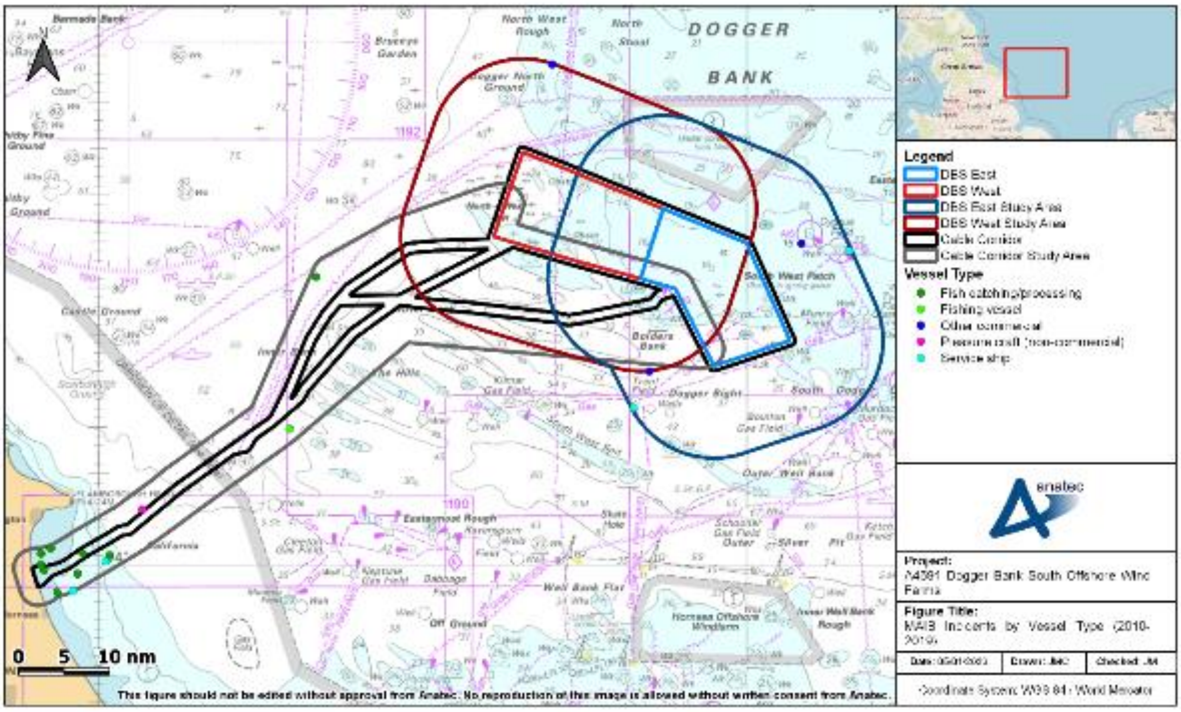
## 8.5 Marine Accident Investigation Branch

106. All UK flagged vessels and non-UK flagged vessels in UK territorial waters (12nm), a UK port or carrying passengers to a UK port are required to report incidents to the MAIB. Data arising from these reports are assessed within this section, primarily covering the ten-year period between 2010 and 2019.

107. The incidents recorded within the MAIB data between 2010 and 2019 occurring within the study area are presented in Figure 8.6, colour-coded by incident type. Following this, Figure 8.7 shows the same data colour-coded by the type of vessel(s) involved in each incident.




## Figure 8.6 MAIB Incidents by Incident Type (2010 to 2019)




## Figure 8.7 MAIB Incidents by Vessel Type (2010 to 2019)

108. A total of four unique incidents were recorded by the MAIB within the DBS East study area between 2010 and 2019, which corresponds to an average of one incident every two to three years. Two of the incidents involved support vessels while the other two

involved vessels of "*other commercial*" type. Three of the incidents involved an "*accident to person*" while the fourth involved "*contact*" in the Cygnus gas field. None of these incidents occurred within the DBS East array area itself.

109. There was a single documented MAIB incident during the ten year period within the DBS West study area, involving the grounding of a barge towing another vessel. This incident occurred at the northern extent of the DBS West study area on the Dogger North Shoal.

110. A total of 13 incidents were recorded by the MAIB within the offshore export cable corridor study area between 2010 and 2019, which corresponds to an average of one to two incidents per year. There were two incidents within the offshore export cable corridor itself. The most common incident types recorded were "*machinery failure*" (46%), *"accident to person"* (15%) and "*damage / loss of equipment*" (15%). The vessel types involved in incidents were fishing vessels (77%), support vessels (15%), and pleasure craft (8%).

111. A review of older MAIB incident data within the study area between 2000 and 2009 indicates that the number of incidents has generally remained steady in proximity to the DBS array areas while slightly decreasing closer to the UK east coast, with a total of three incidents within the DBS East study area, two incidents within the DBS West study area, and 21 incidents within the offshore export cable corridor study area. No incidents occurred within the DBS array areas.

## 8.6 Historical Offshore Wind Farm Incidents

### 8.6.1 Incidents Involving UK Offshore Wind Farm Developments

112. As of December 2022, there are 42 operational offshore wind farms in the UK, ranging from the North Hoyle offshore wind farm (fully commissioned in 2003) to Hornsea Project Two (fully commissioned in 2022). Between them these developments encompass approximately 19,611 fully operational wind turbine years.

113. MAIB incident data has been used to collate a list of reported historical collision and allision incidents involving UK offshore wind farm developments[2], which is summarised in Table 8.1. Other sources have also been used to produce this list including the UK Confidential Human Factors Incident Reporting Programme (CHIRP) for Aviation and Maritime, International Marine Contractors Association (IMCA) and basic web searches.

[2] Includes only those incidents reported explicitly as collisions or allisions to an accident investigation branch or anonymous reporting service. Unconfirmed incidents have not been considered noting that to date only two further incidents have been noted but not publicly reported as such.

## Table 8.1 Summary of Historical Collision and Allision Incidents Involving UK Offshore Wind Farm Developments

| Incident Vessel | Incident Type | Date | Description of Incident | Vessel Damage* | Harm to Persons | Source |
|---|---|---|---|---|---|---|
| Project | Allision | 7th August 2005 | Wind turbine installation vessel allision with wind turbine base whilst manoeuvring alongside it. Minor damage sustained to a gangway on the vessel, the wind turbine tower and a wind turbine blade. | Minor damage to gangway on the vessel | None | MAIB |
| Project | Allision | 29th September 2006 | Offshore services vessel allision with rotating wind turbine blade. | None | None | MAIB |
| Project | Allision | 8th February 2010 | Work boat allision with disused pile following human error with throttle controls whilst in proximity. Passenger later diagnosed with injuries and no serious damage sustained by vessel. | Minor | Injury | MAIB |
| Project / third-party | Collision | 23rd April 2011 | Third-party catamaran collision with project guard vessel within harbour. | Moderate | None | MAIB |
| Project | Allision | 18th November 2011 | Cable-laying vessel allision with wind turbine foundation following watchkeeping failure. Two hull breaches to vessel. | Major | None | MAIB |
| Project / project | Collision | 2nd June 2012 | CTV allision with flotel. Nine persons safely evacuated and transferred to nearby vessel before being brought back in to port. | Moderate | None | UK CHIRP |
| Project | Allision | 20th October 2012 | Project vessel allision with wind turbine monopile following human error (misjudgement of distance). Minor damage sustained by vessel. | Minor | None | MAIB |
| Project | Allision | 21st November 2012 | Passenger transfer catamaran allision with buoy following navigational error. Vessel abandoned by crew of 12 having been holed, causing extensive flooding but no injuries sustained. | Major | None | MAIB |
| Project | Allision | 21st November 2012 | Work boat allision with unlit wind turbine transition piece at moderate speed following | Moderate | Injury | MAIB |

| Incident Vessel | Incident Type | Date | Description of Incident | Vessel Damage* | Harm to Persons | Source |
|---|---|---|---|---|---|---|
| | | | navigational error. Vessel able to proceed to port unassisted with no water ingress but some structural damage sustained. | | | |
| Project | Allision | 1st July 2013 | Service vessel allision with wind turbine foundation following machinery failure. Minor damage sustained by vessel. | Minor | None | IMCA Safety Flash |
| Project | Allision | 14th August 2014 | Standby safety vessel allision with wind turbine pile. Oil leaked by vessel which moved away from environmentally sensitive areas until leak was stopped. | Minor with pollution | None | UK CHIRP |
| Third-party | Allision | 26th May 2016 | Third-party fishing vessel allision with wind turbine following human error (autopilot). Lifeboat attended the incident. | Moderate | Injury | Web search (RNLI, 2016) |
| Project | Allision | 14th February 2019 | Survey vessel contacted with wind turbine jacket whilst autopilot was engaged. | Minor | None | MAIB |
| Project | Allision | 16th January 2020 | Project vessel allision with wind turbine. Injury sustained by crew member but vessel able to proceed to port unassisted. | None | Injury | Web search (Vessel Tracker, 2020) |
| Project | Allision | 27th January 2020 | Project vessel allision with wind turbine. Minor damage to vessel and wind turbine sustained, with no personal injuries. | Minor | None | Marine Safety Forum |
| Third-party | Allision | 9th June 2022 | Fishing vessel allision with wind turbine resulting in damage to vessel and two minor injuries for crew members. RNLI lifeboat escorted vessel under its own power to port. | Minor | Injury | Web search (RNLI, 2022) |

(*) As per incident reports.

114. The worst consequences reported for vessels involved in a collision or allision incident involving a UK offshore wind farm development has been flooding, with no life-threatening injuries to persons reported.

115. As of December 2022, there have been no third-party collisions directly as a result of the presence of an offshore wind farm in the UK. The only reported collision incident in relation to a UK offshore wind farm involved a project vessel hitting a third-party vessel whilst in harbour.

116. As of December 2022, there have been 13 reported cases of an allision between a vessel and a wind turbine (under construction, operational or disused) in the UK, with all but one involving a support vessel for the development and the errant vessel in each case under power rather than drifting. Therefore, there has been an average of 1,509 wind turbine years per allision incident in the UK, noting that this is a conservative calculation given that only operational wind turbine hours have been included (whereas allision incidents counted include non-operational wind turbines).

### 8.6.2 Incidents Involving Non-UK Offshore Wind Farms

117. It is acknowledged that collision and allision incidents involving non-UK offshore wind farm developments have also occurred. However, it is not possible to maintain a comprehensive list of such incidents.

118. One high profile non-UK incident which is noted is that involving a bulk carrier in January 2022 which dragged anchor during a storm in Dutch waters and collided with another anchored vessel. The vessel began to take on water, leading to all crew members being evacuated by helicopter. The vessel then continued to drift towards shore including though an under construction offshore wind farm where it allided with a wind turbine foundation and a platform foundation before being taken under tow.

### 8.6.3 Incidents Responded to by Vessels Associated with UK Offshore Wind Farms

119. From news reports, basic web searches and experience at working with existing offshore wind farm developments, a list has been collated of historical incidents responded to by vessels associated with UK offshore wind farm developments, which is summarised in Table 8.2. The initial cause of these incidents is not related to the offshore wind farm in question.

120. Table 8.2 comprises known incidents that were responded to by a wind farm vessel. Additional incidents associated with the construction or operation of offshore wind farms are also known to have occurred. These incidents typically involve an accident to person which requires medical attention (including emergency response).

**Table 8.2 Historical Incidents Responded to By Vessels Associated with UK Offshore Wind Farm Developments**

| Incident Type | Date | Related Development | Description of Incident | Source |
|---|---|---|---|---|
| Capsize | 21 June 2018 | Walney | HMCG issued mayday relay broadcast following trimaran capsize. Support vessel for Walney arrived and recovered two persons from the water who were then winched onboard a Coastguard helicopter. | Web search (4C Offshore, 2018) |
| Capsize | 5 November 2018 | Race Bank | Fishing vessel capsized resulting in two persons in the water. Vessel operating at the nearby | Web search (British |

| Incident Type | Date | Related Development | Description of Incident | Source |
|---|---|---|---|---|
| | | | Race Bank reported to have assisted with the rescue which also involved a Belgian military helicopter and the RNLI. | Broadcasting Corporation (BBC), 2018) |
| Vessel in distress | 15 May 2019 | London Array | Yacht in difficulty sought shelter by tying up to a wind turbine but suffered damage and a person in the water. Support vessel for London Array identified and secured the casualty vessel and recovered the person in the water. The support vessel raised the alarm to the Coastguard. The Coastguard later instructed the support vessel to return to port and seek medical assistance for the casualty vessel's occupant. | Web search (The Isle of Thanet News, 2019) |
| Drifting | 7 July 2019 | Gwynt y Môr | Speedboat suffered mechanical failure stranding four persons. Support vessel for Gwynt y Môr responded to an 'all-ships' broadcast from the Coastguard and prevented the casualty vessel drifting into the Gwynt y Môr array. The support vessel later towed the casualty vessel back towards port. | Web search (Renews, 2019) |
| Machinery failure | 28 September 2019 | Race Bank | Fishing vessel suffered mechanical failure and launched flares. Guard vessel and SOV for Race Bank both immediately offered assistance until the MCA's arrival on-scene. | Internal daily progress report received by Anatec |
| Vessel in distress | 13 December 2019 | Race Bank | Passing vessel got into difficulty and guard vessel for Race Bank was requested to assist. The Coastguard later requested that the guard vessel tow the casualty vessel into port. | Internal daily progress report received by Anatec |
| Search | 21 May 2020 | Walney | Coastguard contacted guard vessel for Walney reporting red flare sighting at the wind farm. Guard vessel proceeded to undertake search but did not find anything to report. | Internal daily progress report received by Anatec |
| Aircraft crash | 15 June 2020 | Hornsea Project One | United States (US) jet crashed into sea during routine flight. CTV and SOV for Hornsea Project One joined the search for the missing pilot. | Web search (4C Offshore, 2020) |
| Fire / explosion | 15 December 2020 | Dudgeon | Fishing vessel experienced explosions on board with crew injured. SOV for Dudgeon deployed its Fast Rescue Boat (FRB) and evacuated the casualty vessel. | Web search (Offshore WIND, 2020) |
| Vessel in distress | 3 July 2021 | Robin Rigg | Wind farm CTV fire alarm sounded, with the engine then shut down. A support vessel for Robin Rigg was able to assist in escorting the vessel to port. | Web search (Vessel Tracker, 2021) |

| Incident Type | Date | Related Development | Description of Incident | Source |
|---|---|---|---|---|
| Drifting | 17 July 2021 | Neart na Gaoithe | Small dinghy with two children aboard drifted offshore due to strong winds. A guard vessel associated with Neart na Gaoithe was able to retrieve the children. | Web search (Edinburgh Evening News, 2021) |
| Allision | 9 June 2022 | Westermost Rough | Fishing vessel allided with a wind turbine at Westermost Rough. A supply vessel was among the responders as an RNLI lifeboat escorted the vessel under its own power to port. | Web search (Vessel Tracker, 2022) |

# 9 Vessel Traffic Movements

121. This section presents an overview of vessel traffic movements across the study areas (defined in Section 3.4) for the DBS array areas and offshore export cable corridor, based upon the findings of the summer and winter vessel traffic surveys undertaken in July and October / November 2022 and excluding temporary traffic (see Section 5.2).

## 9.1 Dogger Bank South Array Areas

122. This section provides a general overview of vessel traffic within the DBS East study area and DBS West study area, with more detailed analysis of each of the main vessel types presented in Sections 9.1.3 to 9.1.6.

123. Figure 9.1 presents the tracks of vessels recorded within the DBS East study area during the 28-day period, followed by a vessel density heat map of the same data.

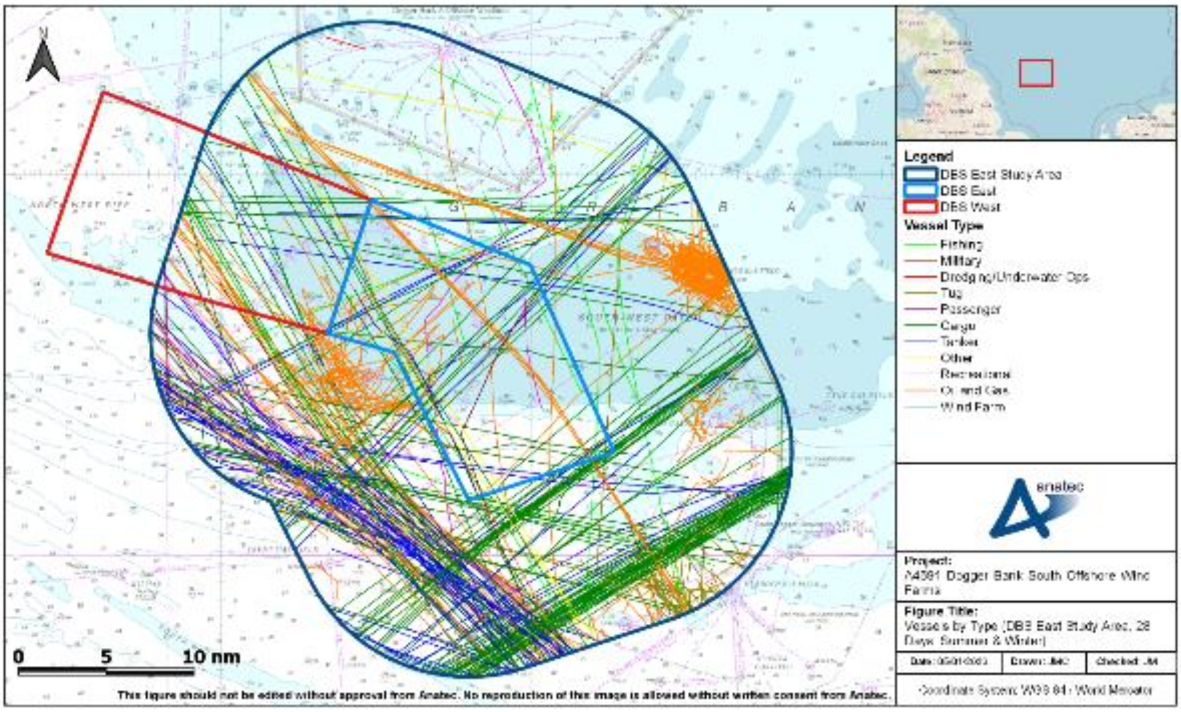
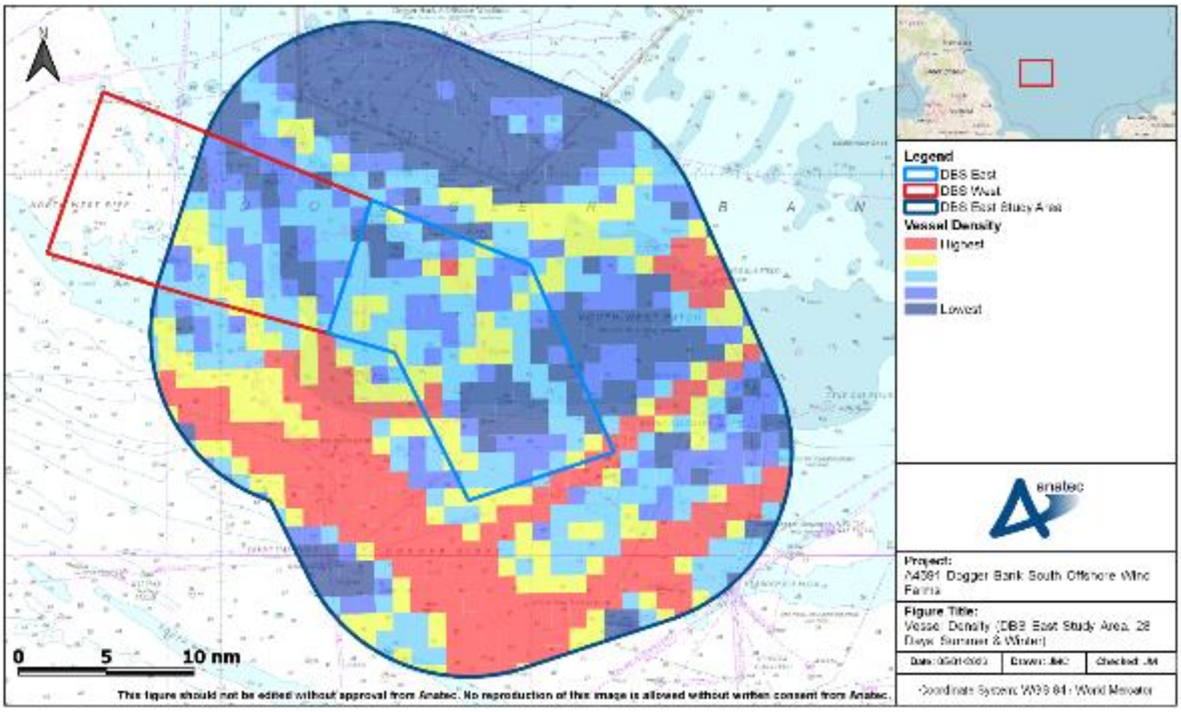



**Figure 9.1 Vessels by Type (DBS East Study Area, 28 Days, Summer and Winter)**

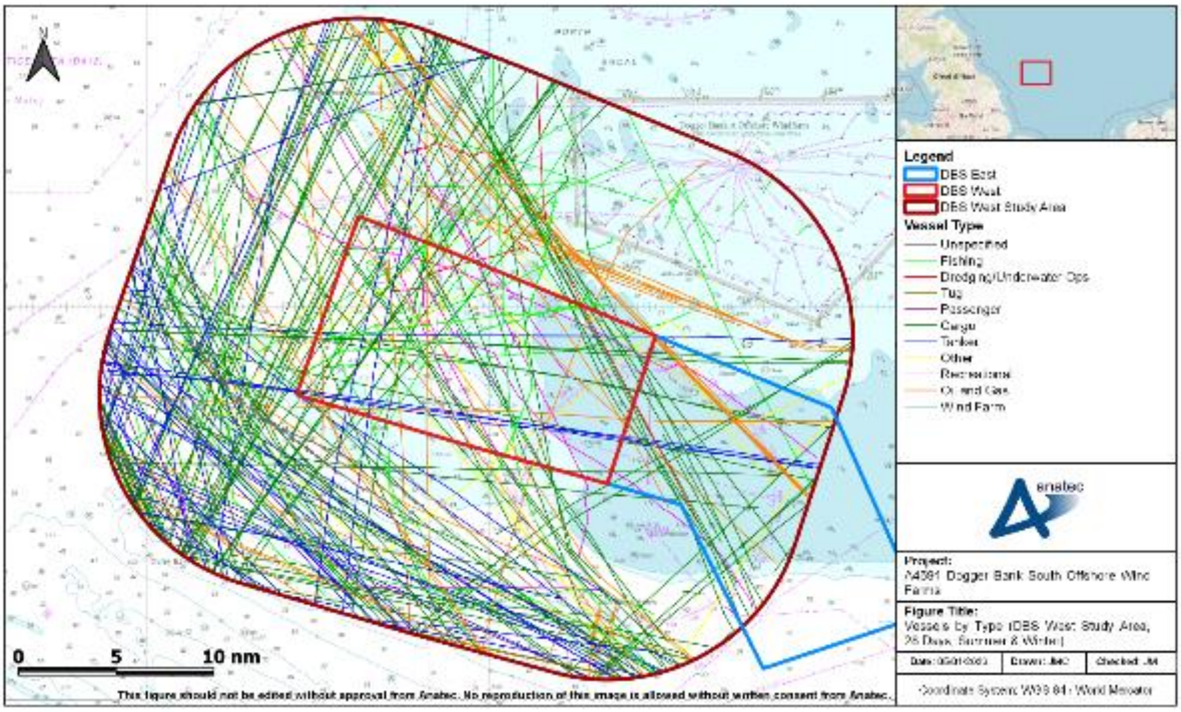



## Figure 9.2 Vessel Density (DBS East Study Area, 28 Days, Summer and Winter)

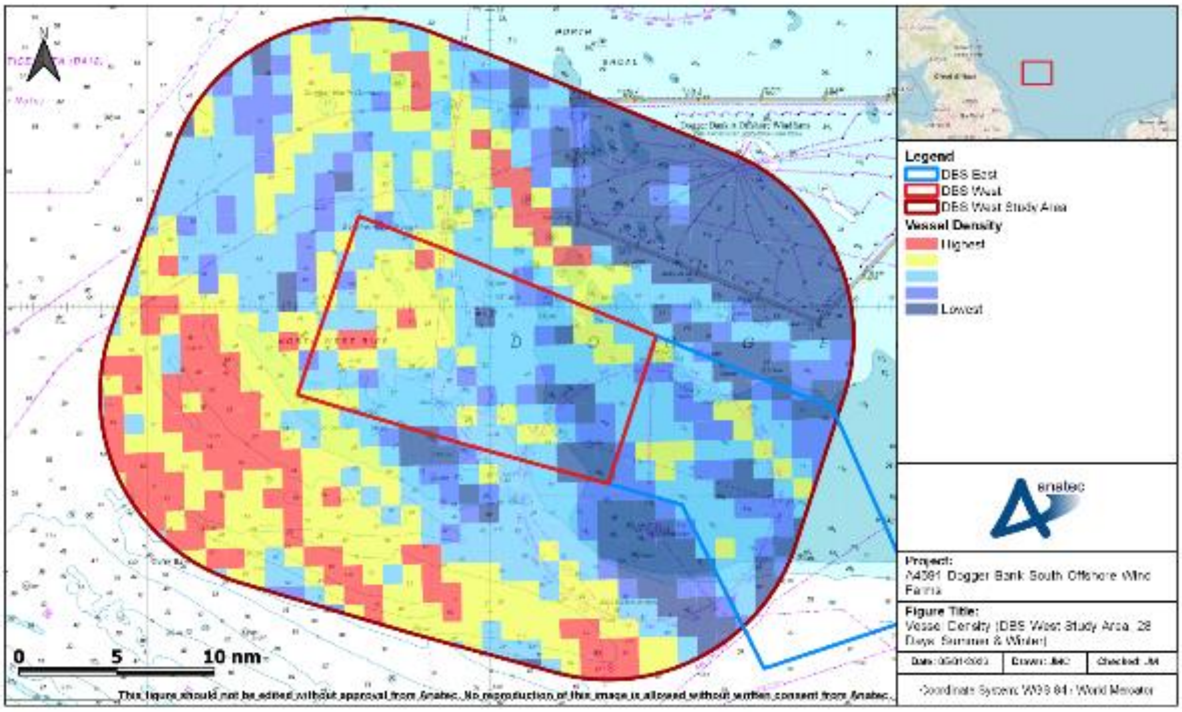
124. High-density traffic is mainly located to the south-west of the DBS East array area, comprising commercial traffic undertaking north-west / south-east transits across the North Sea. There are also north-east / south-west cargo vessel routes of relatively high density to the south-east of the DBS East array area, one of which intersects the south-eastern extent of the DBS East array area.

125. High density traffic is also located in proximity to the Cygnus gas field to the north-east, due to oil and gas vessel activity. In contrast, the lowest density area is at Dogger Bank A, which had minimal traffic within its boundary (and was mostly recorded during early July).

126. Figure 9.3 presents the tracks of vessels recorded within the DBS West study area during the 28-day period, followed by a vessel density heat map of the same data.




## Figure 9.3 Vessels by Type (DBS West Study Area, 28 Days, Summer and Winter)




## Figure 9.4 Vessel Density (DBS West Study Area, 28 Days, Summer and Winter)

127. High density traffic is mainly located to the south and west of the DBS West array area, mainly comprising commercial traffic undertaking north-west / south-east transits across the North Sea. Transits by cargo vessels and oil and gas vessels also

contribute to a region of relatively high density to the north of the DBS West array area between the boundary of the DBS West array area and the boundary of Dogger Bank A. Traffic within the Dogger Bank A was minimal (and mostly recorded during July), with this region being the largest region of relatively low density within the DBS West study area.

### 9.1.1 Vessel Count

128. This section presents an overview of vessel counts within the DBS array study areas during the survey periods. It is noted that throughout this section, only unique vessels are counted for each day to prevent overcounting in cases where a vessel may have been dropped and reacquired.

#### 9.1.1.1 DBS East Array Area

129. For the 28-day period, an average of 14 unique vessels per day was recorded within the DBS East study area while an average of three unique vessels per day was recorded intersecting the DBS East array area itself.

130. Figure 9.5 presents the daily counts of vessels recorded within the DBS East study area and the DBS East array area during the 28-day period. Approximately 23% of vessels recorded within the DBS East study area were also recorded within the DBS East array area itself.

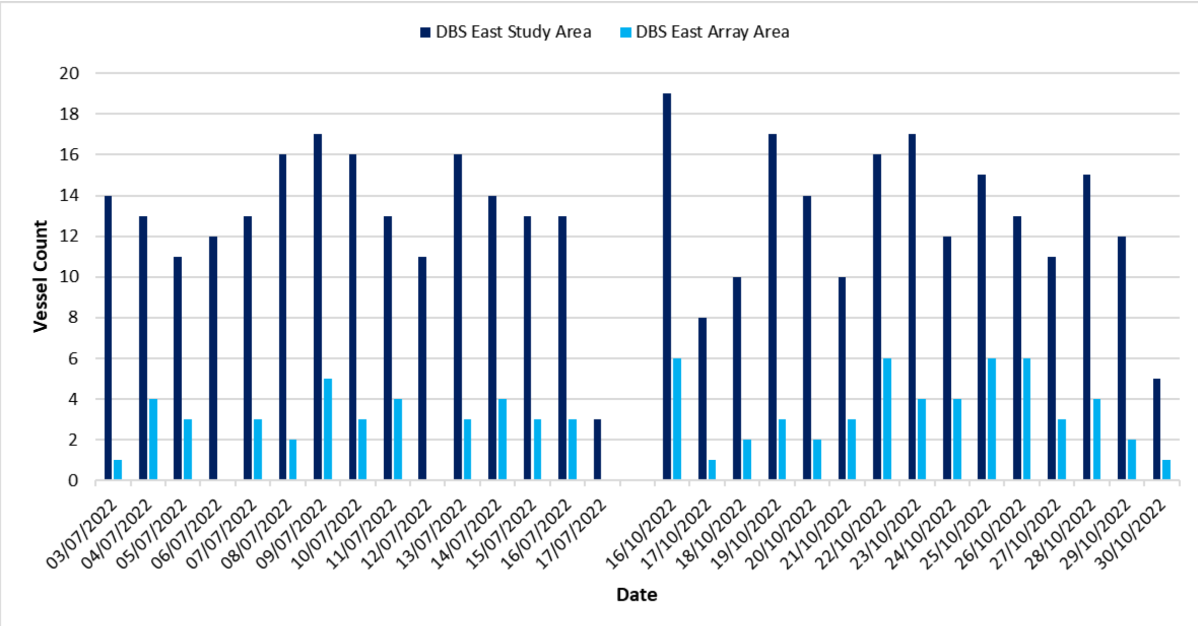



Figure 9.5 Vessel Counts per Day within DBS East Study Area and DBS East Array Area

131. The busiest day within the DBS East study area during the 28-day period was the 16th October, during which 19 unique vessels were recorded. The quietest full day was the 17th October, during which eight unique vessels were recorded.

#### 9.1.1.2 DBS West Array Area

132. For the 28-day period, an average of ten unique vessels per day was recorded within the DBS West study area while an average of three unique vessels per day was recorded intersecting the DBS West array area itself.

133. Figure 9.5 presents the daily counts of vessels recorded within the DBS West study area and the DBS West array area during the 28-day period. Approximately 34% of vessels recorded within the DBS West study area were also recorded within the DBS West array area itself.

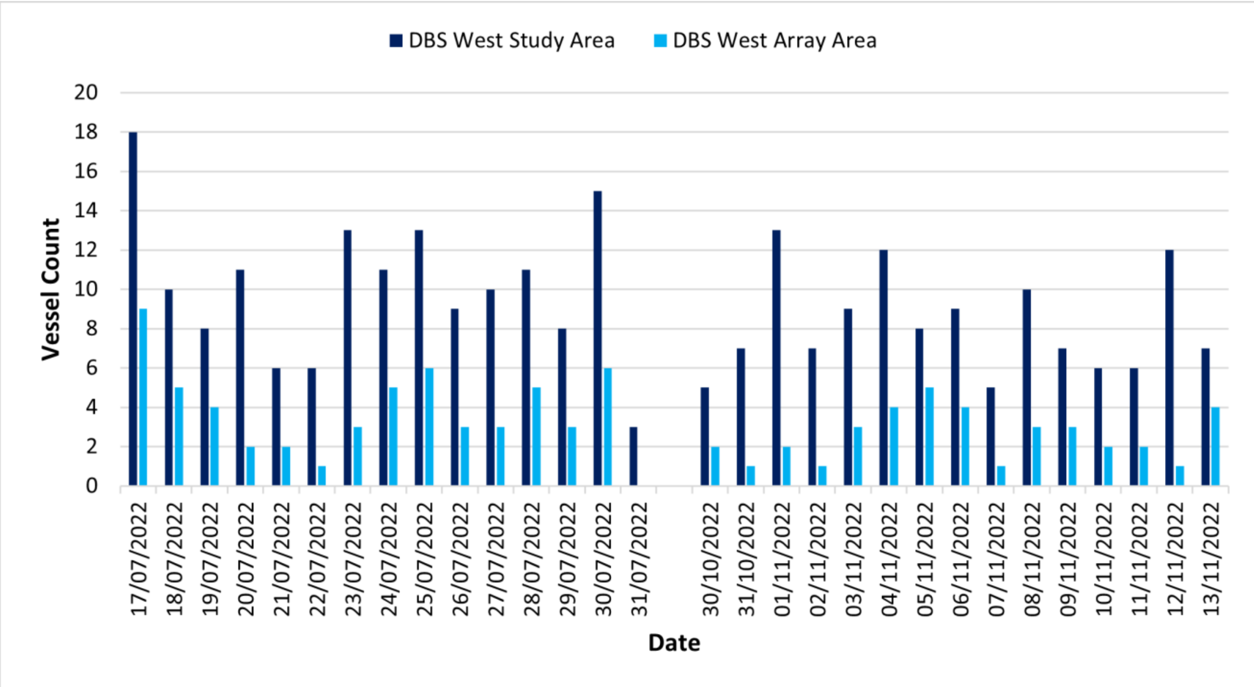



**Figure 9.6 Vessel Counts per Day within DBS West Study Area and DBS West Array Area**

134. The busiest day within the DBS West study area during the 28-day period was the 17th July, during which 17 unique vessels were recorded. The quietest full day was the 7th November, during which five unique vessels were recorded.

### 9.1.2 Vessel Type

135. This subsection presents analysis of the main vessel types recorded within and in proximity to the DBS array areas, with more detailed analysis on each individual vessel type being presented in Sections 9.1.3 to 9.1.7.

#### 9.1.2.1 DBS East Array Area

136. The distribution of the main vessel types recorded within the DBS East study area, as well as intersecting the DBS East array area itself, during the 28-day period is presented in Figure 9.7.

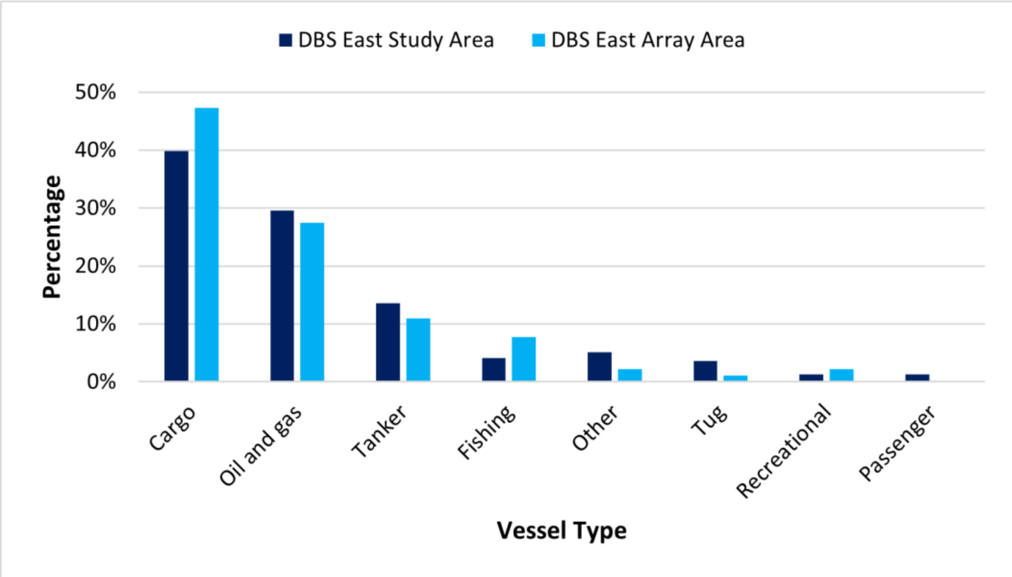



**Figure 9.7 Distribution of Main Vessel Types (DBS East Array Area, 28 Days, Summer and Winter)**

137. The main type of vessel recorded within both the DBS East study area and the DBS East array area itself was cargo vessels, accounting for 40% of the traffic within the DBS East study area and 47% of the traffic within the DBS East array area itself. The next most common vessel type within the DBS East study area was oil and gas vessels, accounting for 30%, followed by tankers (14%) and fishing vessels (4%). The most common vessel type within the DBS East array area itself after cargo vessels was oil and gas vessels, which accounted for 27%. This was followed by tankers (11%) and fishing vessels (8%).

#### 9.1.2.2 DBS West Array Area

138. The distribution of the main vessel types recorded within the DBS West study area, as well as intersecting the DBS West array area itself, during the 28-day period is presented in Figure 9.7.

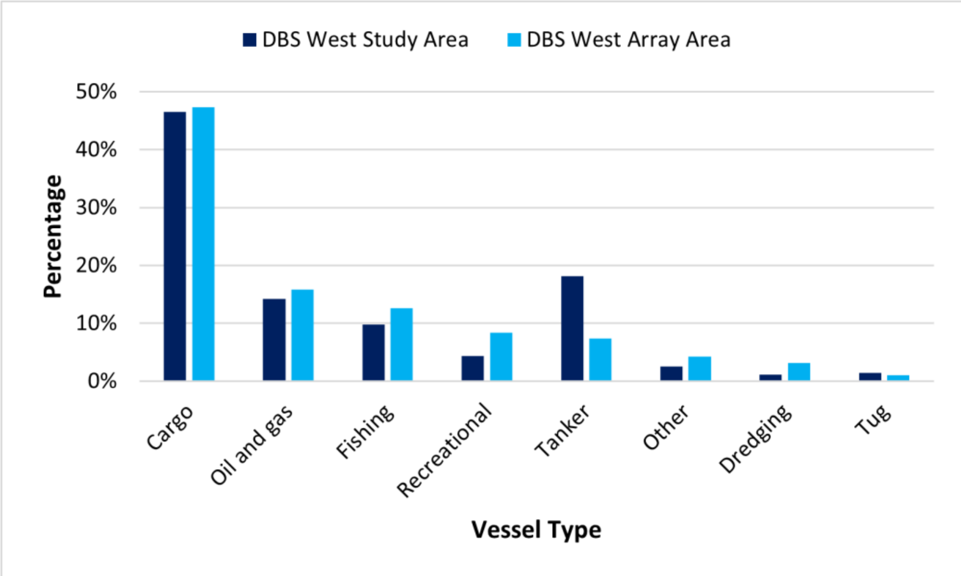


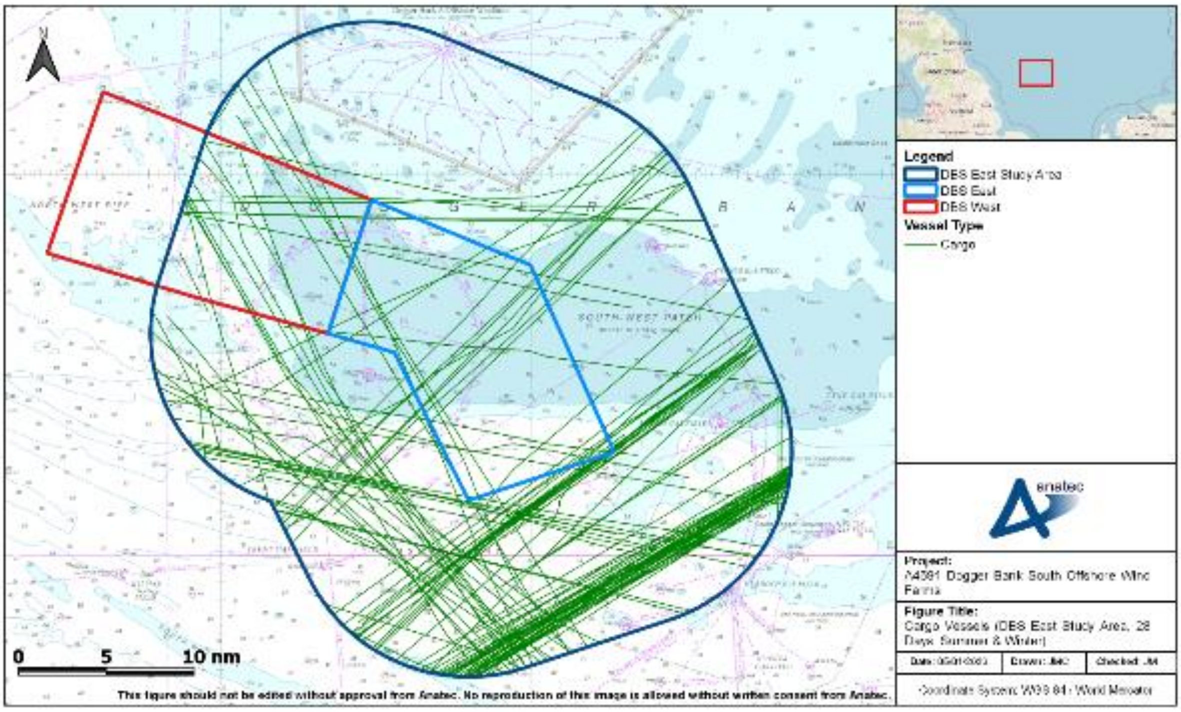

**Figure 9.8 Distribution of Main Vessel Types (DBS West Array Area, 28 Days, Summer and Winter)**

139. The main type of vessel recorded within both the DBS West study area and the DBS West array area was cargo vessels, accounting for 46% of the traffic within the DBS West study area and 47% of the traffic within the DBS West array area. The next most common vessel type within the DBS West study area was tankers, accounting for 18%, followed by oil and gas vessels (14%) and fishing vessels (10%). The most common vessel type within the DBS West array area after cargo vessels was oil and gas vessels, which accounted for 16%. This was followed by fishing vessels (13%) and recreational vessels (8%).

### 9.1.3 Cargo Vessels

#### 9.1.3.1 DBS East Array Area

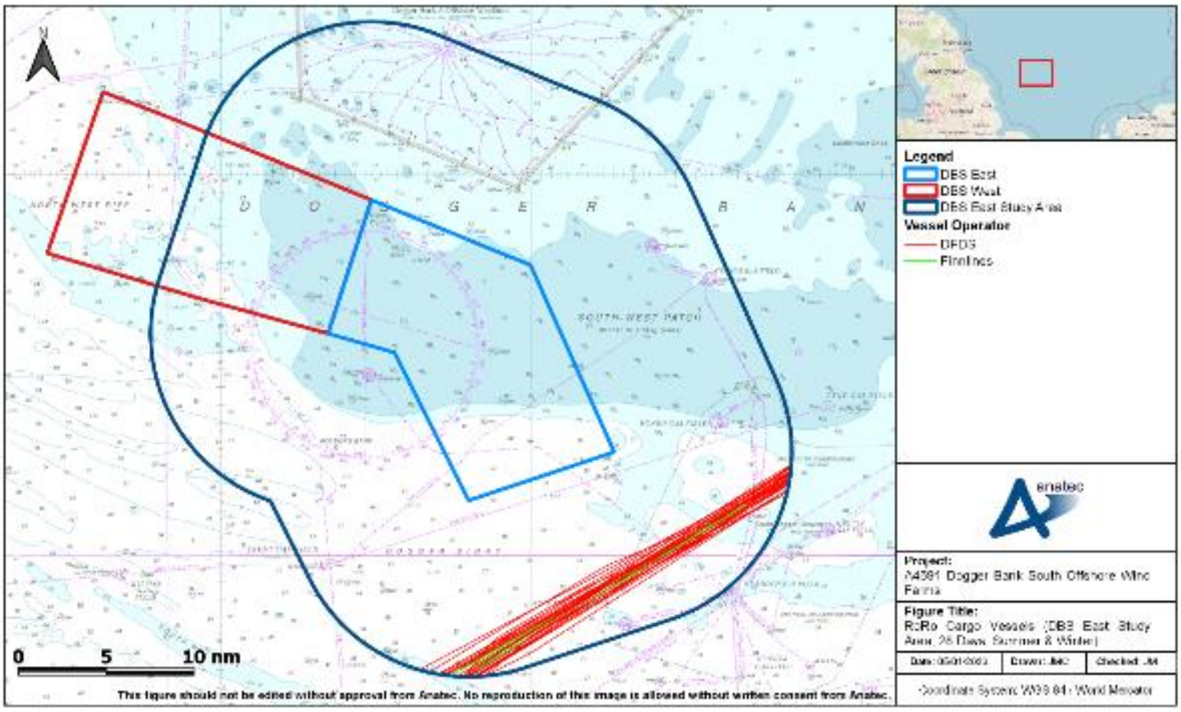
140. Figure 9.9 presents the cargo vessels recorded within the DBS East study area during the 28-day period.




### Figure 9.9 Cargo Vessels (DBS East Study Area, 28 Days, Summer and Winter)

141. An average of between five and six cargo vessels per day was recorded within the DBS East study area during the 28-day period, and an average of between one and two cargo vessels per day was recorded within the DBS East array area itself.

142. Cargo vessels were recorded transiting in a variety of directions but avoided Dogger Bank A. Cargo vessels were commonly observed undertaking north-east / south-west routes, either passing south-east of, passing at the south-eastern corner of, or passing through the DBS East array area. The most frequented of these routes was mainly undertaken by two Roll-on / Roll-off (RoRo) cargo vessels operated by DFDS Seaways; Figure 9.10 presents the RoRo cargo vessels recorded within the DBS East study area during the 28-day period.

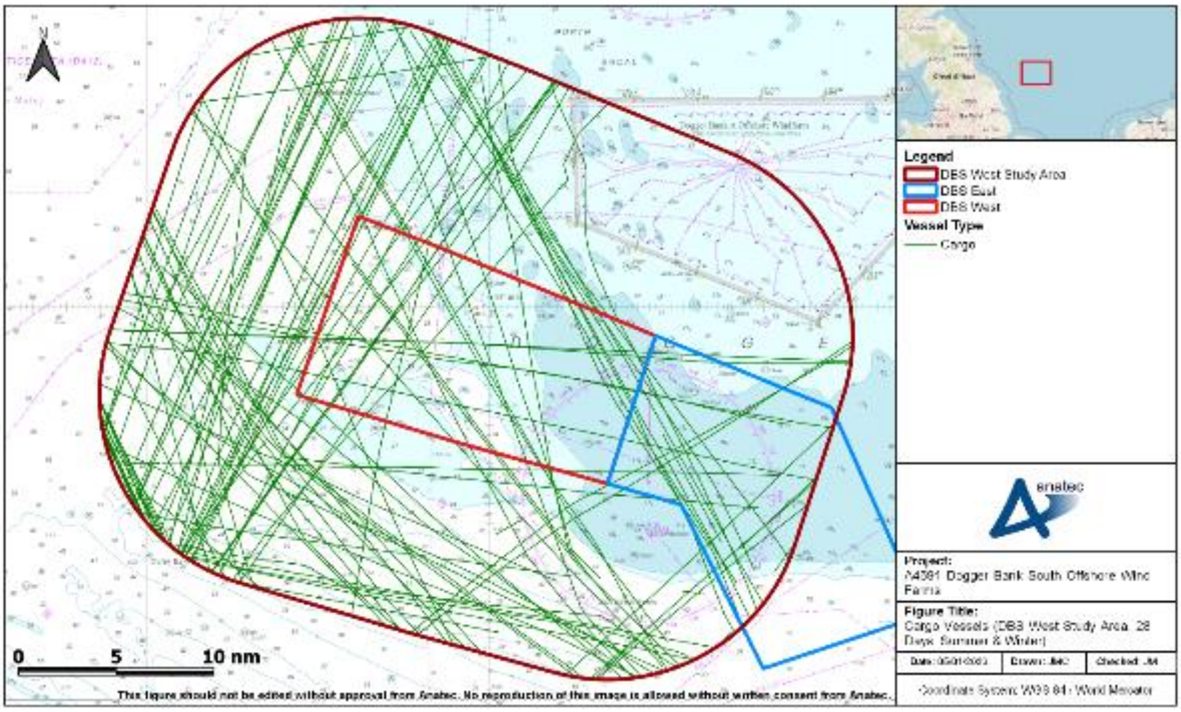



## Figure 9.10 RoRo Cargo Vessels (DBS East Study Area, 28 Days, Summer and Winter)

143. The DFDS Seaways route is between Immingham (UK) and Gothenburg (Sweden) or Immingham and Brevik (Norway), generally featuring one to two transits per day. The route is also operated by Finnlines between Hull (UK) and Helsinki (Finland), generally featuring two transits per week.

### 9.1.3.2 DBS West Array Area

144. Figure 9.11 presents the cargo vessels recorded within the DBS West study area during the 28-day period.




### Figure 9.11 Cargo Vessels (DBS West Study Area, 28 Days, Summer and Winter)

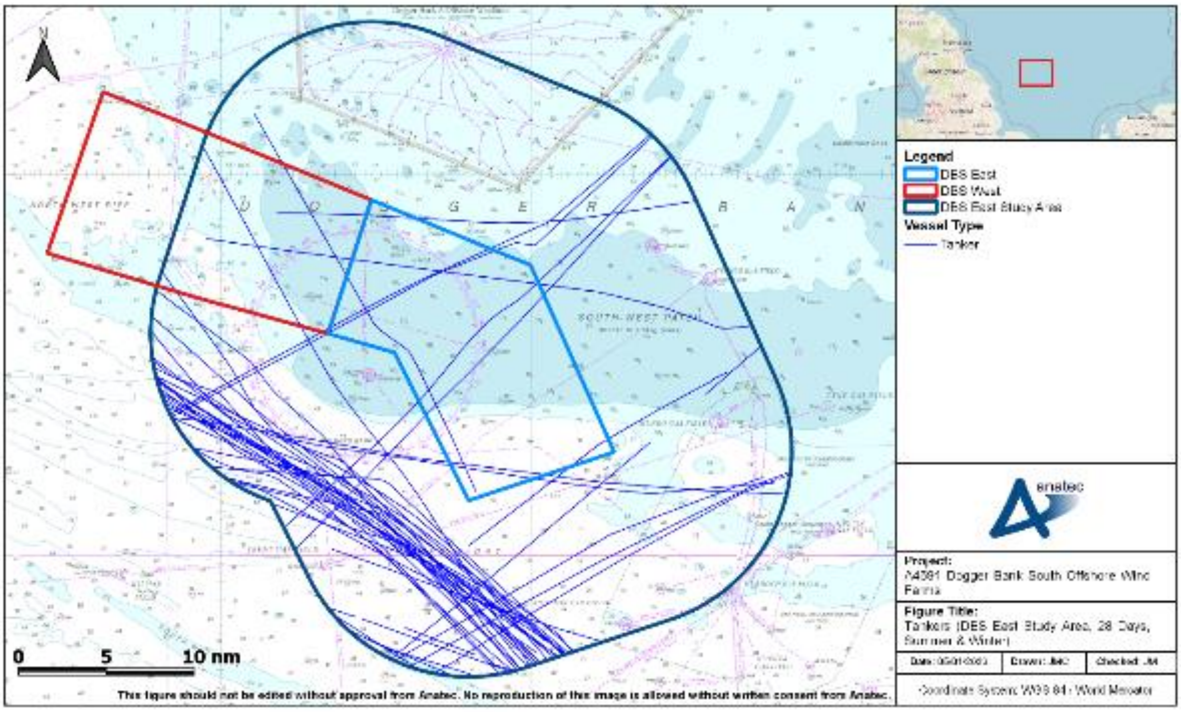
145. An average of between four and five cargo vessels per day was recorded within the DBS West study area during the 28-day period, and an average of between one and two cargo vessels per day was recorded within the DBS West array area itself.

146. Cargo vessels generally avoided the boundary of Dogger Bank A and were seen transiting to / from a variety of destinations including UK and Norwegian ports. No regular RoRo cargo vessels were observed.

## 9.1.4 Tankers

### 9.1.4.1 DBS East Array Area

147. Figure 9.12 presents the tankers recorded within the DBS East study area during the 28-day period.




## Figure 9.12 Tankers (DBS East Study Area, 28 Days, Summer and Winter)

148. An average of two tankers per day was recorded within the DBS East study area during the 28-day period, with an average of one tanker every three days recorded within the DBS East array area itself.

149. Tankers were generally concentrated along a south-east / north-west route to the south-west of the DBS East array area. This route passes between the platforms associated with the Cavendish and Trent gas fields. Destinations of the tankers undertaking this route were mainly UK and Dutch ports.

### 9.1.4.2 DBS West Array Area

150. Figure 9.13 presents the tankers recorded within the DBS West study area during the 28-day period.

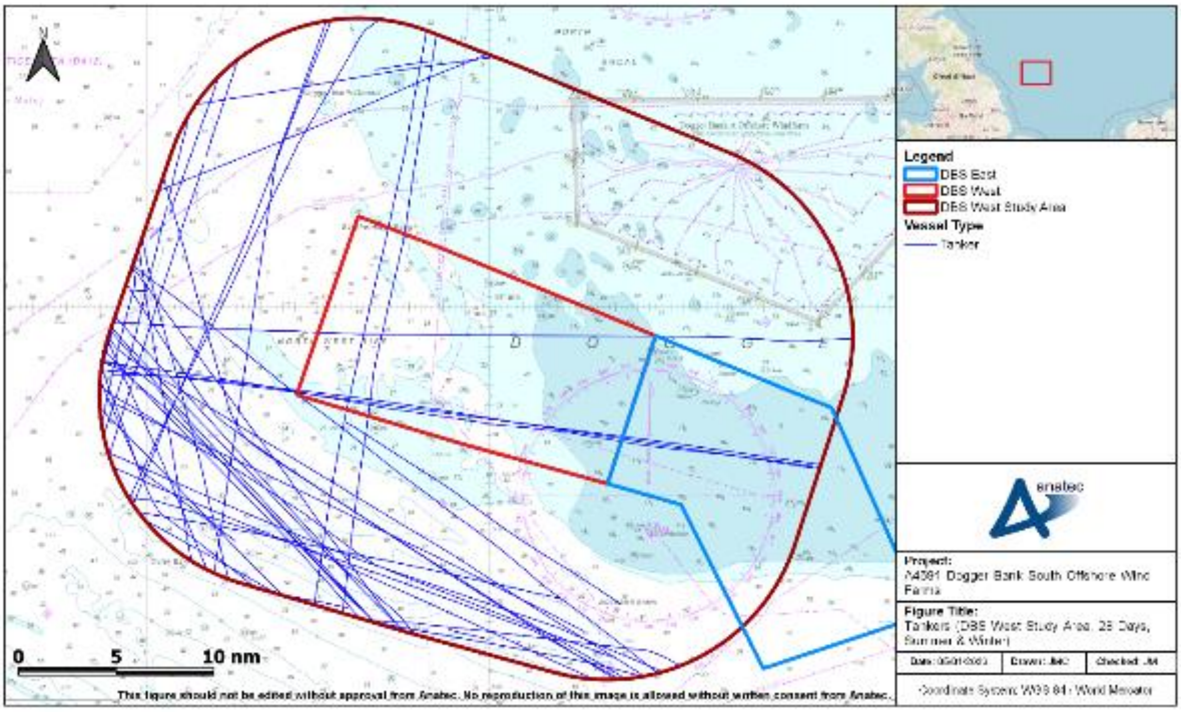



**Figure 9.13 Tankers (DBS West Study Area, 28 Days, Summer and Winter)**

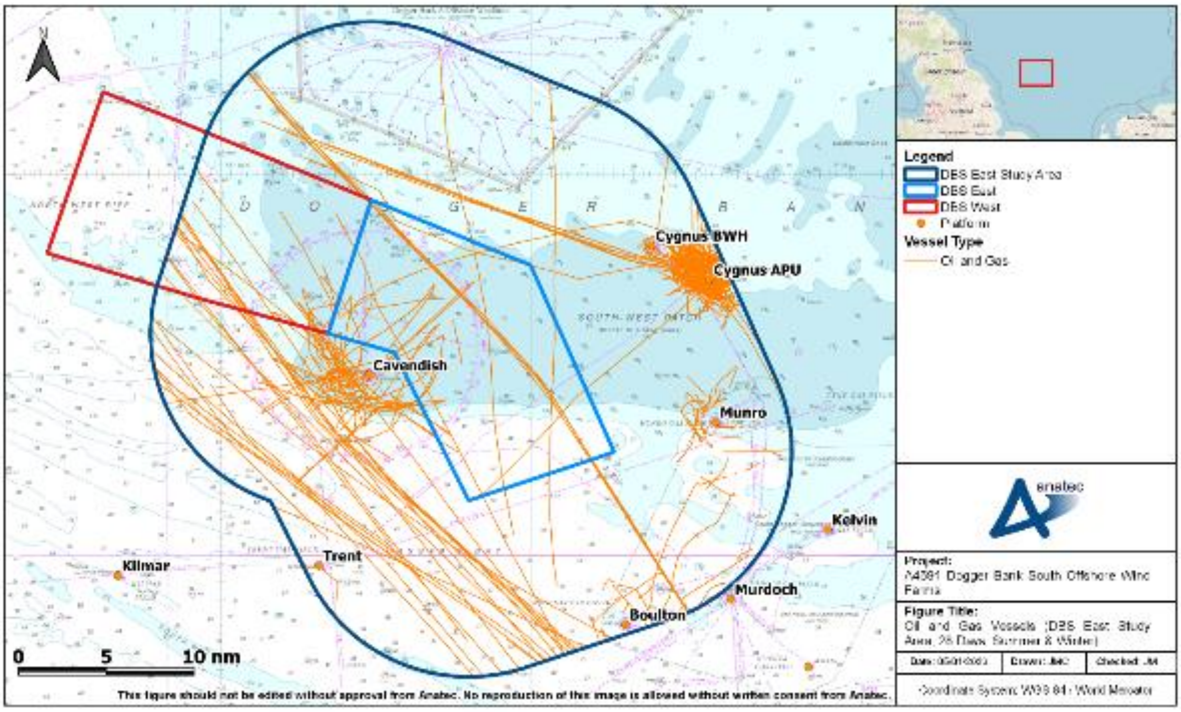
151. An average of between one and two tankers per day was recorded within the DBS West study area during the 28-day period, and an average of one tanker every four days recorded within the DBS West array area itself.

152. Tankers were generally recorded to the west and south of the DBS West array area, with destinations mainly being UK and Dutch ports.

### 9.1.5 Oil and Gas Vessels

#### 9.1.5.1 DBS East Array Area

153. Figure 9.14 presents the oil and gas vessels recorded within the DBS East study area during the 28-day period. The platforms associated with activities are also shown for context.




### Figure 9.14 Oil and Gas Vessels (DBS East Study Area, 28 Days, Summer and Winter)

154. An average of between three and four oil and gas vessels per day was recorded within the DBS East study area during the 28-day period, and an average of one oil and gas vessel every day was recorded within the DBS East array area itself.

155. Oil and gas vessel activity was largely concentrated in proximity to the Cygnus gas field to the east of the DBS East array area, with transits to the Cygnus gas field passing north of the DBS array areas and south of Dogger Bank A. An oil and gas vessel was also seen in proximity to Cavendish, located south of the DBS East array area, for a duration of ten days.

156. The remainder of the traffic was largely observed undertaking south-east / north-west transits, with Aberdeen (UK) being one of the most common destinations for these vessels.

### 9.1.5.2 DBS West Array Area

157. Figure 9.15 presents the oil and gas vessels recorded within the DBS West study area during the 28-day period.

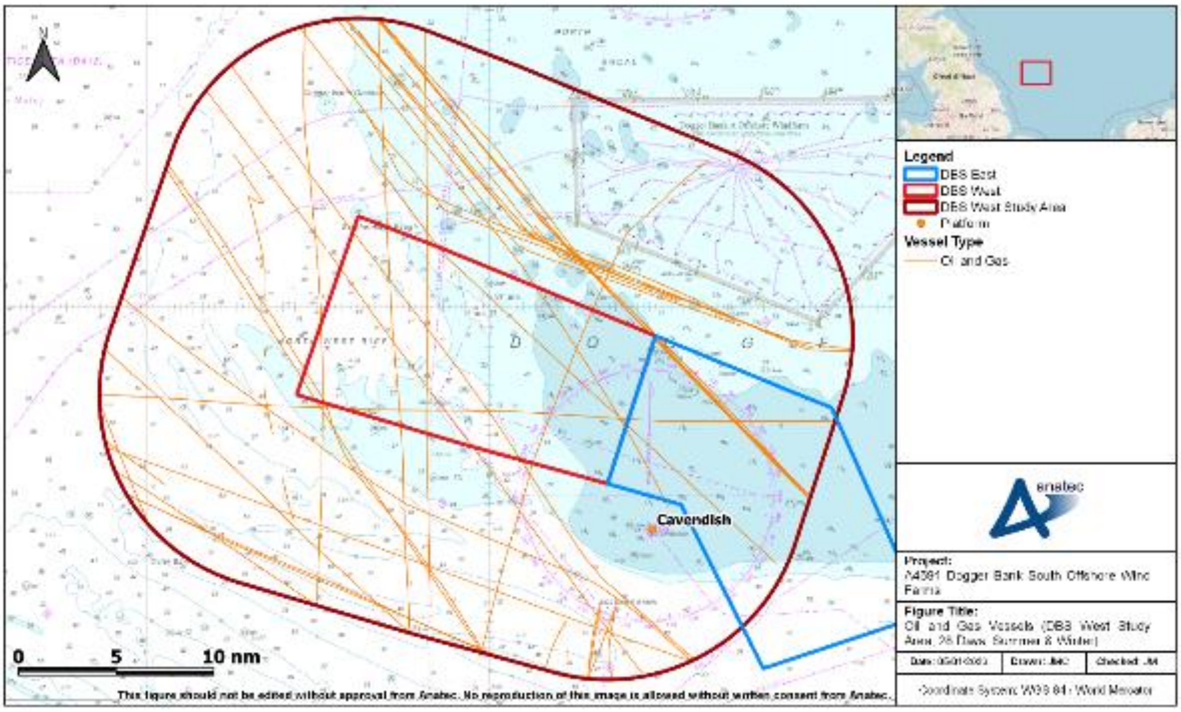



**Figure 9.15 Oil and Gas Vessels (DBS West Study Area, 28 Days, Summer and Winter)**

158. An average of between one and two oil and gas vessels per day was recorded within the DBS West study area during the 28-day period, and an average of one oil and gas vessel every two days was recorded within the DBS West array area. Destinations included Aberdeen, the Cygnus gas field (located within the DBS East study area) and the Southwark oil field. Again, transits to / from the Cygnus gas field were generally made north of the DBS array areas and south of Dogger Bank A.

### 9.1.6 Fishing Vessels

#### 9.1.6.1 DBS East Array Area

159. Figure 9.16 presents the fishing vessels recorded within the DBS East study area during the 28-day period, colour-coded by average vessel speed.

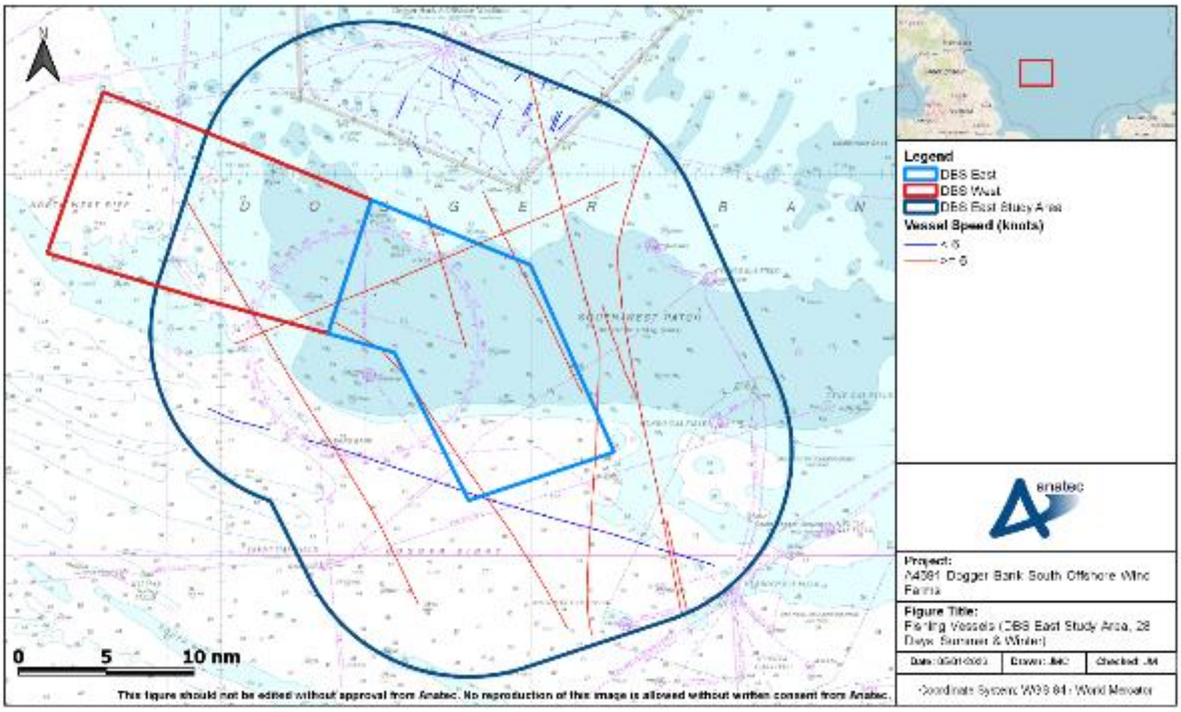



**Figure 9.16 Fishing Vessels by Speed (DBS East Study Area, 28 Days, Summer and Winter)**

160. An average of one fishing vessel per day was recorded within the DBS East study area during the 28-day period, and a fishing vessel was recorded intersecting the DBS East array area every four days.

161. Although some fishing vessels were clearly in transit (based on track behaviour and average speed), there were various sparse tracks recorded within Dogger Bank A from a vessel likely actively fishing during early July.

### 9.1.6.2 DBS West Array Area

162. Figure 9.17 presents the fishing vessels recorded within the DBS West study area during the 28-day period, colour-coded according to average vessel speed.

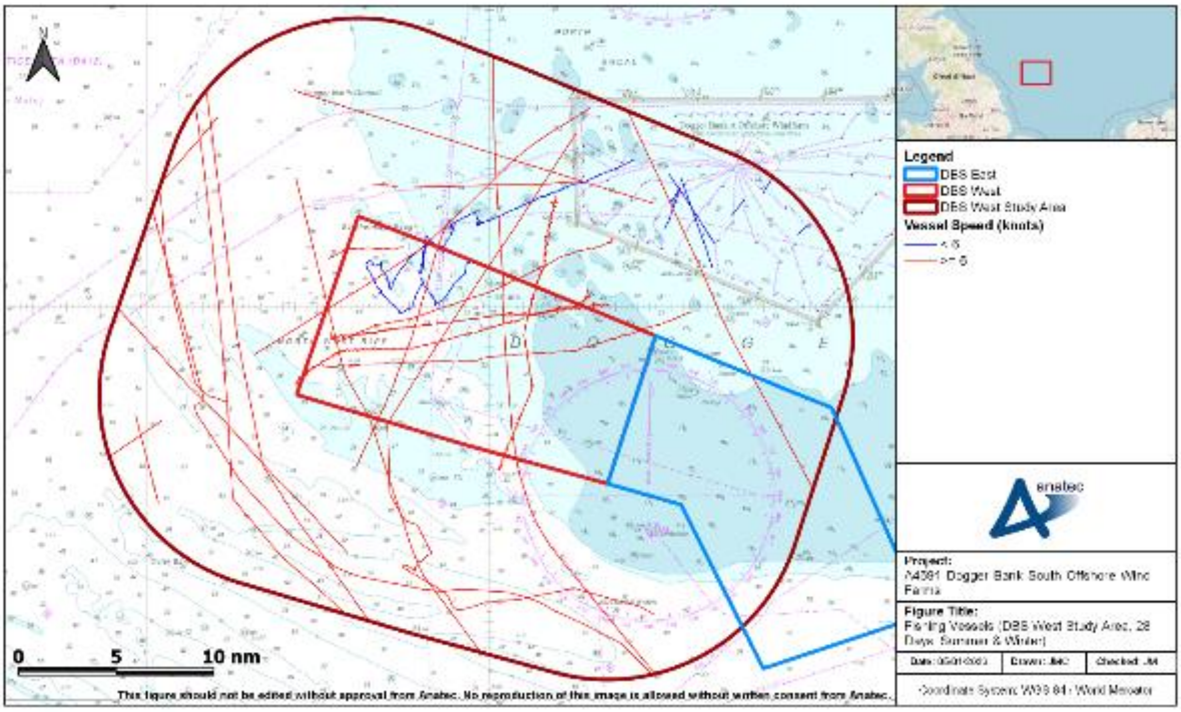



**Figure 9.17 Fishing Vessels by Speed (DBS West Study Area, 28 Days, Summer and Winter)**

163. An average of one fishing vessel per day was recorded within the DBS West study area during the 28-day period, and an average of one fishing vessel every two to three fishing vessels was recorded within the DBS West array area itself.

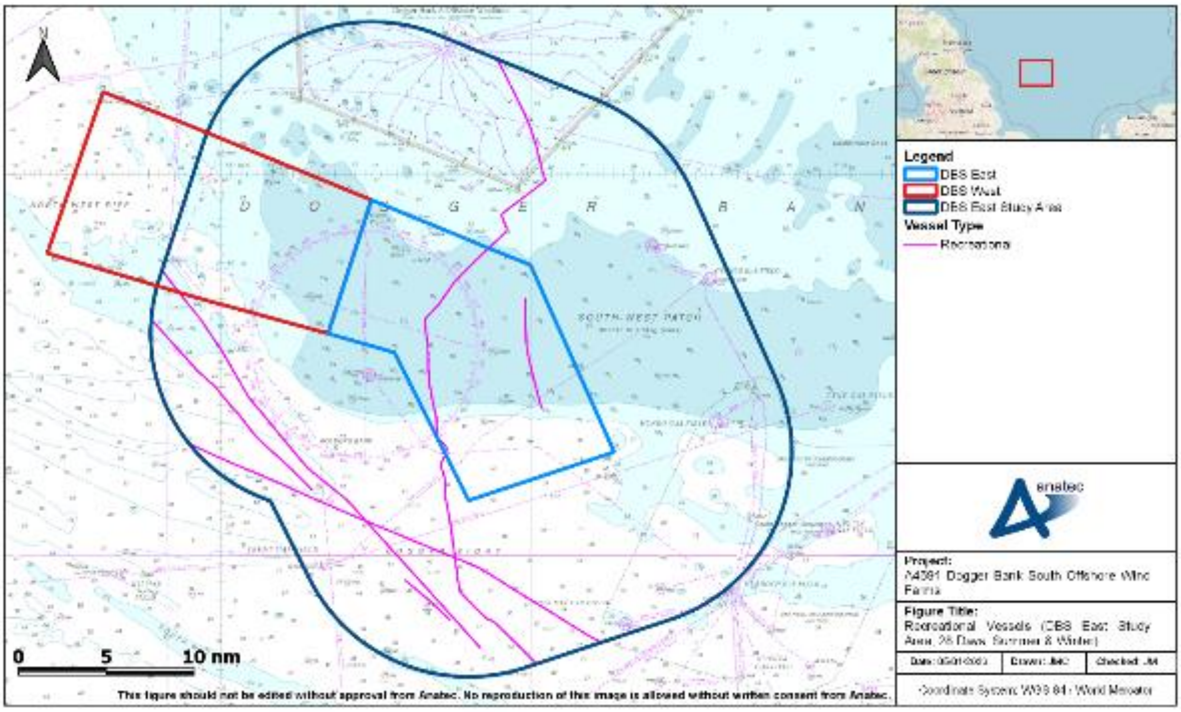
164. Fishing vessels were generally recorded transiting in a variety of directions. One fishing vessel was recorded at speeds suggestive of active fishing within the DBS West array area; this vessel was recorded on Radar. A fishing vessel was also recorded at speeds suggestive of active fishing within Dogger Bank A during early July.

165. The relatively low level of fishing vessel activity (across both DBS array areas) may be attributed to the distance offshore.

### 9.1.7 Recreational Vessels

#### 9.1.7.1 DBS East Array Area

166. Figure 9.18 presents the recreational vessels recorded within the DBS East study area during the 28-day period.

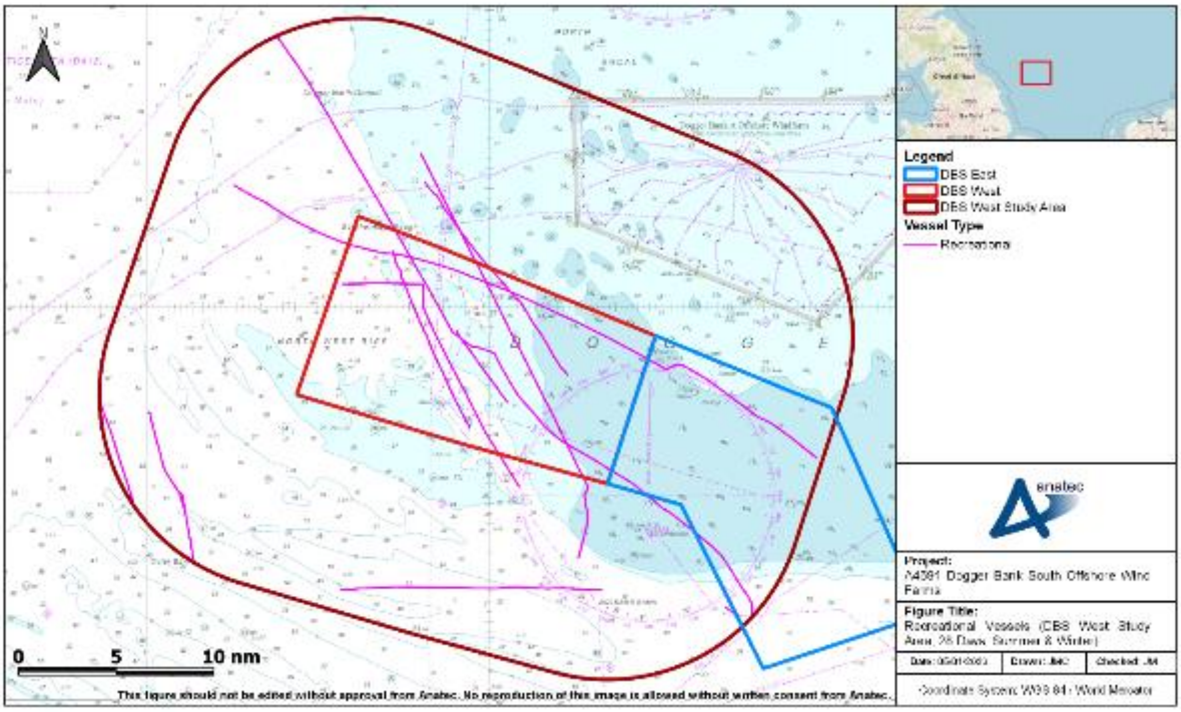



## Figure 9.18 Recreational Vessels (DBS East Study Area, 28 Days, Summer and Winter)

167. A recreational vessel was recorded within the DBS East study area every five to six days. Two of these vessels were recorded intersecting the DBS East array area itself.

### 9.1.7.2 DBS West Array Area

168. Figure 9.19 presents the recreational vessels recorded within the DBS West study area during the 28-day period.




### Figure 9.19 Recreational Vessels (DBS West Study Area, 28 Days, Summer and Winter)

169. A recreational vessel was recorded within the DBS West study area every two to three days. The DBS West array area itself was intersected eight times, with three of these intersections being recorded on Radar.

170. The relatively low level of recreational vessel activity (across both DBS array areas) may be attributed to the distance offshore.

## 9.1.8 Vessel Size

### 9.1.8.1 Vessel Length – DBS East Array Area

171. Vessel length was available for approximately 99% of vessels recorded throughout the two 14-day survey periods for the DBS East study area and ranged from 9m for a sailing vessel to 336m for a crude oil tanker. The distribution of vessel lengths recorded within the DBS East study area throughout each survey period is presented in Figure 9.20.

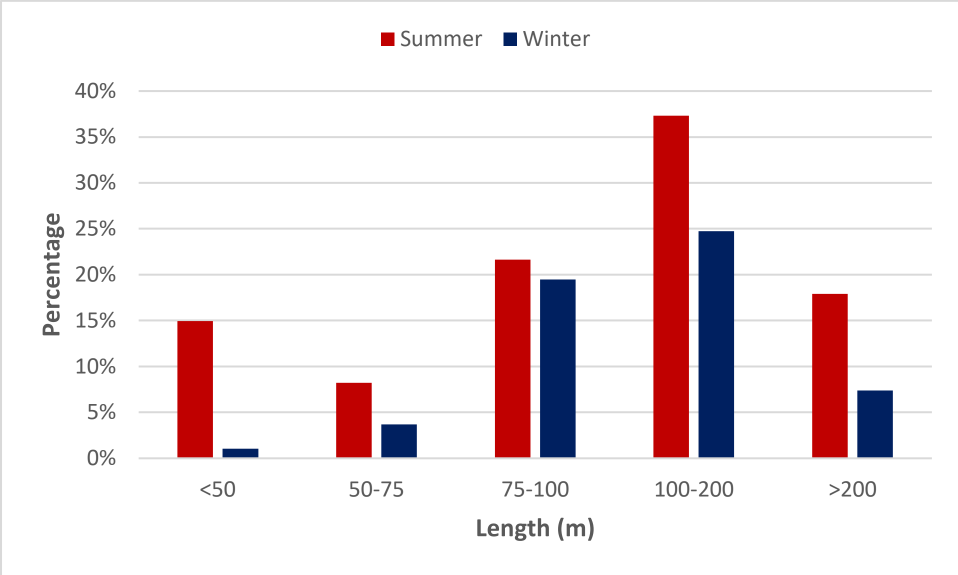



**Figure 9.20 Distribution of Vessel Lengths (DBS East Array Area)**

172. Excluding the proportion of vessels for which length was not available, the average length of vessels within the DBS East study area throughout the summer and winter survey periods was 119m and 110m respectively.

173. Figure 9.21 presents a plot of the vessel tracks recorded in the DBS East study area throughout the survey periods, colour-coded by vessel length.

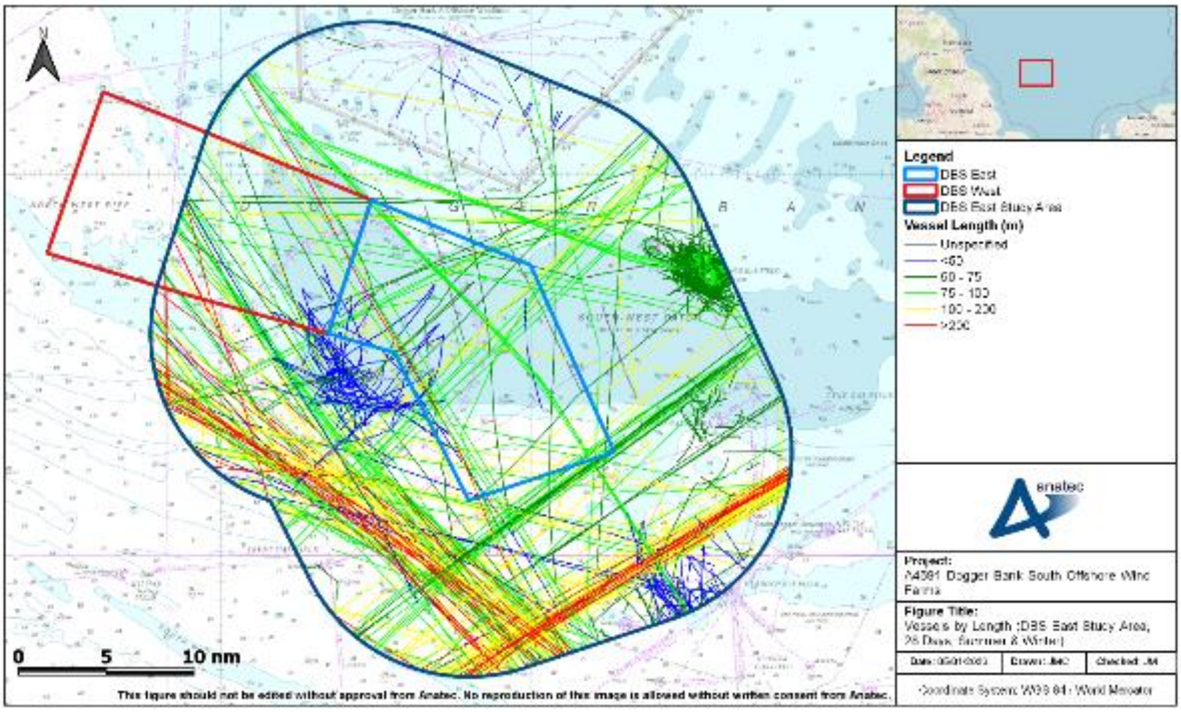



**Figure 9.21 Vessels by Length (DBS East Study Area, 28 Days, Summer and Winter)**

174. The vessels of smaller length were associated with oil and gas activities clustered around the platforms in the area, as well as the less frequently recorded fishing and recreational vessels. Vessels of larger length were typically tankers and the DFDS Seaways-operated RoRo cargo vessels transiting between Immingham and Gothenburg.

#### 9.1.8.2 Vessel Length – DBS West Array Area

175. Vessel length was available for approximately 94% of vessels recorded throughout the two 14-day survey periods for the DBS West study area and ranged from 11m for a sailing vessel to 300m for two container vessels. The distribution of vessel lengths recorded within the DBS West study area throughout each survey period is presented in Figure 9.22.

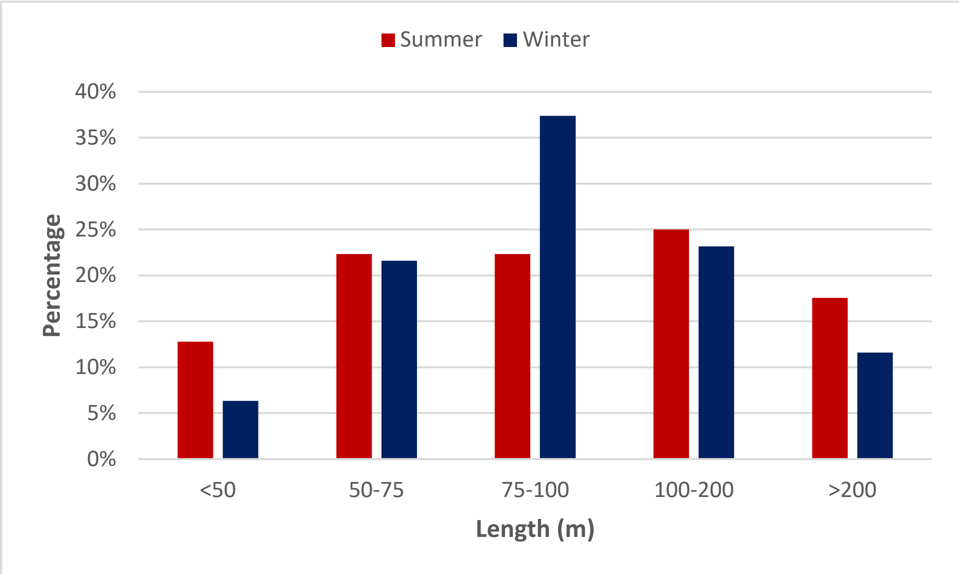
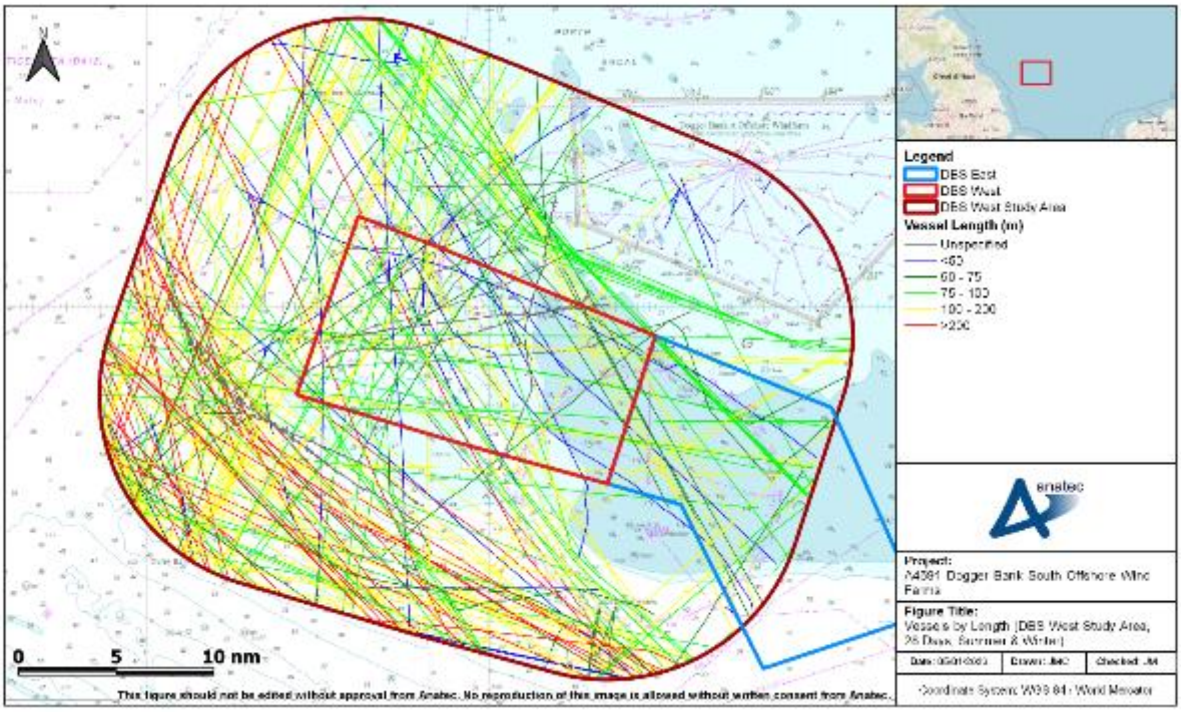



**Figure 9.22 Distribution of Vessel Lengths (DBS West Array Area)**

176. Excluding the proportion of vessels for which length was not available, the average length of vessels within the DBS West study area throughout the summer and winter survey periods was 124m and 128m respectively.

177. Figure 9.23 presents a plot of the vessel tracks recorded in the DBS West study area throughout the survey periods, colour-coded by vessel length.




### Figure 9.23 Vessels by Length (DBS West Study Area, 28 Days, Summer and Winter)

178. Vessels of smaller length were recorded as being the oil and gas vessels and fishing vessels transiting within the DBS study area, whilst the vessels of greater length were cargo vessels and tankers.

### 9.1.8.3 Vessel Draught – DBS East Array Area

179. Vessel draught was available for approximately 84% of vessels recorded throughout the two 14-day survey periods for DBS East study area and ranged from 2.4m for two wind farm vessels and 13.8m for a bulk carrier. The distribution of vessel draughts recorded within the DBS East study area throughout each survey period is presented in Figure 9.24.

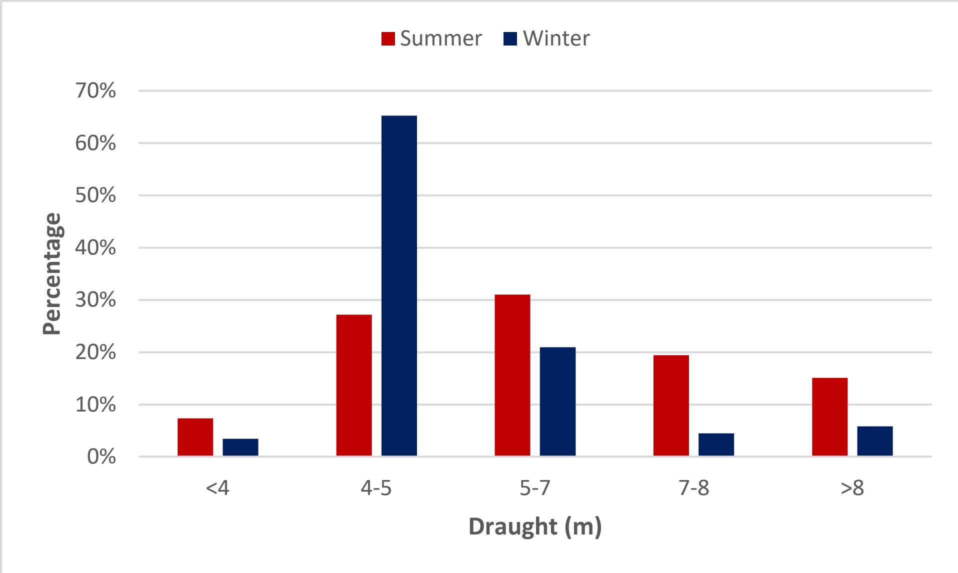



**Figure 9.24 Distribution of Vessel Draughts (DBS East Array Area)**

180. Excluding the proportion of vessels for which draught data were not available, the average draught of vessels within the DBS East study area throughout the summer and winter survey periods was 6.1m and 5.3m respectively.

181. Figure 9.25 presents a plot of the vessel tracks recorded in the DBS East study area throughout the survey periods, colour-coded by vessel draught.

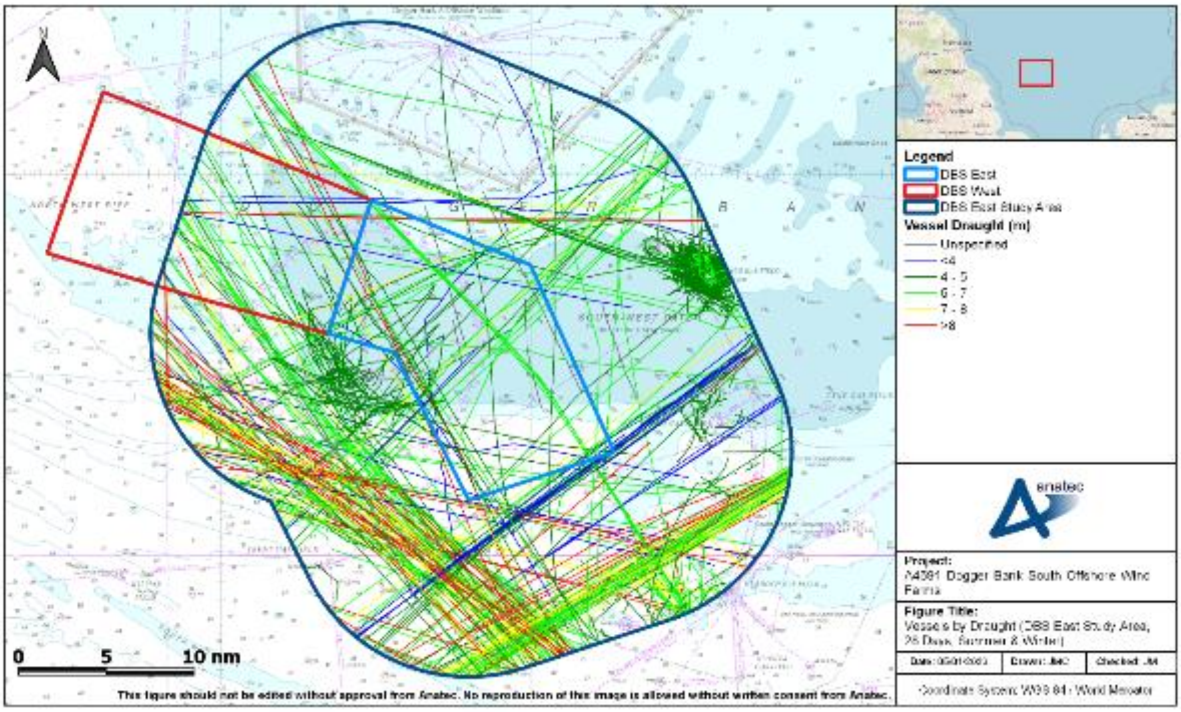



**Figure 9.25 Vessels by Draught (DBS East Study Area, 28 Days, Summer and Winter)**

182. Similarly to vessel length, the vessels of shallower draught were associated with oil and gas, fishing, and recreational vessels, with one smaller cargo vessel regularly routeing directly to the south of the DBS array area. Vessels of larger draught were typically tankers.

#### 9.1.8.4 Vessel Draught – DBS West Array Area

183. Vessel draught was available for approximately 86% of vessels recorded throughout the two 14-day survey periods for DBS West study area and ranged from 2.5m for a wind farm to 14.6m for a shuttle tanker. The distribution of vessel draughts recorded within the DBS West study area throughout each survey period is presented in Figure 9.26.

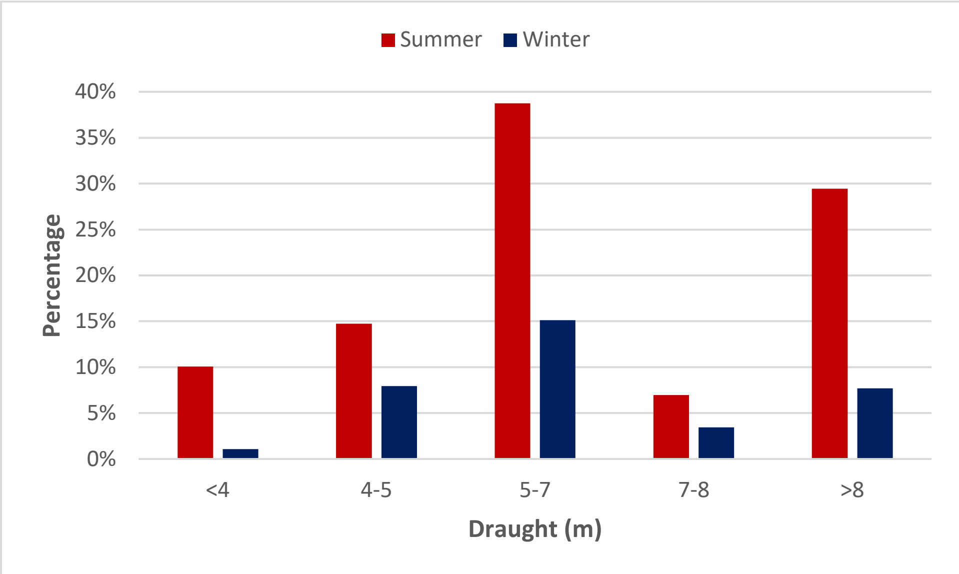



**Figure 9.26 Distribution of Vessel Draughts (DBS West Array Area)**

184. Excluding the proportion of vessels for which draught data were not available, the average draught of vessels within the DBS West study area throughout the summer and winter survey periods was 6.7m for both.

185. Figure 9.27 presents a plot of the vessel tracks recorded in the DBS West study area throughout the survey periods, colour-coded by vessel draught.

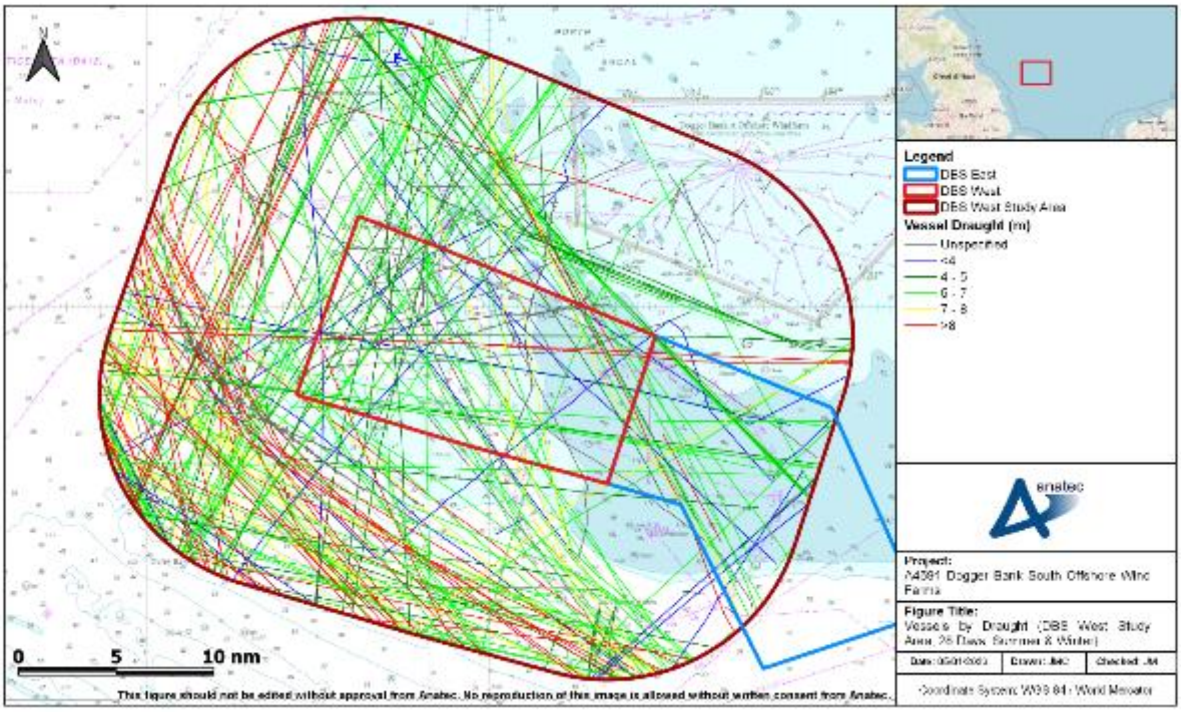


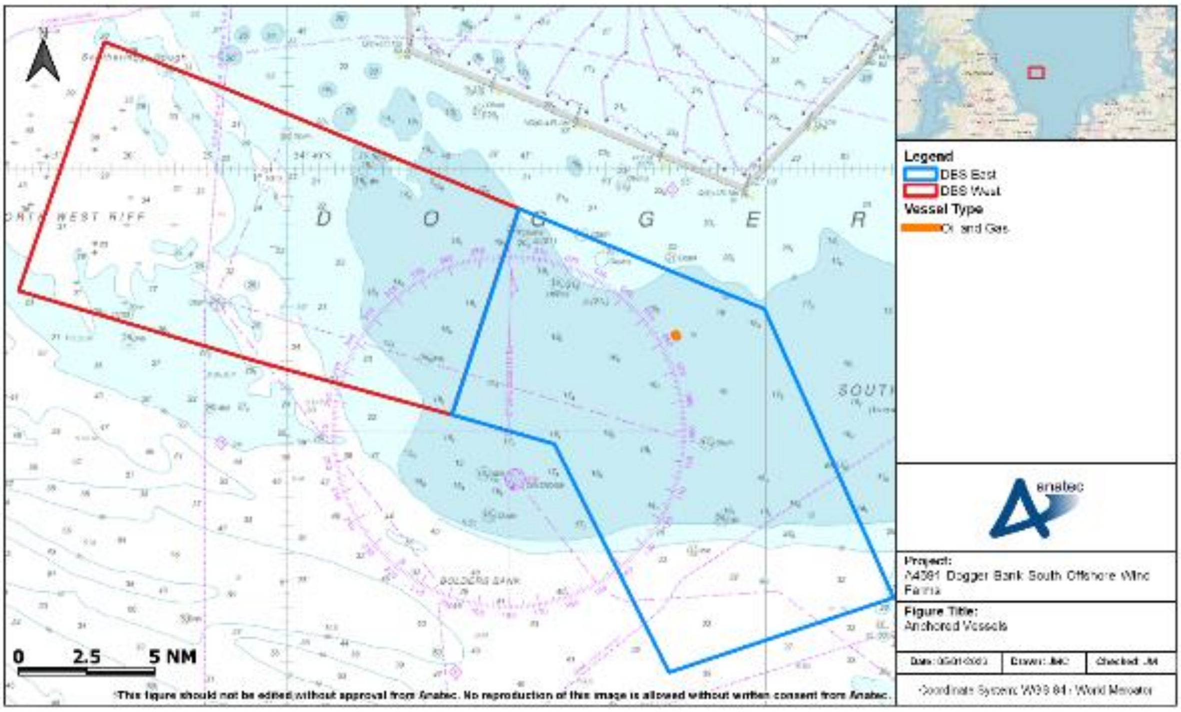

**Figure 9.27 Vessels by Draught (DBS West Study Area, 28 Days, Summer and Winter)**

186. As with vessel length, vessels of shallower draught were recorded as being the oil and gas vessels and fishing vessels transiting within the DBS study area, whilst the vessels of greater draught were cargo vessels and tankers.

### 9.1.9 Anchored Vessels

187. Vessels broadcast their navigation status via AIS, including whether they are at anchor. Any vessels broadcasting their status as "*at anchor*" were identified. However, navigation status is not always up to date since it relies on the officer of the watch. Therefore, the AIS tracks from vessels broadcasting their status as "*at anchor*" were manually inspected to confirm or deny anchoring activity. Additionally, AIS tracks from vessels which transmitted a navigation status other than "*at anchor*" were used as input to Anatec's Speed Analysis model. This program detects any tracks of vessels that were travelling with speeds less than one knot (kt) for a minimum of 30 minutes. The output is then manually reviewed to check for any additional anchored vessels.

188. One vessel recorded on AIS was deemed as being at anchor across the 28-day periods for the DBS array study areas, based on track behaviour and navigation status. This was an oil and gas vessel and was recorded within the DBS East array area. The tracks of this vessel are shown in Figure 9.28.




### Figure 9.28 Anchored Vessel

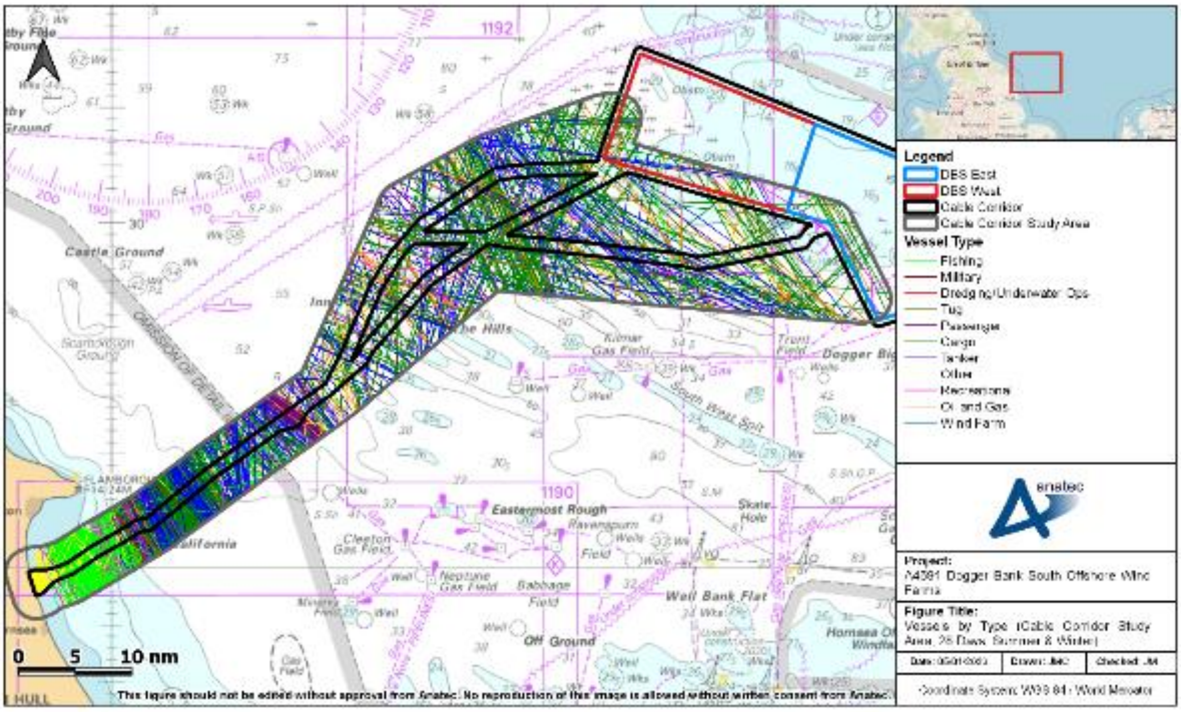
189. The vessel was recorded during the winter period and with the behaviour characteristic of anchoring activity occurring over a 12-hour period.

## 9.2 Offshore Export Cable Corridor

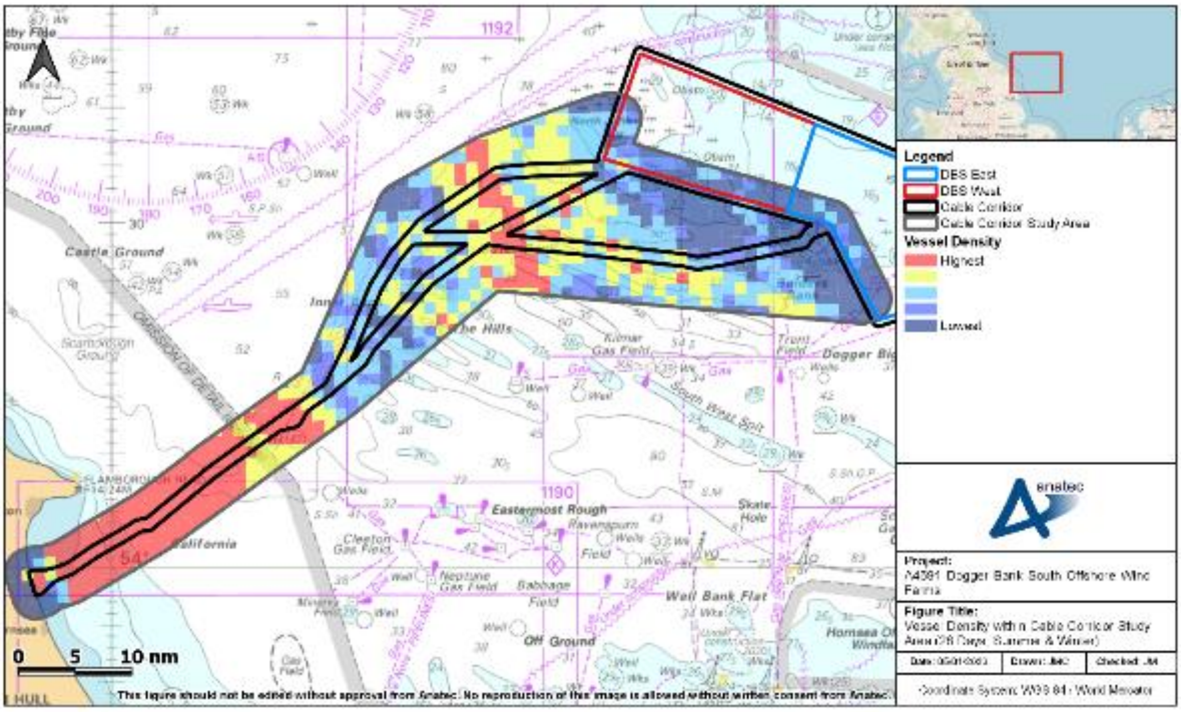
190. This section provides a general overview of vessel traffic within the offshore export cable corridor study area, with more detailed analysis of each of the main vessel types presented in Sections 9.2.3 to 9.2.8.

191. Figure 9.29 presents the tracks of vessels recorded within the offshore export cable corridor study area during the 28-day period, colour-coded by vessel type, followed by a vessel density heat map[3] of the same data.

[3] To ensure contrasts in vessel density are suitably illustrated, the scale used for the vessel density heat map of the offshore export cable corridor study area is specific to the vessel traffic data and does not match that used for the vessel density heat maps associated with the DBS array areas.




## Figure 9.29 Vessels by Type (Offshore Export Cable Corridor Study Area, 28 Days, Summer and Winter)




## Figure 9.30 Vessel Density (Offshore Export Cable Corridor Study Area, 28 Days, Summer and Winter)

192. Traffic of relatively high density is mainly located within 30nm of the coast; this traffic mainly consisted of fishing vessels within 9nm of the coast, with the high density traffic further offshore mainly being composed of commercial vessels routeing along the UK east coast. Two particularly high density areas for commercial vessels are noted – a route featuring passenger vessels crossing the offshore export cable corridor approximately 27nm from the landfall and a route featuring mainly cargo vessels passing in a north-west / south-east direction.

### 9.2.1 Vessel Count

193. This section presents an overview of vessel counts within the offshore export cable corridor study area during the survey periods. It is noted that throughout this subsection, only unique vessels are counted for each day to prevent overcounting in cases where a vessel may have been dropped and reacquired.

194. For the 28-day period, an average of 50 unique vessels per day was recorded within the offshore export cable corridor study area while an average of 47 unique vessels per day was recorded intersecting the offshore export cable corridor itself.

195. Figure 9.31 presents the daily counts of vessels recorded within the offshore export cable corridor study area and the offshore export cable corridor itself during the 28-day period. Approximately 95% of vessels recorded within the offshore export cable corridor study area were also recorded within the offshore export cable corridor itself.

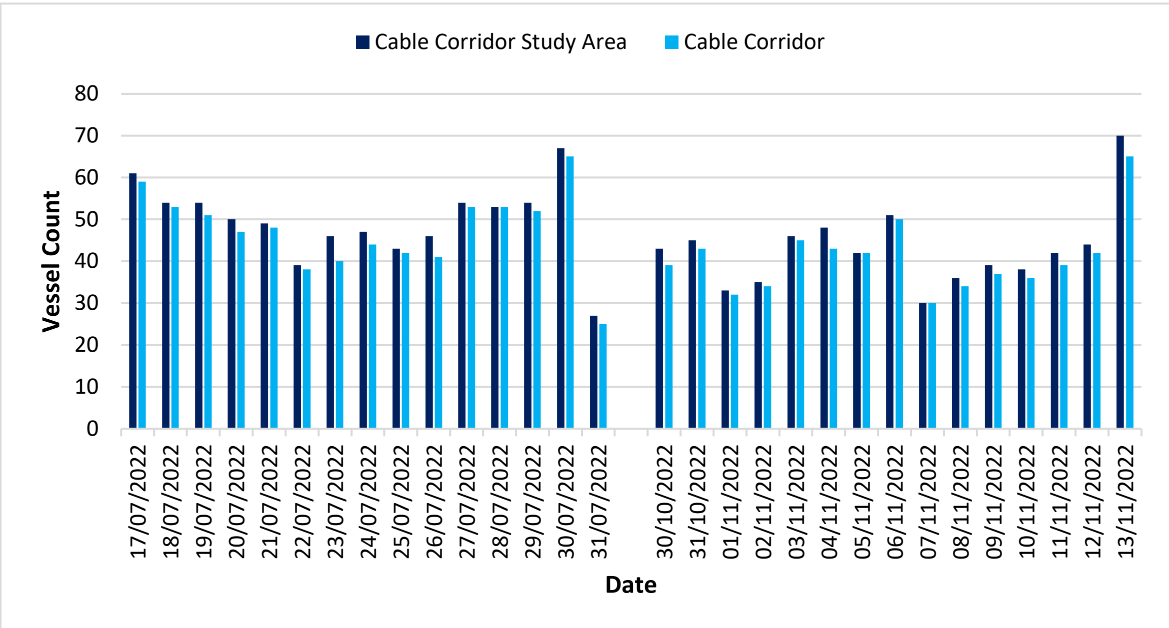



**Figure 9.31 Vessel Counts per Day within Offshore Export Cable Corridor Study Area**

196. The busiest day within the offshore export cable corridor study area during the 28-day period was the 30th July, during which 67 unique vessels were recorded. The

quietest full day was the 7th November, during which 30 unique vessels were recorded.

### 9.2.2 Vessel Type

197. This section presents analysis of the main vessel types recorded within and in proximity to the offshore export cable corridor, with more detailed analysis on each individual vessel type being presented in Sections 9.2.3 to 9.2.8.

198. The distribution of the main vessel types recorded within the offshore export cable corridor study area, as well as intersecting the offshore export cable corridor itself during the 28-day period is presented in Figure 9.32.

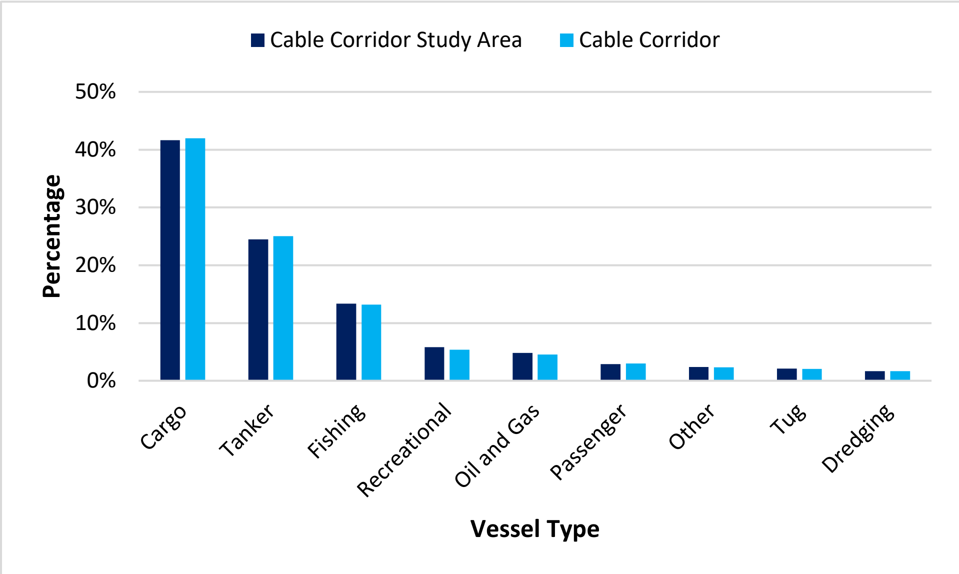



**Figure 9.32 Distribution of Vessel Types (Offshore Export Cable Corridor, 28 Days, Summer and Winter)**

199. The main type of vessel recorded within the offshore export cable corridor study area was cargo, accounting for 42% of the traffic. The next most common vessel type within the offshore export cable corridor study area was tankers, accounting for 24% of the traffic. This was then followed by fishing vessels (13%), recreational vessels (6%), oil and gas vessels (5%) and passenger vessels (3%). These proportions were generally the same for the traffic within the offshore export cable corridor itself given that the majority of traffic crosses the offshore export cable corridor.

### 9.2.3 Cargo Vessels

200. Figure 9.33 presents the cargo vessels recorded within the offshore export cable corridor study area during the 28-day period.

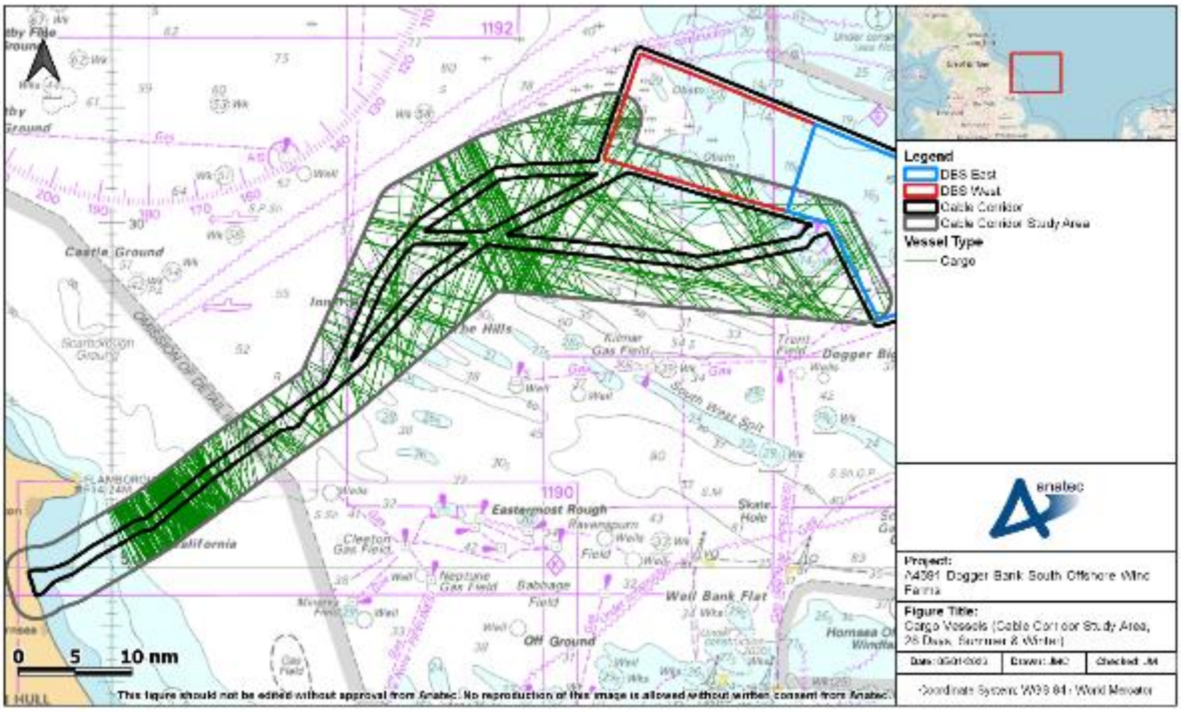



**Figure 9.33 Cargo Vessels (Offshore Export Cable Corridor Study Area, 28 Days, Summer and Winter)**

201. An average of between 20 and 21 cargo vessels per day was recorded within the offshore export cable corridor study area during the 28-day period, with an average of 20 per day within the offshore export cable corridor itself.

202. A large proportion of cargo vessel traffic was concentrated within 21nm of the landfall, engaged in south-east / north-west transit between UK ports and Belgian or Dutch ports. A prominent south-east / north-west cargo vessel route further offshore was also recorded, with destinations including UK ports, Dutch ports and Icelandic ports.

### 9.2.4 Tankers

203. Figure 9.34 presents the tankers recorded within the offshore export cable corridor study area during the 28-day period.

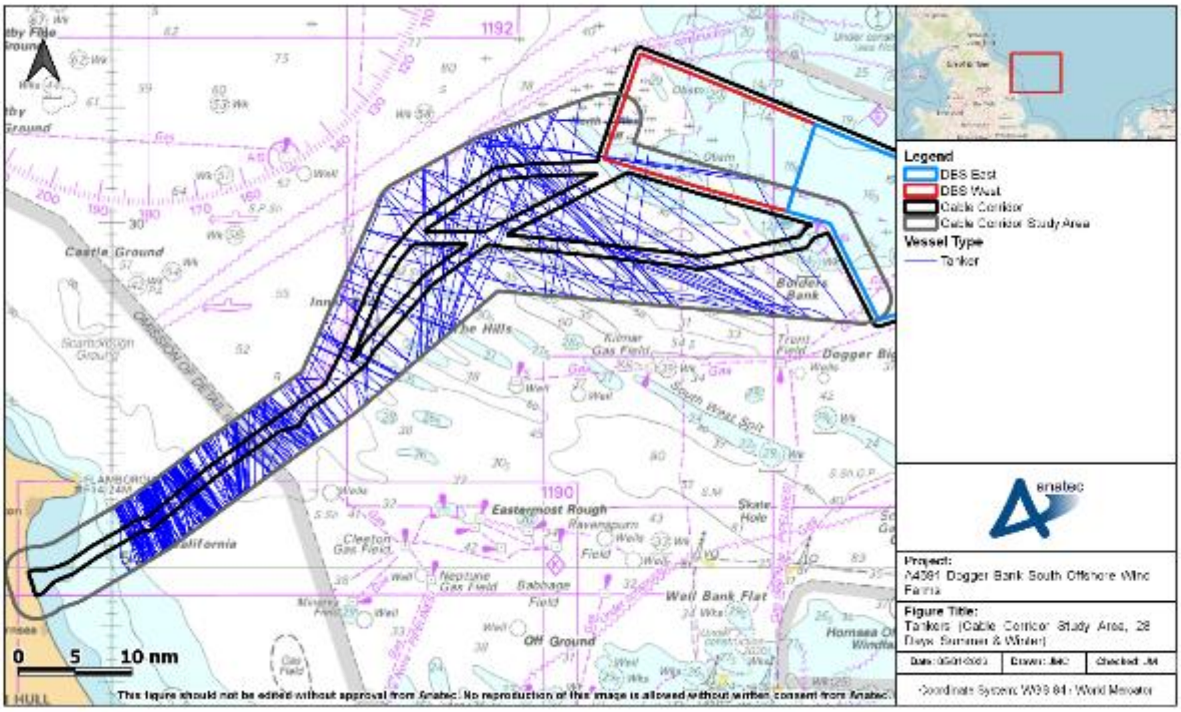



**Figure 9.34 Tankers (Offshore Export Cable Corridor Study Area, 28 Days, Summer and Winter)**

204. An average of 12 unique tankers per day was recorded within the offshore export cable corridor study area during the 28-day period, with almost all of these tankers also intersecting the offshore export cable corridor itself.

205. The majority of tanker traffic was recorded within 30nm of the landfall; these tankers were engaged in north-west / south-east transit with destinations mainly including UK ports and Dutch ports.

### 9.2.5 Passenger Vessels

206. Figure 9.35 presents the passenger vessels recorded within the offshore export cable corridor study area during the 28-day period.

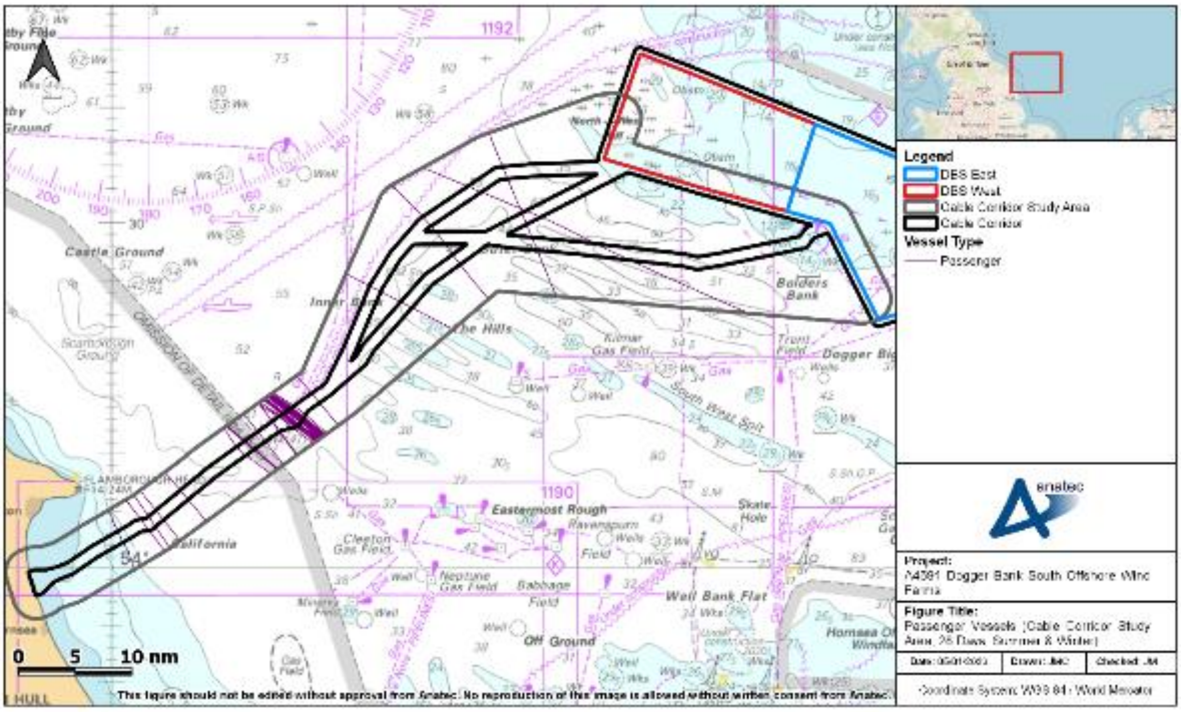



**Figure 9.35 Passenger Vessels (Offshore Export Cable Corridor Study Area, 28 Days, Summer and Winter)**

207. An average of between one and two passenger vessels per day was recorded within the offshore export cable corridor study area, with each of these vessels also being recorded within the offshore export cable corridor itself.

208. The majority of these vessels were recorded in north-west / south-east transit 27nm from the landfall. This traffic was composed of two Roll-on / Roll-off Passenger (RoPax) vessels operated by DFDS Seaways, navigating a twice daily route between North Shields (UK) and Ijmuiden (the Netherlands).

### 9.2.6 Fishing Vessels

209. Figure 9.36 presents the fishing vessels recorded within the offshore export cable corridor study area during the 28-day period, colour-coded by average vessel speed.

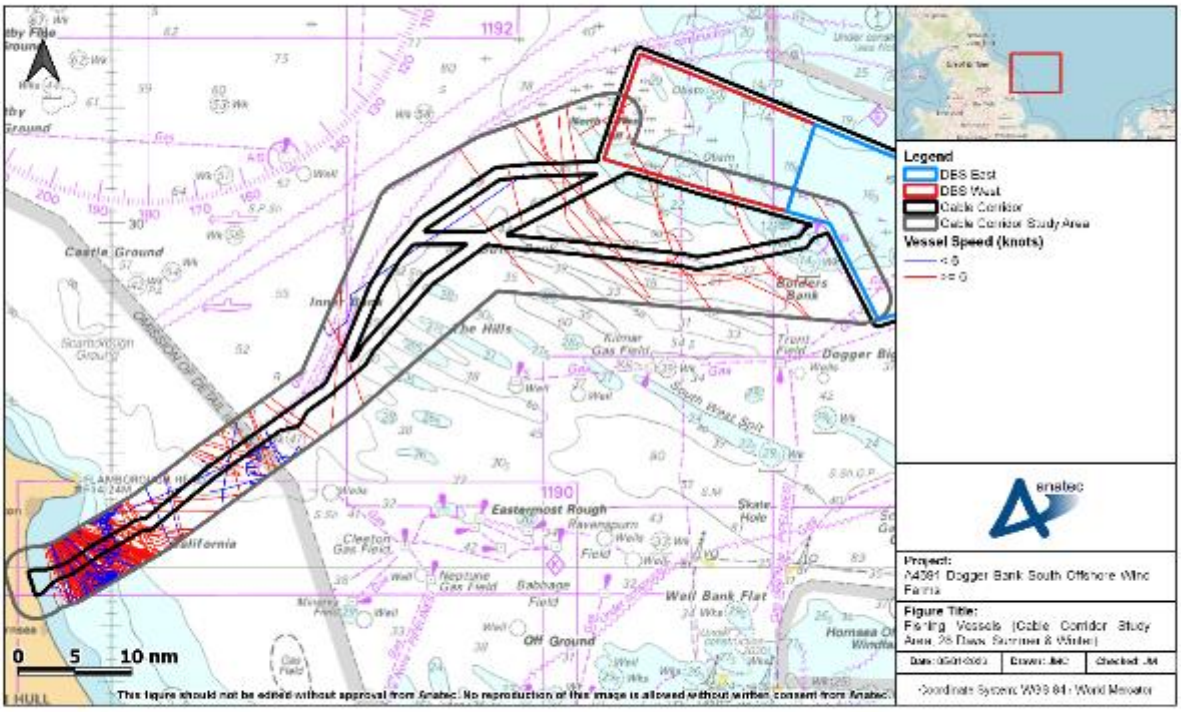



**Figure 9.36 Fishing Vessels by Speed (Offshore Export Cable Corridor Study Area, 28 Days, Summer and Winter)**

210. An average of between six and seven fishing vessels per day was recorded within the offshore export cable corridor study area, with a similar level of traffic being recorded within the offshore export cable corridor itself.

211. The large majority of fishing vessel traffic was recorded within 9nm of the landfall, engaged in north-west / south-east transit. Behaviour suggestive of active fishing was also recorded within this region, displayed by three fishing vessels, including within the offshore export cable corridor itself.

### 9.2.7 Oil and Gas Vessels

212. Figure 9.37 presents the oil and gas vessels recorded within the offshore export cable corridor study area during the 28-day period.

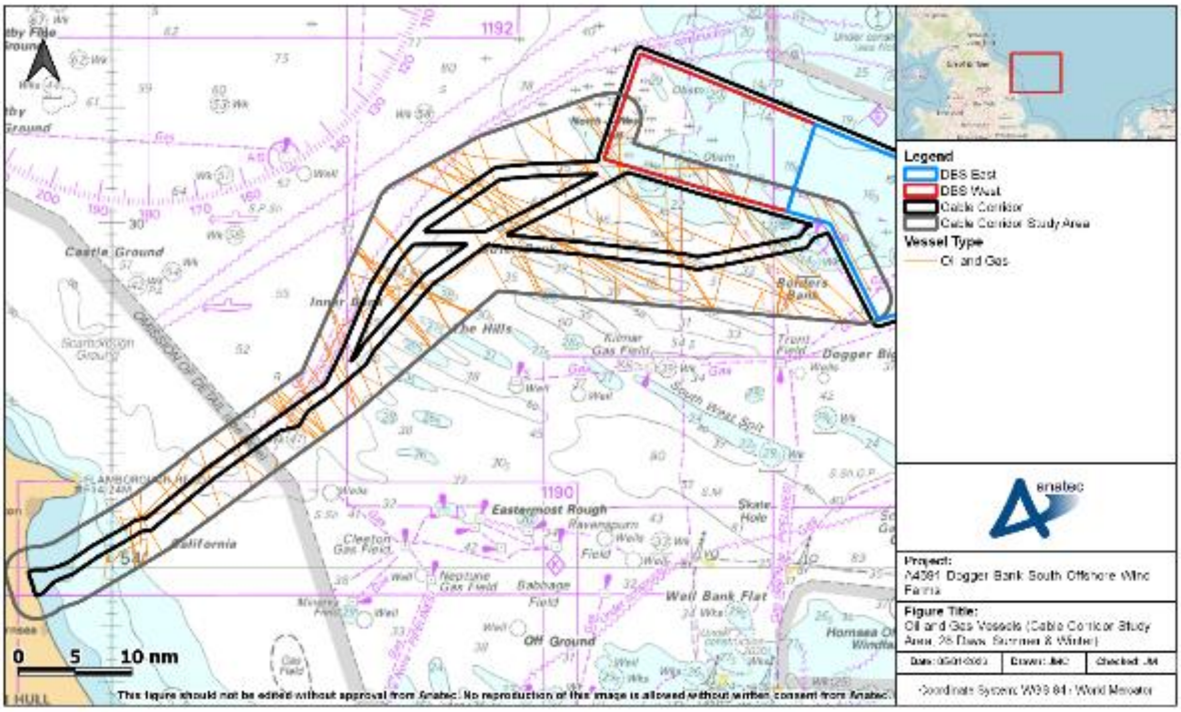



**Figure 9.37 Oil and Gas Vessels (Offshore Export Cable Corridor Study Area, 28 Days, Summer and Winter)**

213. An average of between two and three oil and gas vessels per day were recorded within the offshore export cable corridor study area during the 28-day period, with a similar level of traffic being recorded within the offshore export cable corridor itself.

214. The traffic was distributed throughout the offshore export cable corridor study area and was mostly in north-west / south-east transit.

### 9.2.8 Recreational Vessels

215. Figure 9.38 presents the recreational vessels recorded within the offshore export cable corridor study area during the 28-day period.

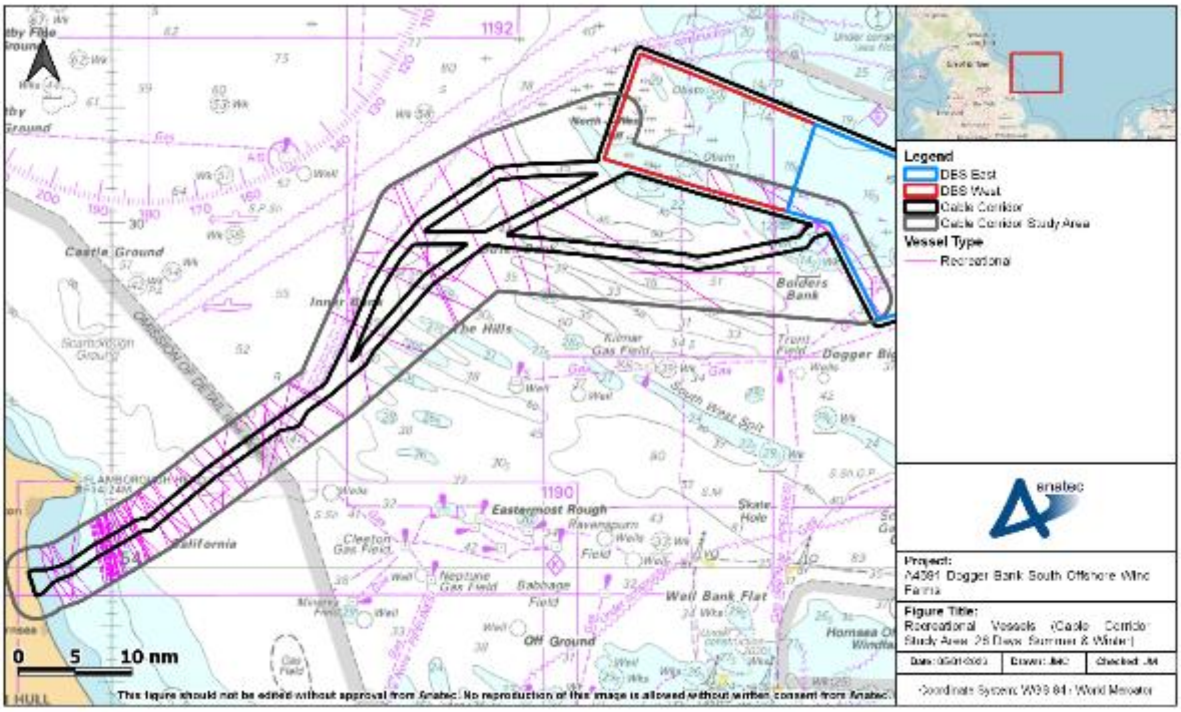



**Figure 9.38 Recreational Vessels (Offshore Export Cable Corridor Study Area, 28 Days, Summer and Winter)**

216. An average of three recreational vessels per day was recorded within the offshore export cable corridor study area during the 28-day period, with two to three vessels being recorded within the offshore export cable corridor itself.

217. The majority of traffic was recorded within 12nm of landfall, undertaking north-west / south-east transits.

### 9.2.9 Vessel Size

#### 9.2.9.1 Vessel Length

218. Vessel length was available for over 99% of vessels recorded throughout the two 14-day survey periods and ranged from 8m for an RNLI lifeboat to 333m for a crude oil tanker. The distribution of vessel lengths recorded within the DBS East study area throughout each survey period is presented in Figure 9.39.

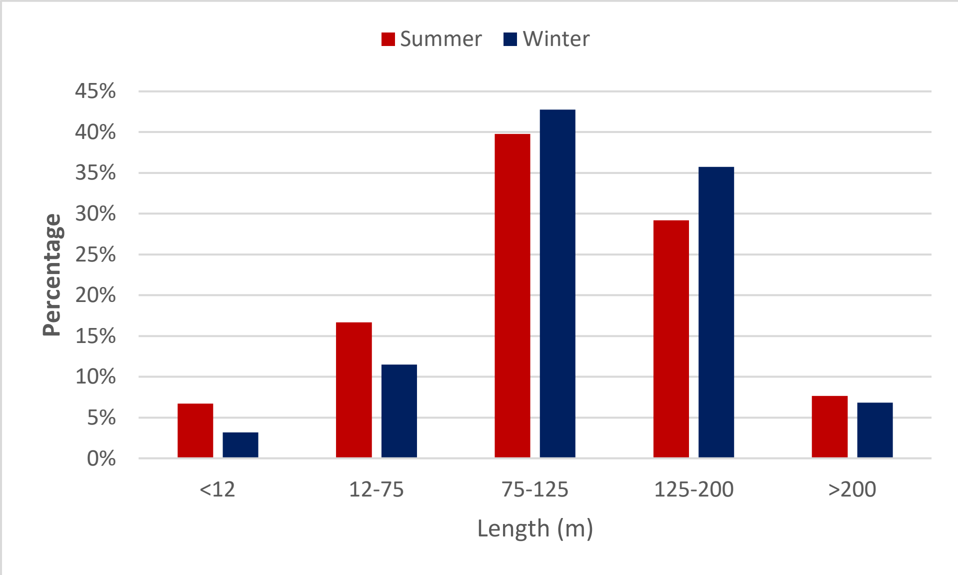



**Figure 9.39 Distribution of Vessel Lengths (Offshore Export Cable Corridor)**

219. Excluding the proportion of vessels for which length was not available, the average length of vessels within the offshore export cable corridor study area throughout the summer and winter survey periods was 100m and 113m respectively.

220. Figure 9.40 presents a plot of the vessel tracks recorded in the offshore export cable corridor study area throughout the survey periods, colour-coded by vessel length.

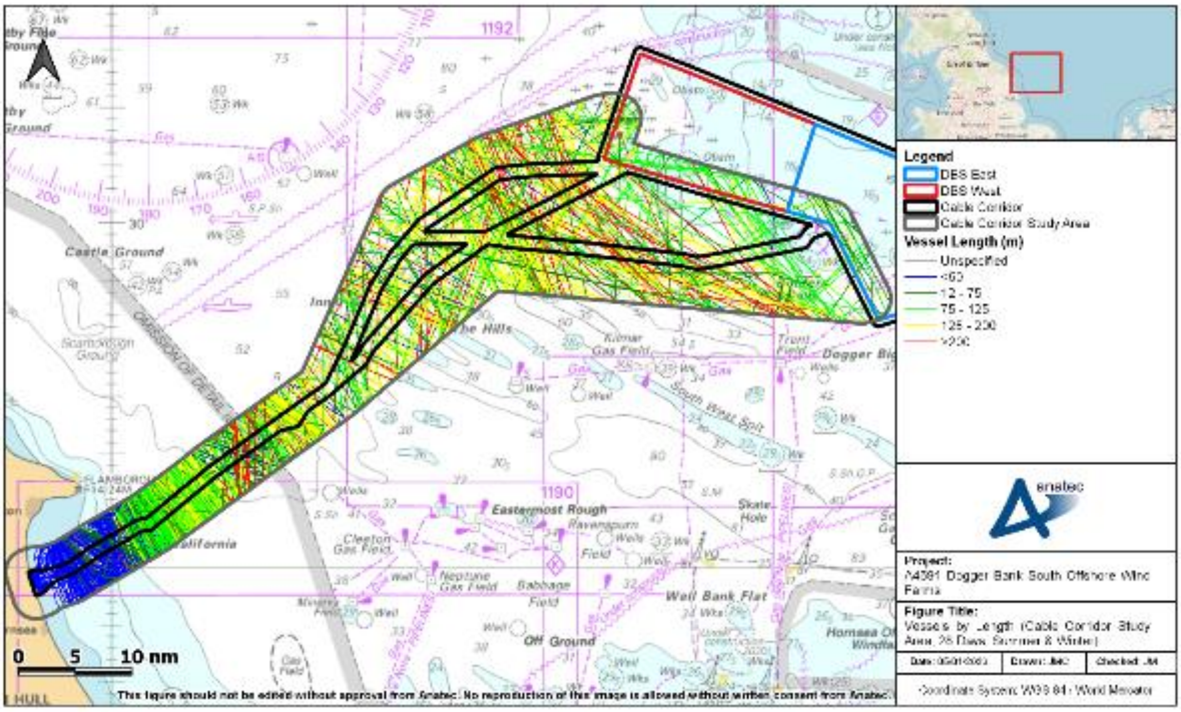



**Figure 9.40 Vessels by Length (Offshore Export Cable Corridor Study Area, 28 Days, Summer and Winter)**

221. Vessels of smaller length were recorded close to shore and were primarily composed of fishing and recreational vessels. Larger commercial vessels were recorded further offshore.

### 9.2.9.2 Vessel Draught

222. Vessel draught was available for approximately 78% of vessels recorded throughout the two 14-day survey periods and ranged from 1.0m for charter vessel and 19.5m for a crude oil carrier. The distribution of vessel draughts recorded within the DBS East study area throughout each survey period is presented in Figure 9.41.

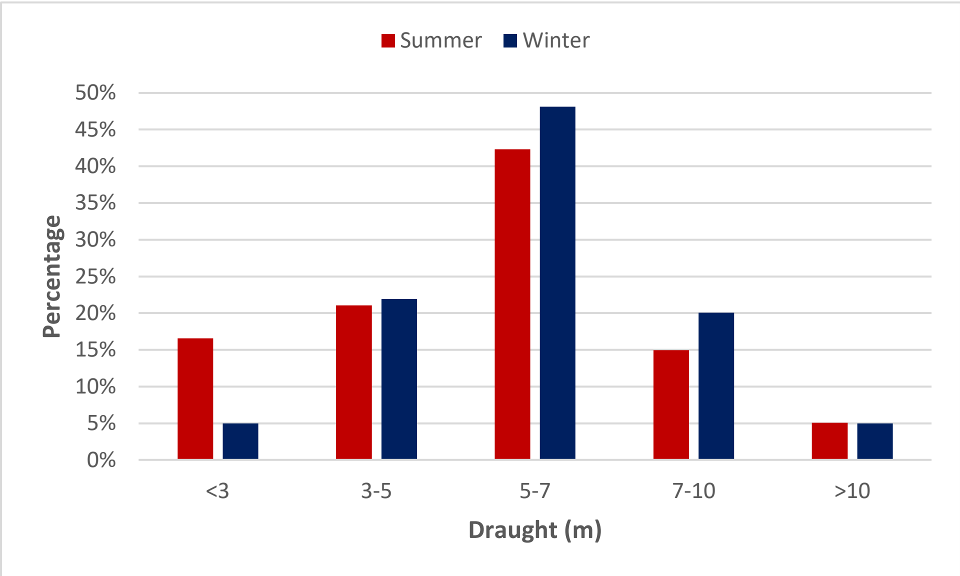



**Figure 9.41 Distribution of Vessel Draughts (Offshore Export Cable Corridor)**

223. Excluding the proportion of vessels for which draught was not available, the average draught of vessels within the offshore export cable corridor study area throughout the summer and winter survey periods was 5.6m and 6.2m respectively.

224. Figure 9.25 presents a plot of the vessel tracks recorded in the offshore export cable corridor study area throughout the survey periods, colour-coded by vessel draught.

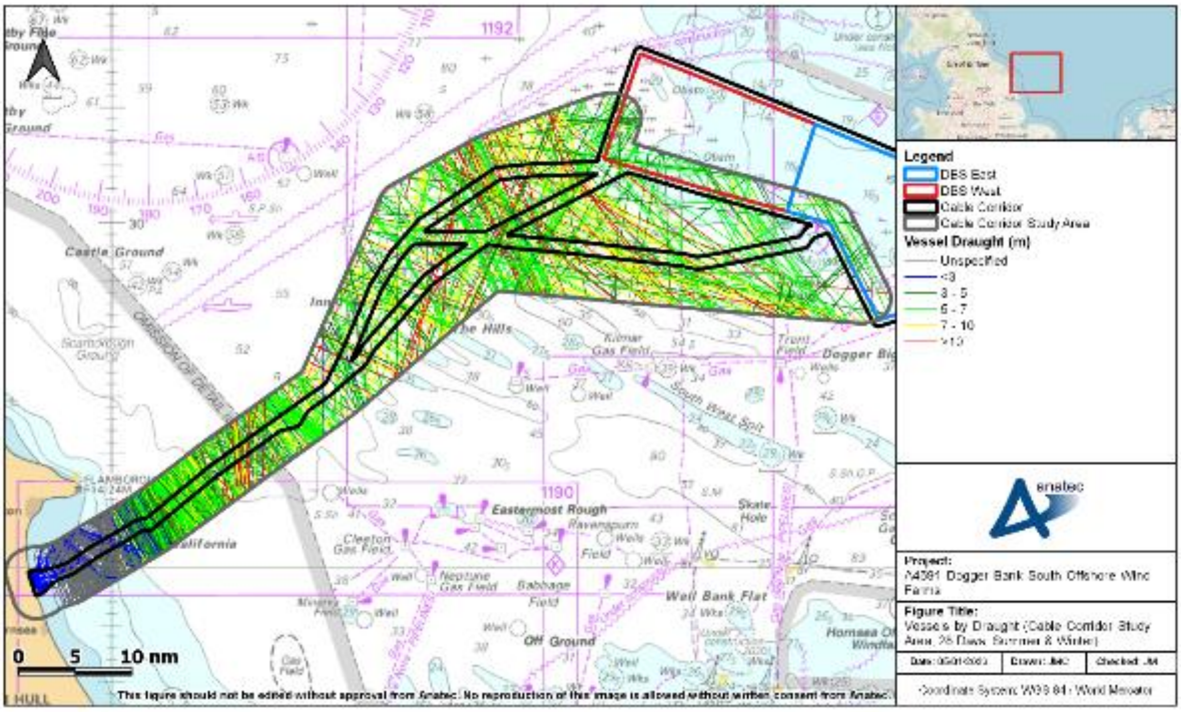


**Figure 9.42 Vessels by Draught (Offshore Export Cable Corridor Study Area, 28 Days, Summer and Winter)**

225. Similarly to vessel length, vessels of shallower draught were recorded close to shore and were primarily composed of fishing and recreational vessels, with larger commercial vessels recorded further offshore.

### 9.2.10 Anchored Vessels

226. The same criteria as outlined for the array areas has been used to identify anchored vessels within the offshore export cable corridor study area.

227. One vessel recorded on AIS was deemed as being at anchor during the 28-day period, based on its track behaviour and navigation status. This was a cargo vessel recorded 3.2nm south of the offshore export cable corridor in The Hills (a series of banks) with the behaviour characteristic of anchoring activity occurring over the course of six days.

# 10 Base Case Vessel Routeing

## 10.1 Definition of a Main Commercial Route

228. Main commercial routes have been identified using the principles set out in MGN 654 (MCA, 2021). Vessel traffic data are assessed and vessels transiting at similar headings and locations are identified as a main route. To help identify main routes, vessel traffic data is also interrogated to show vessels (by name and / or operator) that frequently transit those routes. The route width is then calculated using the 90$^{th}$ percentile rule from the mean position of the potential shipping route as shown in Figure 10.1.

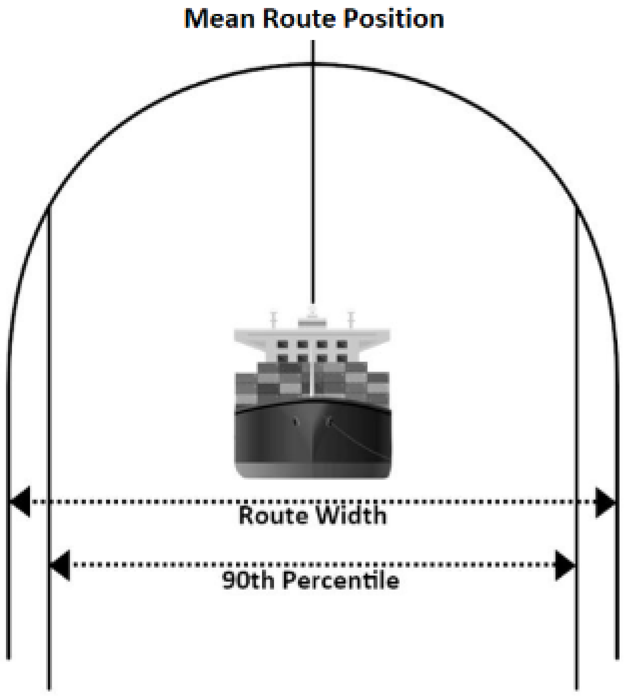
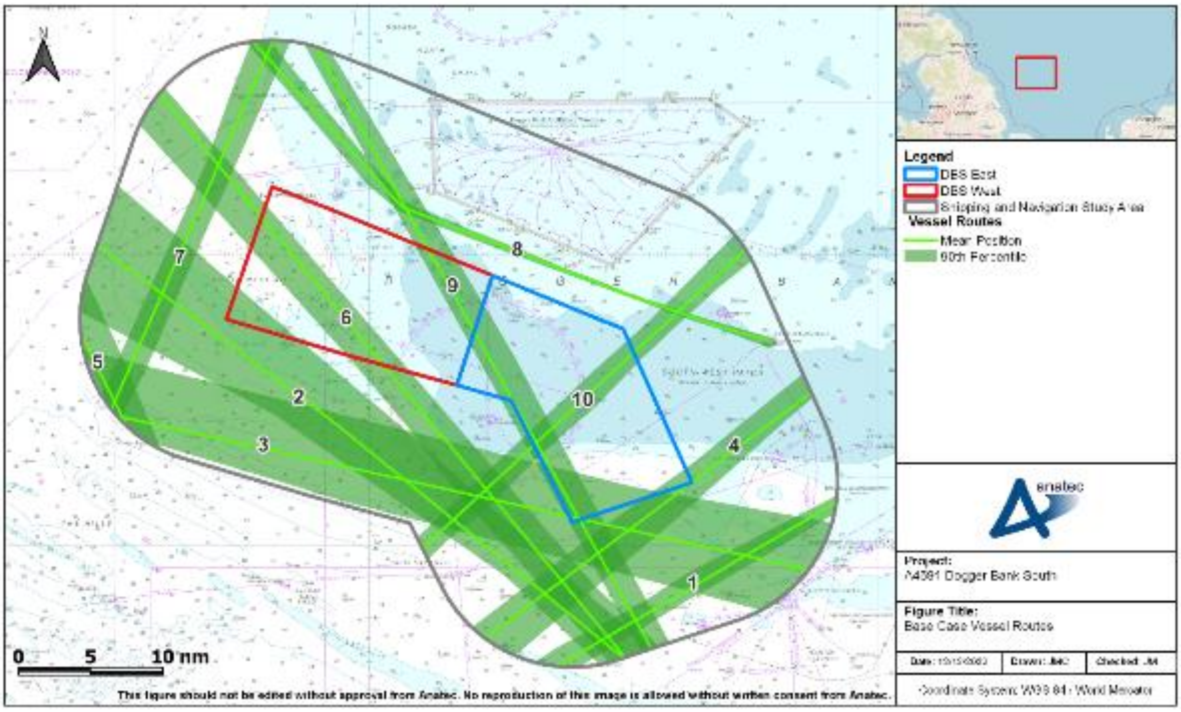



**Figure 10.1 Illustration of Main Route Calculation**

## 10.2 Pre Wind Farm Main Commercial Routes

229. A total of ten main commercial routes were identified from the 28-day survey period. These main commercial routes and corresponding 90$^{th}$ percentiles within the shipping and navigation study area are shown relative to the DBS array areas in Figure 10.2. Following this, a description of each route is provided in Table 10.1, including the average number of vessels per day, start and end locations, main vessel types, and details of commercial ferry routeing (where applicable). It is noted that the start and end locations are based on the most common destinations transmitted via AIS by vessels on these routes.




## Figure 10.2 Base Case Main Commercial Routes

## Table 10.1 Description of Main Commercial Routes

| Route Number | Average Vessels per Day | Description |
|---|---|---|
| 1 | 2 | **Immingham – Gothenburg.** Mainly used by cargo vessels (95%), including the DFDS Seaways operated RoRo cargo services between Immingham and Gothenburg / Immingham and Brevik and the Finnlines operated RoRo cargo services between Immingham and Helsinki. |
| 2 | 2 | **Aberdeen – Rotterdam (Netherlands).** Generally used by tankers (53%) and cargo vessels (22%). |
| 3 | 1 | **Tees (UK) – Gdynia (Poland).** Generally used by cargo vessels (62%), tankers (19%), and tugs (19%). |
| 4 | 0 to 1 | **Grimsby (UK) – Thyborøn (Denmark).** Mainly used by cargo vessels (92%). |
| 5 | 0 to 1 | **Rotterdam – Tórshavn (Faroe Islands).** Mainly used by cargo vessels (78%). |
| 6 | 0 to 1 | **Aberdeen – Rotterdam.** Generally used by oil and gas vessels (56%) and cargo vessels (28%). |
| 7 | 0 to 1 | **Immingham – Odda (Norway).** Mainly used by cargo vessels (78%). |
| 8 | 0 to 1 | **Aberdeen – Cygnus gas field.** Only used by oil and gas vessels (100%). |
| 9 | 0 to 1 | **Rotterdam – Icelandic ports.** Mainly used by cargo vessels (86%). |
| 10 | 0 to 1 | **Immingham – Kristiansand (Norway).** Mainly used by cargo vessels (89%). |

# 11 Adverse Weather Routeing

230. Some vessels and vessel operators may operate alternative routes during periods of adverse weather. This section focuses on vessel movements in adverse weather given the implications if a commercial vessel is unable to make passage or a small craft is unable to access safe havens in adverse weather due to the presence of the Projects or activities associated with the Projects.

231. Adverse weather includes wind, wave, and tidal conditions as well as reduced visibility due to fog that may hinder a vessel's standard route, speed of navigation and / or ability to enter the destination port. Adverse weather routes are assessed to be significant course adjustments to mitigate vessel motion in adverse weather conditions. When transiting in adverse weather conditions, a vessel is likely to encounter various types of weather and tidal phenomena, which may lead to severe roll motions, potentially causing damage to cargo, equipment and / or discomfort and danger to persons on board. The sensitivity of a vessel to these phenomena depends upon the actual stability parameters, hull geometry, vessel type, vessel size, and speed.

## 11.1 Identification of Periods of Adverse Weather

232. The survey data has been checked for instances of adverse weather, based on the weather log maintained by the on-site survey vessel. The sea state was rough during the 2$^{nd}$ of November causing the survey vessel to move to deeper water for approximately 12 hours, although it remained within full coverage of the relevant study area. This was the only recorded instance of adverse weather.

## 11.2 Commercial Routeing Changes

233. No adverse weather routeing was identified from the vessel traffic survey data during the 2$^{nd}$ of November when adverse weather was known to be present.

234. However, based on previous experience of the area, as well as Anatec's ShipRoutes database and the NRA for Hornsea Project Four (Anatec, 2022), it has been identified that the DFDS Seaways-operated Immingham-Gothenburg route occasionally passes west of the DBS array areas (likely beyond the DBS West study area) during periods of adverse weather, rather than passing to the south.

# 12 Navigation, Communication, and Position-Fixing Equipment

235. This section discusses the potential effects on the use of navigation, communication and position fixing equipment of vessels that may arise due to the infrastructure associated with the Projects.

## 12.1 Very High Frequency Communications (including Digital Selective Calling)

236. In 2004, trials were undertaken at the North Hoyle Offshore Wind Farm, located off the coast of North Wales. As part of these trials, tests were undertaken to evaluate the operational use of typical small vessel Very High Frequency (VHF) (transceivers) (including Digital Selective Calling (DSC)) when operated close to wind turbines.

237. The wind turbines had no noticeable effect on voice communications within the array or ashore. It was noted that if small craft vessel to vessel and vessel to shore communications were not affected significantly by the presence of wind turbines, then it is reasonable to assume that larger vessels with higher powered and more efficient systems would also be unaffected.

238. During this trial, a number of telephone calls were made from ashore, both within and offshore of the array area. No effects were recorded using any system provider (MCA and QinetiQ, 2004).

239. Furthermore, as part of SAR trials carried out at North Hoyle in 2005, radio checks were undertaken between the Sea King helicopter and both Holyhead and Liverpool coastguards. The aircraft was positioned offshore of the array area and communications were reported as very clear, with no apparent degradation of performance. Communications with the service vessel located within the array were also fully satisfactory throughout the trial (MCA, 2005).

240. In addition to the North Hoyle trials, a desk-based study was undertaken for the Horns Rev 3 Offshore Wind Farm in Denmark in 2014 and it was concluded that there were not expected to be any conflicts between point-to-point radio communications networks and no interference upon VHF communications (Energinet, 2014).

241. Following consideration of these reports and noting that since the trials detailed above there have been no significant issues with regards to VHF observed or reported, the presence of the Projects is anticipated to have no significant impact upon VHF communications.

## 12.2 Very High Frequency Direction Finding

242. During the North Hoyle trials in 2004, the VHF Direction Finding (DF) equipment carried in the trial boats did not function correctly when very close to wind turbines (within approximately 50m). This is deemed to be a relatively small-scale impact due to the limited use of VHF DF equipment and would not impact operational or SAR activities (MCA and QinetiQ, 2004).

243. Throughout the 2005 SAR trials carried out at North Hoyle, the Sea King radio homer system was tested. The Sea King radio homer system utilises the lateral displacement of a vertical bar on an instrument to indicate the sense of a target relative to the aircraft heading. With the aircraft and the target vessel within the array, at a range of approximately 1nm, the homer system operated as expected with no apparent degradation.

244. Since the trials detailed above, no significant issues with regards to VHF DF have been observed or reported, and therefore the presence of the Projects is anticipated to have no significant impact upon VHF DF equipment.

## 12.3 Automatic Identification System

245. No significant issues with interference to AIS transmission from operational offshore wind farms have been observed or reported to date. Such interference was also absent in the trials carried out at North Hoyle (MCA and QinetiQ, 2004).

246. In theory there could be interference when there is a structure located between the transmitting and receiving antennas (i.e., blocking line of sight) of the AIS. However, given no issues have been reported to date at operational developments or during trials, no significant impact is anticipated due to the presence of the Projects.

## 12.4 Navigational Telex System

247. The Navigational Telex (NAVTEX) system is used for the automatic broadcast of localised Maritime Safety Information (MSI) and either prints it out in hard copy or displays it on a screen, depending upon the model.

248. There are two NAVTEX frequencies. All transmissions on NAVTEX 518 Kilohertz (kHz), the international channel, are in English. NAVTEX 518 kHz provides the mariner (both recreational and commercial) with weather forecasts, severe weather warnings and navigation warnings such as obstructions or buoys off station. Depending on the user's location, other information options may be available such as ice warnings for high latitude sailing.

249. The 490 kHz national NAVTEX service may be transmitted in the local language. In the UK full use is made of this secondary frequency including useful information for smaller craft, such as the inshore waters forecast and actual weather observations from weather stations around the coast.

250. Although no specific trials have been undertaken, no significant effect on NAVTEX has been reported to date at operational developments, and therefore no significant impact is anticipated due to the presence of the Projects.

## 12.5 Global Positioning System

251. Global Positioning System (GPS) is a satellite based navigational system. GPS trials were also undertaken throughout the 2004 trials at North Hoyle and it was stated that "*no problems with basic GPS reception or positional accuracy were reported during the trials*".

252. The additional tests showed that "*even with a very close proximity of a wind turbine to the GPS antenna, there were always enough satellites elsewhere in the sky to cover for any that might be shadowed by the wind turbine tower*" (MCA and QinetiQ, 2004).

253. Therefore, there are not expected to be any significant impacts associated with the use of GPS systems within or in proximity to the Projects, noting that there have been no reported issues relating to GPS within or in proximity to any operational offshore wind farms to date.

## 12.6 Electromagnetic Interference

254. A compass, magnetic compass or mariner's compass is a navigational instrument for determining direction relative to the earth's magnetic poles. It consists of a magnetised pointer (usually marked on the north end) free to align itself with the Earth's magnetic field. A compass may be used to calculate heading, used with a sextant to calculate latitude, and with a marine chronometer to calculate longitude.

255. Like any magnetic device, compasses are affected by nearby ferrous materials as well as by strong local electromagnetic forces, such as magnetic fields emitted from power cables. As the compass still serves as an essential means of navigation in the event of power loss or as a secondary source, it is important that potential impacts from Electromagnetic Field (EMF) are minimised to ensure continued safe navigation.

256. The vast majority of commercial traffic uses non-magnetic gyrocompasses as the primary means of navigation, which are unaffected by EMF. Therefore, it is considered highly unlikely that any interference from EMF as a result of the presence the Projects would have a significant impact on vessel navigation. However, some smaller craft (fishing or leisure) may rely on it as their sole means of navigation.

### 12.6.1 Sub-Sea Cables

257. The sub-sea cables for the Projects could be Direct Current (DC) or a combination of DC and Alternating Current (AC).

258. Studies indicate that AC does not emit an EMF significant enough to impact marine magnetic compasses (Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), 2008).

259. With regard to DC, the Moray Offshore Renewables Environmental Statement (Moray Offshore Renewables, 2012) notes that for both buried and protected DC cables the magnetic field would decrease exponentially with vertical distance from the seabed and with horizontal distance from the cables (within a few metres), irrespective of whether cables are buried or protected. It states that "*in all cases, where cables are buried to 1m depth, the predicted magnetic field is expected to be below the earth's magnetic field (assumed to be 50 microtesla (µT)). Where DC cables cannot be buried and are instead protected, the magnetic field is expected to be below the earth's magnetic field within 5m from the seabed*".

260. The following are therefore considered to be important factors affecting the likelihood of EMF to affect compass deviation as a result of the presence of cables:

- Water depth;
- Burial depth (or protection);
- Type of current (alternating or direct) running through the cables; and / or
- Spacing or separation of the cables.

### 12.6.2 Wind Turbines

261. MGN 654 (MCA, 2021) notes that small vessels with simple magnetic steering and hand bearing compasses should be wary of using these close to wind turbines as with any structure in which there is a large amount of ferrous material (MCA and QinetiQ, 2004). Potential effects are deemed to be within acceptable levels when considered alongside other mitigation such as the mariner being able to make visual observations (not wholly reliant on the magnetic compass), lighting, sound signals and identification marking in line with MGN 654.

### 12.6.3 Experience at Operational Offshore Wind Farms

262. No issues with respect to magnetic compasses have been reported to date in any of the trials (MCA and QinetiQ, 2004) undertaken (inclusive of SAR helicopters) nor in any published reports from operational offshore wind farms.

## 12.7 Marine Radar

263. This section summarises the results of trials and studies undertaken in relation to Radar effects from offshore wind farms in the UK. It is important to note that since the time of the trials and studies discussed, wind turbine technology has advanced significantly, most notably in terms of the size of wind turbines available to be installed and utilised. The use of these larger wind turbines allows for a greater spacing between wind turbines than was achievable at the time of the studies being undertaken, which is beneficial in terms of Radar interference effects (and surface navigation in general) as detailed below.

### 12.7.1 Trials

264. During the early years of offshore renewables within the UK, maritime regulators undertook a number of trials (both shore-based and vessel-based) into the effects of wind turbines on the use and effectiveness of marine Radar.

265. In 2004 trials undertaken at North Hoyle (MCA, 2004) identified areas of concern regarding the potential impact on marine- and shore-based Radar systems due to the large vertical extents of the wind turbines (based on the technology at that time). This resulted in Radar responses strong enough to produce interfering side lobes and reflected echoes (often referred to as false targets or ghosts).

266. Side lobe patterns are produced by small amounts of energy from the transmitted pulses that are radiated outside of the narrow main beam. The effects of side lobes are most noticeable within targets at short range (below 1.5nm) and with large objects. Side lobe echoes form either an arc on the Radar screen similar to range rings, or a series of echoes forming a broken arc, as illustrated in Figure 12.1.

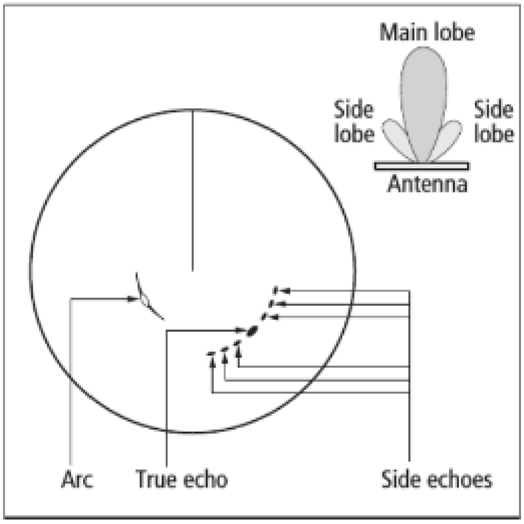



**Figure 12.1 Illustration of Side Lobes on Radar Screen**

267. Multiple reflected echoes are returned from a real target by reflection from some object in the Radar beam. Indirect echoes or 'ghost' images have the appearance of true echoes but are usually intermittent or poorly defined; such echoes appear at a false bearing and false range, as illustrated in Figure 12.2.

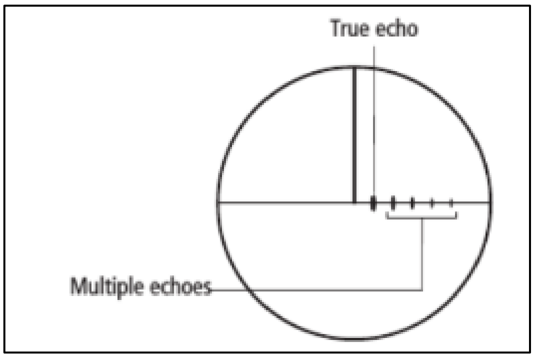



**Figure 12.2 Illustration of Multiple Reflected Echoes on Radar Screen**

268. Based on the results of the North Hoyle trials, the MCA produced a Shipping Route Template designed to give guidance to mariners on the distances which should be established between shipping routes and offshore wind farms. However, as experience of effects associated with use of marine Radar in proximity to offshore wind farms grew, the MCA refined their guidance, offering more flexibility within the most recent Shipping Route Template contained within MGN 654 (MCA, 2021).

269. A second set of trials conducted at Kentish Flats Offshore Wind Farm in 2006 on behalf of the British Wind Energy Association (BWEA) (BWEA, 2007) – now called RenewableUK – also found that Radar antennas which are sited unfavourably with respect to components of the vessel's structure may exacerbate effects such as side lobes and reflected echoes. Careful adjustment of Radar controls suppressed these spurious Radar returns but mariners were warned that there is a consequent risk of losing targets with a small Radar cross section, which may include buoys or small craft, particularly yachts or Glass Reinforced Plastic (GRP) constructed craft; therefore, due care should be taken in making such adjustments.

270. Theoretical modelling of the effects of the development of the proposed Atlantic Array Offshore Wind Farm, which was to be located off the south coast of Wales, on marine Radar systems was undertaken by the Atlantic Array project (Atlantic Array, 2012) and considered a wider spacing of wind turbines than that considered within the early trials[4]. The main outcomes of the modelling were the following:

- Multiple and indirect echoes were detected under all modelled parameters;
- The main effects noticed were stretching of targets in azimuth (horizontal) and appearance of ghost targets;
- There was a significant amount of clear space amongst the returns to ensure recognition of vessels moving amongst the wind turbines and safe navigation;
- Even in the worst case with Radar operator settings artificially set to be poor, there is significant clear space around each wind turbine that does not contain any multipath or side lobe ambiguities to ensure safe navigation and allow differentiation between false and real (both static and moving) targets;

[4] It is acknowledged that other theoretical analysis has been undertaken.

- Overall, it was concluded that the amount of shadowing observed was very little (noting that the model considered lattice-type foundations which are sufficiently sparse to allow Radar energy to pass through);
- The lower the density of wind turbines the easier it is to interpret the Radar returns and fewer multipath ambiguities are present;
- In dense, target rich environments S-Band Radar scanners suffer more severely from multipath effects in comparison to X-Band Radar scanners;
- It is important for passing vessels to keep a reasonable separation distance between the wind turbines in order to minimise the effect of multipath and other ambiguities;
- The Atlantic Array study undertaken in 2012 noted that the potential for Radar interference was mainly a problem during periods of reduced visibility when mariners may not be able to visually confirm the presence of other vessels in proximity (those without AIS installed which are usually fishing vessels and recreational craft). It is noted that this situation would arise with or without wind turbines in place; and
- There is potential for the performance of a vessel's ARPA to be affected when tracking targets in or near the array. Although greater vigilance is required, during the Kentish Flats trials it was shown that false targets were quickly identified as such by the mariners and then by the equipment itself.

271. In summary, experience in UK waters has shown that mariners have become increasingly aware of any Radar effects as more offshore wind farms become operational. Based on this experience, the mariner can interpret the effects correctly, noting that effects are the same as those experienced by mariners in other environments such as in close proximity to other vessels or structures. Effects may be effectively mitigated by "*careful adjustment of Radar controls*".

272. The MCA has also produced guidance to mariners operating in proximity to OREIs in the UK which highlights Radar issues amongst others to be taken into account when planning and undertaking voyages in proximity to OREIs (MCA, 2008). The interference buffers presented in Table 12.1 are based on MGN 654 (MCA, 2021) and MGN 372 Amendment 1 (MCA, 2022). It is noted that technical information has also been carried forward from MGN 371 (MCA, 2008) and MGN 543 (MCA, 2016) which have been withdrawn.

### Table 12.1 Distances at which Impacts on Marine Radar Occur

| Distance at Which Effect Occurs (nm) | Identified Effects |
|---|---|
| 0.5 | ▪ Intolerable impacts may be experienced.<br>▪ X-Band Radar interference is intolerable under 0.25nm.<br>▪ Vessels may generate multiple echoes on shore-based Radars under 0.45nm. |

| Distance at Which Effect Occurs (nm) | Identified Effects |
|---|---|
| 1.5 | ▪ Under MGN 654, impacts on Radar are considered to be tolerable with mitigation between 0.5 and 3.5nm.<br>▪ S-Band Radar interference starts at 1.5nm.<br>▪ Echoes develop at approximately 1.5nm, with progressive deterioration in the Radar display as the range closes. Where a main vessel route passes within this range considerable interference may be expected along a line of wind turbines.<br>▪ The wind turbines produce strong Radar echoes giving early warning of their presence.<br>▪ Target size of the wind turbine echo increases close to the wind turbine with a consequent degradation on both X- and S-Band Radars. |

273. As noted in Table 12.1, the onset range from the wind turbines of false returns is approximately 1.5nm, with progressive deterioration in the Radar display as the range closes. If interfering echoes develop, the requirements of the Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) *Rule 6 Safe Speed* are particularly applicable and must be observed with due regard to the prevailing circumstances (IMO, 1972/77). In restricted visibility, *Rule 19 Conduct of Vessels in Restricted Visibility* applies and compliance with *Rule 6* becomes especially relevant. In such conditions mariners are required, under *Rule 5 Look-out* to take into account information from other sources which may include sound signals and VHF information, for example from a Vessel Traffic Service (VTS) or AIS (MCA, 2016).

### 12.7.2 Experience from Operational Developments

274. The evidence from mariners operating in proximity to existing offshore wind farms is that they quickly learn to adapt to any effects. Figure 12.3 presents the example of the Galloper and Greater Gabbard Offshore Wind Farms, which are located in proximity to IMO routeing measures. Despite this proximity to heavily trafficked Traffic Separation Scheme (TSS) lanes, there have been no reported incidents or issues raised by mariners operating in close proximity. The interference buffers presented in Figure 12.3 are as per Table 12.1.

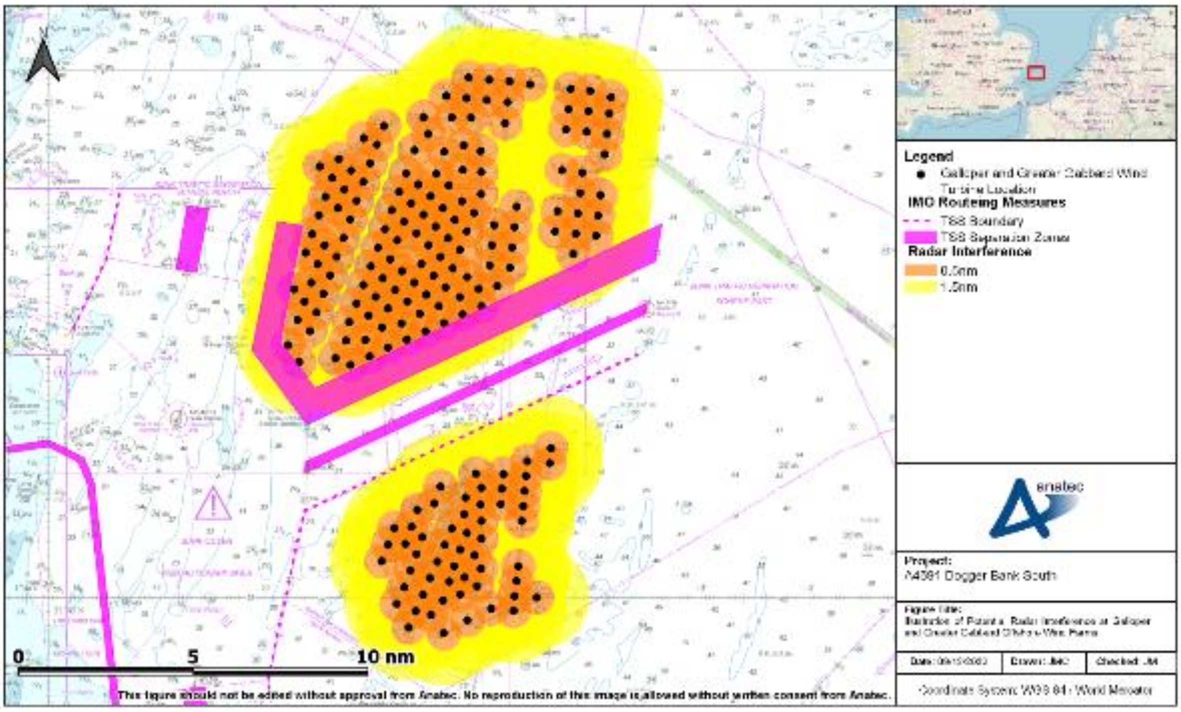



**Figure 12.3 Illustration of Potential Radar Interference at Galloper and Greater Gabbard Offshore Wind Farms**

275. As indicated by Figure 12.3, vessels utilising these TSS lanes would experience some Radar interference based on the available guidance. Both developments are operational, and the lanes are used by a minimum of eight vessels per day on average. However, to date, there have been no incidents recorded (including any related to Radar use) or concerns raised by the users.

276. AIS information may also be used to verify the targets of larger vessels (generally vessels over 15m LOA – the minimum threshold for fishing vessel AIS carriage requirements). Approximately 1% of the vessel traffic recorded within the DBS array study areas was under 15m in length, although throughout the vessel traffic surveys approximately 97% of vessel tracks were recorded on AIS, indicating a high level of AIS take-up among vessels for which AIS carriage is not mandatory.

277. For any smaller vessels, particularly fishing vessels and recreational vessels, AIS Class B devices are becoming increasingly popular and allow the position of these small craft to be verified when in proximity to an offshore wind farm.

### 12.7.3 Increased Radar Returns

278. Beam width is the angular width, horizontal or vertical, of the path taken by the Radar pulse. Horizontal beam width ranges from 0.75° to 5°, and vertical beam width from 20° to 25°. How well an object reflects energy back towards the Radar depends upon its size, shape and aspect angle.

279. Larger wind turbines (either in height or width) would return greater target sizes and / or stronger false targets. However, there is a limit to which the vertical beam width would be affected (20° to 25°) dependent upon the distance from the target, and at closer distances this five degree width would be limited much further. Therefore, increased wind turbine height in the array would not create any effects in addition to those already identified from existing operational wind farms (interfering side lobes, multiple and reflected echoes). Additionally, the level and way Radar returns occur is not expected to differ significantly for different foundation types (i.e., monopiles and jacket foundations).

280. Again, when taking into consideration the potential options available to marine users (such as reducing gain to remove false returns) and feedback from operational experience, this shows that the effects of increased returns may be managed effectively.

### 12.7.4 Fixed Radar Antenna Use in Proximity to an Operational Offshore Wind Farm

281. It is noted that there are multiple operational offshore wind farms including Galloper that successfully operate fixed Radar antenna from locations on the periphery of the array. These antennas are able to provide accurate and useful information to onshore coordination centres.

### 12.7.5 Application to the Projects

282. Upon development of the Projects, some commercial vessels may pass within 1.5nm of the wind farm structures and therefore may be subject to a minor level of Radar interference. Trials, modelling, and experience from existing developments note that any impact may be mitigated by adjustment of Radar controls.

283. Figure 12.4 presents an illustration of potential Radar interference due to the Projects, with Dogger Bank A included for context. The Radar effects have been applied to the indicative full build out array layout introduced in Section 6.2.1.

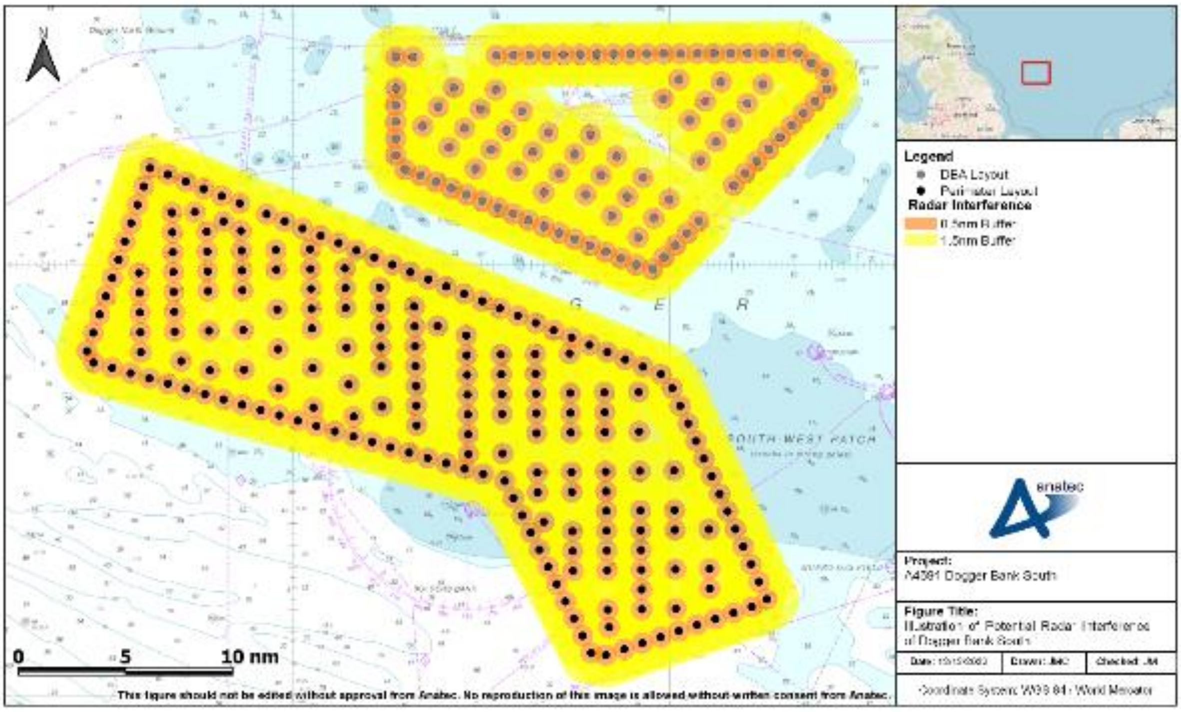



**Figure 12.4 Illustration of Potential Radar Interference at the Projects**

284. Vessels passing within the arrays would be subject to a greater level of interference with impacts becoming more substantial in close proximity to wind turbines. This would require additional mitigation by any vessels including consideration of the navigational conditions (visibility) when passage planning and compliance with the COLREGs (IMO, 1972/77) would be essential.

285. Overall, the impact on marine Radar is expected to be low and no further impact upon navigational safety is anticipated outside the parameters which may be mitigated by operational controls.

## 12.8 Sound Navigation Ranging Systems

286. No evidence has been found to date with regard to existing offshore wind farms to suggest that Sound Navigation Ranging (SONAR) systems produce any kind of SONAR interference which is detrimental to the fishing industry, or to military systems. No impact is therefore anticipated in relation to the presence of the Projects.

## 12.9 Noise

287. No evidence has been found to date with regard to existing offshore wind farms to suggest that prescribed sound signals are in any way impacted by acoustic noise produced by the wind farm.

## 12.10 Summary of Potential Effects on Use

288. Based on the detailed technical assessment of the effects due to the presence of the Projects on navigation, communication and position fixing equipment in the previous subsections, Table 12.2 summarises the assessment of frequency of occurrence and severity of consequence and the resulting significance of risk for each component of this hazard.

**Table 12.2 Summary of Risk to Navigation, Communication, and Position Fixing Equipment**

| Topic | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|
| VHF | Negligible | Minor | Broadly Acceptable |
| VHF DF | Extremely Unlikely | Minor | Broadly Acceptable |
| AIS | Negligible | Minor | Broadly Acceptable |
| NAVTEX | Negligible | Minor | Broadly Acceptable |
| GPS | Negligible | Minor | Broadly Acceptable |
| EMF | Extremely Unlikely | Negligible | Broadly Acceptable |
| Marine Radar | Remote | Minor | Broadly Acceptable |
| SONAR | Negligible | Minor | Broadly Acceptable |
| Noise | Negligible | Minor | Broadly Acceptable |

289. On the basis of these findings, associated risks are screened out of the risk assessment undertaken in Section 15, noting that as part of the SAR Checklist completed post consent, VHF trials may be undertaken to investigate effects due to larger wind turbines.

# 13 Cumulative and Transboundary Overview

## 13.1 Screened in Other Developments

### 13.1.1 Offshore Wind Farms

290. In addition to the Projects, there are a number of other offshore wind farm developments located in the region. Table 13.1 includes details of these offshore wind farm developments, whether they are screened into the cumulative risk assessment, and the cumulative tier applied (where applicable). The project statuses listed are as of December 2022.

291. As per the cumulative risk assessment methodology, any development greater than 50nm from the DBS array areas or greater than 5nm from the offshore export cable corridor is not considered.

292. Figure 13.1 presents the locations of the offshore wind farm developments screened into the cumulative risk assessment alongside baseline developments.

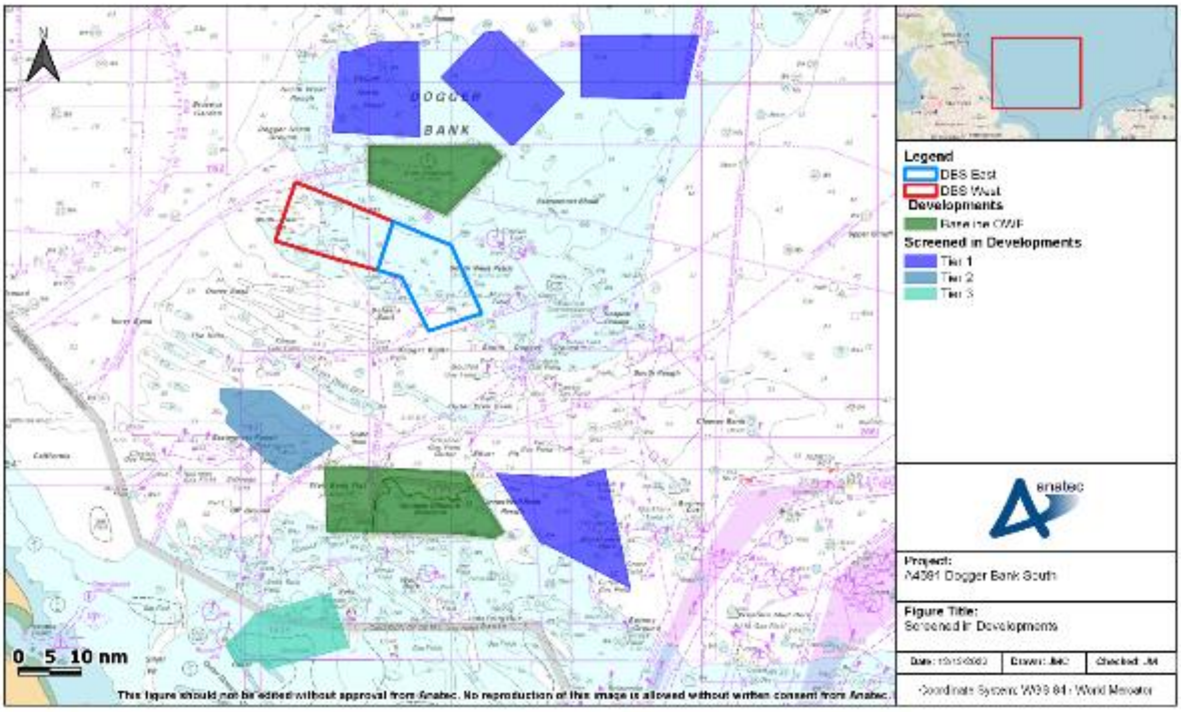



Figure 13.1 Screened in Developments

## Table 13.1 Cumulative Screening

| Development | Development Type | Development Status (as of December 2022) | Closest Distance (nm) | | Data Confidence | Cumulative Risk Assessment Screened In / Out | Cumulative Tier |
|---|---|---|---|---|---|---|---|
| | | | Array Areas | Cable Corridor | | | |
| Aminth Interconnector | Sub-sea cable | In planning | Unknown | Unknown | Low | Screened out – preliminary status and low data confidence | N/A |
| Boulton | Oil and gas platform | Operational | 9.4 | 9.4 | High | Screened out – baseline | N/A |
| Cavendish | Oil and gas platform | Operational | 1.9 | 0 | High | Screened out – baseline | N/A |
| Cygnus A | Oil and gas platform | Operational | 8.7 | 8.7 | High | Screened out – baseline | N/A |
| Cygnus B | Oil and gas platform | Operational | 6.8 | 6.8 | High | Screened out – baseline | N/A |
| Dogger Bank A | Offshore wind farm | Under construction | 4.7 | 4.7 | High | Screened out – baseline | N/A |
| Dogger Bank B | Offshore wind farm | Consented | 9.4 | 9.4 | High | Screened in | 1 |
| Dogger Bank C[5] | Offshore wind farm | Consented | 30 | 30 | High | Screened in | 1 |
| Hornsea Project Four | Offshore wind farm | Under determination | 22 | 12 | High | Screened in | 2 |
| Hornsea Project One | Offshore wind farm | Operational | 25 | 25 | High | Screened out – baseline | N/A |
| Hornsea Project Three | Offshore wind farm | Consented | 25 | 27 | High | Screened in | 1 |
| Hornsea Project Two | Offshore wind farm | Operational | 22 | 24 | High | Screened out – baseline | N/A |
| Munro | Oil and gas platform | Operational | 6.0 | 6.0 | High | Screened out – baseline | N/A |

[5] It is acknowledged that Dogger Bank C will not be built out in full and the remainder of the Dogger Bank C array area is being developed separately as 'Dogger Bank D'. This new development will be monitored at the ES stage, and Dogger Bank D added to the cumulative screening if deemed appropriate.

| Development | Development Type | Development Status (as of December 2022) | Closest Distance (nm) | | Data Confidence | Cumulative Risk Assessment Screened In / Out | Cumulative Tier |
|---|---|---|---|---|---|---|---|
| | | | Array Areas | Cable Corridor | | | |
| Outer Dowsing | Offshore wind farm | Scoped | 44 | 47 | High | Screened in | 3 |
| Sofia | Offshore wind farm | Consented | 18 | 18 | High | Screened in | 1 |

### 13.1.2 Oil and Gas Infrastructure

293. There are no known future oil and gas developments in the region. The various existing oil and gas infrastructure (listed in Table 13.1) is considered as part of the baseline and is therefore screened out of the cumulative risk assessment.

### 13.1.3 Marine Aggregate Dredging Areas

294. There are no marine aggregate exploration areas in the region. The 2021/22 marine aggregate tender round does include several areas within the southern North Sea, although geographical information is unavailable. Based on the information available, there is not expected to be any proximity to the Offshore Development Areas, and therefore these potential future areas are screened out of the cumulative risk assessment.

### 13.1.4 Sub-Sea Cables

295. The Aminth Interconnector (listed in Table 13.1) is a planned sub-sea cable development between Mablethorpe and the Danish North Sea Energy Island. An application for an electricity interconnector licence was made to the Gas and Electricity Markets Authority and published in November 2022 (Ofgem, 2022). It is possible that this development may pass in proximity to the DBS array areas; however, given the preliminary status and low data confidence, it has been screened out of the cumulative risk assessment.

## 13.2 Pre Wind Farm Interaction with Screened in Developments

296. The main commercial routes identified within the DBS array study areas which interact with screened in cumulative developments are summarised in Table 13.2. As per the methodology for re-routeing due to the Projects in isolation (see Section 14.4), it is assumed that any main commercial route within 1nm of a surface piercing installation would require a deviation.

**Table 13.2 Anticipated Main Commercial Route Interaction with Cumulative Developments**

| Route Number | Average Vessels per Day | Main Ports | Interaction with Cumulative Developments | | |
|---|---|---|---|---|---|
| | | | Hornsea Project Three | Hornsea Project Four | Dogger Bank C |
| 2 | 2 | Aberdeen – Rotterdam | ✓ | | |
| 5 | 0 to 1 | Rotterdam – Tórshavn | | ✓ | |
| 6 | 0 to 1 | Aberdeen – Rotterdam | ✓ | | |
| 9 | 0 to 1 | Rotterdam – Icelandic ports | ✓ | | |

| Route Number | Average Vessels per Day | Main Ports | Interaction with Cumulative Developments | | |
|---|---|---|---|---|---|
| | | | Hornsea Project Three | Hornsea Project Four | Dogger Bank C |
| 10 | 0 to 1 | Immingham – Kristiansand | | | ✓ |

297. In summary, three main commercial routes are anticipated to be permanently displaced by the additional presence of Hornsea Project Three (Tier 1), with one main commercial route displaced by the presence of Hornsea Project Four (Tier 2) and Dogger Bank C (Tier 1).

298. Deviations would be determined as part of the cumulative risk assessment in the ES.

# 14 Future Case Vessel Traffic

299. The characterisation of vessel traffic established in the baseline (see Section 9 and Section 10) is used as input to the risk assessment (see Section 15). However, it is also necessary to consider potential future case vessel traffic, in terms of general volume and size changes, port developments which may influence movements, and changes to movements associated with the presence of the Projects (the post wind farm scenario).

300. The following subsections provide a high level future case scenario which has been used to inform the risk assessment.

## 14.1 Increases in Commercial Vessel Activity

301. There is uncertainty associated with long-term predictions of vessel traffic growth including the potential for any other new developments in UK or transboundary ports and the long-term effects of Brexit.

302. Therefore, two independent scenarios of potential growth in commercial vessel movements of 10% and 20% have been estimated throughout the lifetime of the Projects.

## 14.2 Increases in Commercial Fishing Vessel and Recreational Vessel Activity

303. There is similar uncertainty associated with long-term predictions for commercial fishing vessel and recreational vessel transits given the limited reliable information on future trends upon which any firm assumption could be made. There are no known major developments which would increase commercial fishing or recreational vessel activity in the region.

304. Therefore, a conservative potential growth in commercial fishing vessel and recreational vessel movements of 10% and 20% has been estimated throughout the lifetime of the Projects.

## 14.3 Increases in Traffic Associated with Project Operations

305. During the construction phase up to 6,778 annual round trips to port would be made by vessels involved in the installation of the Projects (see Section 6.4). During the operation and maintenance phase, up to 473 annual round trips to port would be made by vessels involved in the operation and maintenance of the Projects (see Section 6.5).

## 14.4 Commercial Traffic Routeing (Projects in Isolation)

### 14.4.1 Methodology

306. It is not possible to consider all potential alternative routeing options for commercial traffic and therefore alternatives have been considered where possible in consultation with operators. Assumptions for re-routeing include:

- All alternative routes maintain a minimum mean distance of 1nm from offshore installations and existing offshore wind farm boundaries in line with industry experience. This distance is considered for shipping and navigation from a safety perspective as explained below; and
- All mean routes take into count sandbanks, aids to navigation and known routeing preferences.

307. Annex 1 of MGN 654 defines a methodology for assessing passing distance from offshore wind farm boundaries but states that it is "*not a prescriptive tool but needs intelligent application*".

308. To date, internal and external studies undertaken by Anatec on behalf of the UK Government and individual clients show that vessels do pass consistently and safely within 1nm of established offshore wind farms (including between distinct developments) and these distances vary depending upon the sea room available as well as the prevailing conditions. This evidence also demonstrates that the Mariner defines their own safe passing distance based upon the conditions and nature of the traffic at the time, but they are shown to frequently pass 1nm off established developments. Evidence also demonstrates that commercial vessels do not transit through arrays.

309. The NRA also aims to establish the MDS based on navigational safety parameters, and when considering this the most conservative realistic scenario for vessel routeing is when main commercial routes pass 1nm off developments. Evidence collected during numerous assessments at an industry level confirms that it is a safe and reasonable distance for vessels to pass; however, it is likely that a large number of vessels would instead choose to pass at a greater distance depending upon their own passage plan and the current conditions.

### 14.4.2 Main Commercial Route Deviations

310. An illustration of the anticipated worst case shift in the mean positions of the main commercial routes within the shipping and navigation study area following the development of the Projects is presented in Figure 14.1. These deviations are based on Anatec's assessment of the MDS.

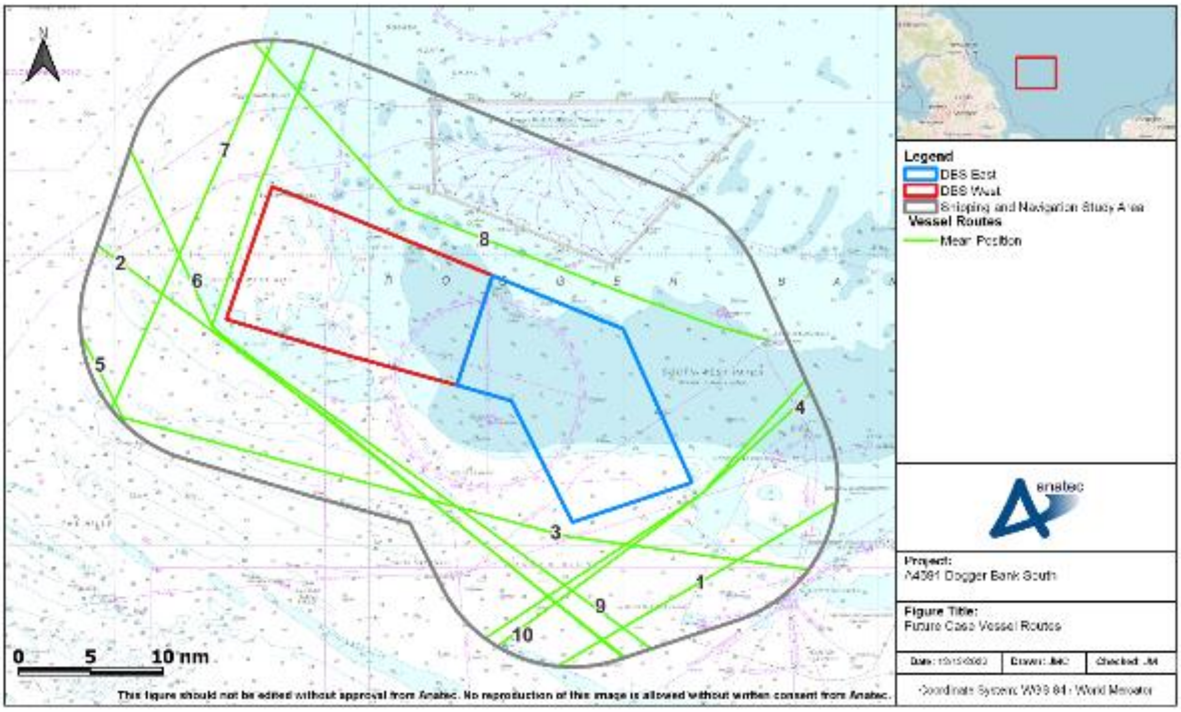



**Figure 14.1 Future Case Vessel Traffic Routes**

311. Deviations from the pre wind farm scenario would be required for five out of the ten main commercial routes identified, with the level of deviation varying between a 0.1nm increase for Routes 3 and 4, and a 10.7nm increase for Route 9. For the displaced routes, the increase in distance from the pre wind farm scenario is presented in Table 14.1.

**Table 14.1 Summary of Post Wind Farm Main Commercial Deviations within the Shipping and Navigation Study Area**

| Route Number | Increase in Route Length (nm) | Percentage Change in Total Route Length (%) | Nature of Deviation |
|---|---|---|---|
| 3 | 0.1 | <0.1 | Passing slightly further south of the DBS East array area. |
| 4 | 0.1 | <0.1 | Passing slightly further east of the DBS East array area. |
| 6 | 2.6 | 0.7 | Passing slightly further west of the DBS West array area. |
| 9 | 10.7 | 0.9 | Passing slightly further west of the DBS West array area. |
| 10 | 4.4 | 1.1 | Passing slightly further east of the DBS East array area. |

312. In the case of Route 9, although the increase in route length is relatively high, due to the total distance involved in the transit, the percentage change in total route length is low.

# 15 Risk Assessment

## 15.1 Hazard 1 Vessel Displacement and Increased Vessel to Vessel Collision Risk Between Third-Party Vessels (All Phases)

313. *Activities associated with the installation, maintenance and decommissioning of structures and cables as well as the presence of surface structures may displace third-party vessels from their existing routes or activity, increasing the collision risk with other third-party vessels.*

### 15.1.1 DBS East and DBS West Together – All Users

#### 15.1.1.1 Main Commercial Route Displacement

314. During the construction and decommissioning phases, a buoyed construction/ decommissioning area will be deployed around each DBS array area. No restrictions on entry will be enforced for the buoyed construction/ decommissioning area or the arrays during the operations and maintenance phase outside of any statutory safety zones. However, based on experience at previously under construction and existing operational offshore wind farms, it is anticipated that commercial vessels will choose not to navigate internally within the buoyed construction/decommissioning area or the operational arrays.

315. 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 Anatec's ShipRoutes database. Further details of the methodology for main commercial route identification are provided in Section 14.4.1, noting that the vessel traffic data has been agreed as appropriate by the MCA and Trinity House. As part of the future case considerations, increases in 10% and 20% of all traffic including commercial vessels is assumed.

316. A deviation will be required for all phases of the Projects for five of the main commercial routes. The level of deviation varies between an increase of 0.1nm for Route 4 and an increase of 10.7nm for Route 9, with the maximum percentage change in total route length being 1.1% for Route 10. The size of these deviations is small when considered relative to the length of the routes overall, which typically cross the North Sea.

317. The deviated route with the highest vessel traffic was Route 3, with approximately one transit per day, i.e., deviations are expected to be a frequent occurrence. Regular RoRo and RoPax vessels were only recorded on Route 1, which is not expected to require deviation due to the presence of the DBS array areas.

318. The most likely consequences of vessel displacement will be increased journey times and distances for affected third-party vessels. The hazard will occur over a local

spatial extent given that the buoyed construction/ decommissioning area will be deployed around the maximum extent of the DBS array areas.

319. As a worst case, there could be disruption to schedules, particularly for the DFDS Seaways-operated RoRo route. However, given that no deviations are anticipated for this route, and the international nature of routeing in the region alongside the ability to passage plan, disruptions to schedule are expected to be minimal.

#### 15.1.1.2 Collision Risk

320. From historical incident data, no collision incidents between third-party vessels have occurred directly as a result of a UK offshore wind farm.

321. 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 (including reduced speeds) in adverse weather conditions. Moreover, the minimum spacing between structures (830m) will be sufficient to ensure any visual hindrance is very short-term in nature.

322. 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.

323. 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 risks. 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 CTV.

324. It is acknowledged that vessel traffic monitoring will be undertaken throughout the construction phase and the first three years of the operation and maintenance phase to characterise changes to routeing patterns. These will be compared against anticipated deviations to allow a comprehensive review of the embedded mitigation measures applied at the time.

#### 15.1.1.3 Adverse Weather Routeing

325. From the vessel traffic survey data, no instances of alternative routeing due to possible adverse weather were recorded, although from previous experience of the area it has been identified that the DFDS Seaways route between Immingham and Gothenburg does occasionally pass west of the DBS array areas during periods of adverse weather. These instances occur a sufficient distance from the DBS array

areas and no disruption due to the presence of the DBS array areas is anticipated. Further consultation with DFDS Seaways and other relevant operators will be required to inform this element of the hazard at the ES stage.

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

327. 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 undertake an unsafe transit and therefore risk to the vessel or crew are negligible due to the very low frequency of occurrence.

#### 15.1.1.4 Promulgation of Information and Passage Planning

328. 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 the Projects 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 operations and maintenance 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 the Projects.

329. 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 the Projects will assist such passage planning.

#### 15.1.1.5 Small Craft Displacement

330. 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 DBS array areas are infrequent (noting that displacement of commercial fishing vessels engaged in fishing activity is assessed in **Chapter 13: Commercial Fisheries**).

331. Based on experience at previously under construction offshore wind farms, 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 may be required during the construction and decommissioning phases.

332. For the operations and maintenance phase, based on experience at existing operational offshore wind farms, 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 arrays increases throughout the operations and maintenance phase. In situations where small craft do navigate internally, the level of displacement is considered negligible.

##### 15.1.1.6 Collision Risk Involving Small Craft

333. 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 DBS array areas are infrequent.

334. In the event of a collision incident the likelihood of a worst case outcome (the small craft foundering with PLL and pollution) is greater due to the size and likely hull material of the small craft.

##### 15.1.1.7 Frequency of Occurrence

335. The frequency of occurrence of risks due to vessel displacement and third-party collision risk is **reasonably probable** for the construction/ decommissioning phases and **reasonably probable** for the operations and maintenance phase.

##### 15.1.1.8 Severity of Consequence

336. The severity of consequence of risks due to vessel displacement and third-party collision risk is **moderate** for the construction/decommissioning phases and **moderate** for the operations and maintenance phase.

### 15.1.2 DBS East or DBS West in Isolation – All Users

#### 15.1.2.1 DBS East in Isolation

337. Should only DBS East in isolation be developed, this would result both in a greater area of available sea room for routeing commercial vessels, and fewer routes requiring a deviation; four route deviations would be necessary compared to five for DBS East and DBS West together. Therefore, it is expected that both the severity of consequence and frequency of occurrence for this hazard would decrease compared to if both DBS East and DBS West are built together.

#### 15.1.2.2 DBS West in Isolation

338. Should only DBS West in isolation be developed, this would result both in a greater area of available sea room able to be utilised, and fewer routes requiring a deviation; two route deviations would be necessary compared to five for DBS East and DBS

West together. Therefore, it is expected that the frequency of occurrence would decrease compared to if both DBS East and DBS West are built together, especially for those vessels transiting further west. For example, as Routes 4 and 10 transit through DBS East, vessels on this route would not be required to deviate.

### 15.1.3 Significance of Risk – DBS East and DBS West Together

339. The frequency of occurrence, severity of consequence, and resulting significance of risk resulting from vessel displacement and third-party collision risk for DBS East and DBS West together, is presented in Table 15.1.

**Table 15.1 Significance of Risk for Vessel Displacement and Third-Party Collision Risk of DBS East and DBS West Together**

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| DBS East and DBS West together | Construction | Displacement with effects on schedule and collision incident occurs with vessel damage, PLL, and/or pollution. | Reasonably Probable | Moderate | **Tolerable** |
| | Operations and maintenance | | Reasonably Probable | Moderate | **Tolerable** |
| | Decommissioning | | Reasonably Probable | Moderate | **Tolerable** |

#### 15.1.3.1 Additional Mitigation Measures and Residual Significance of Risk

340. An additional mitigation measure has been identified relevant to this hazard: consultation should be undertaken with Regular Operators including DFDS Seaways to allow further consideration of any adverse weather routeing in the region. With this additional mitigation measure implemented, the residual significance of risk is **Tolerable with Mitigation**.

### 15.1.4 Significance of Risk – DBS East or DBS West in Isolation

341. The frequency of occurrence, severity of consequence, and resulting significance of risk resulting from vessel displacement and third-party collision risk for DBS East and DBS West in isolation, is presented in Table 15.2.

**Table 15.2 Significance of Risk for Vessel Displacement and Third-Party Collision Risk of DBS East and DBS West Together**

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| DBS East in isolation | Construction | Displacement with effects on schedule and collision incident occurs with vessel damage, PLL, and/or pollution. | Reasonably Probable | Moderate | **Tolerable** |
| | Operations and maintenance | | Reasonably Probable | Moderate | **Tolerable** |
| | Decommissioning | | Reasonably Probable | Moderate | **Tolerable** |
| DBS West in isolation | Construction | | Remote | Moderate | **Tolerable** |
| | Operations and maintenance | | Remote | Moderate | **Tolerable** |
| | Decommissioning | | Remote | Moderate | **Tolerable** |

#### 15.1.4.1 Additional Mitigation Measures and Residual Significance of Risk

342. An additional mitigation measure has been identified relevant to this hazard: consultation should be undertaken with Regular Operators including DFDS Seaways to allow further consideration of any adverse weather routeing in the region. With this additional mitigation measure implemented, the residual significance of risk is **Tolerable with Mitigation**.

## 15.2 Hazard 2 Increased Vessel to Vessel Collision Risk Between a Third-Party Vessel and a Project Vessel (All Phases)

343. *The presence of vessels associated with construction, operations and maintenance, and decommissioning activities may result in increased risk of a collision between a third-party vessel and a project vessel.*

### 15.2.1 DBS East and DBS West Together – All Users

344. The construction/decommissioning phases may last for up to seven years with up to 11,489 return trips by construction vessels made throughout the construction phase, including vessels Restricted in Ability to Manoeuvre (RAM). It is assumed that construction vessels will be on-site throughout the construction phase. The operations and maintenance phase may last for up to 32 years (for the sequential build out scenario) with up to 473 annual return trips by operations and maintenance vessels made throughout this period.

345. From historical incident data, there have been two instances of a third-party vessel colliding with a project vessel associated with a UK offshore wind farm. In both incidents moderate vessel damage was reported with no harm to persons. It is noted that the two incidents occurred in 2011 and 2012, and awareness of offshore wind farm 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.

346. Project vessel movements will be managed by the Applicant’s marine coordination and any associated procedures implemented will account for those areas where collision risk is assessed as greatest (where regular commercial routeing passes close to the arrays). Additionally, project vessels will carry AIS and be compliant with Flag State regulations including IMO conventions such as the COLREGs, and information for fishing vessels will be promulgated through ongoing liaison with fishing fleets via an appointed Fisheries Liaison Officer (FLO).

347. Furthermore, an application for safety zones of 500m will be sought during the construction phase. These will serve to protect project vessels engaged in construction activities associated with surface piercing structures. Minimum advisory passing distances, as defined by a risk assessment, may also be applied, with advanced warning and accurate locations of both safety zones and any minimum advisory passing distances provided by Notifications to Mariners and Kingfisher Bulletins.

348. Also, the Projects will exhibit lights, marks, sounds, signals and other aids to navigation as required by Trinity House and MCA, including the buoyed construction/decommissioning area. These navigational aids will further maximise mariner awareness when in proximity, both in day and night conditions including in poor visibility.

349. Third-party vessels may experience restrictions on visually identifying project vessels entering and exiting the array during reduced visibility; however, this hazard will be mitigated by the application of the COLREGs (reduced speeds) in adverse weather conditions and AIS carriage by project vessels.

350. Should an encounter occur between a third-party vessel and a project vessel, it is likely to be very localised and occur for only a short duration. With collision avoidance action implemented in line with the COLREGs, the vessels involved will likely be able to resume their respective passages and/or activities with no long-term consequences.

351. Should an encounter develop into a collision incident, the most likely consequences will be similar to that outlined for the case of a collision between two third-party vessels. As an unlikely worst case, one of the vessels could founder resulting in 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). If pollution were to occur in proximity

to the Projects or involving a project vessel, then the Marine Pollution Contingency Plan (MPCP) will be implemented to minimise the environmental risks.

#### 15.2.1.1 Frequency of Occurrence

352. The frequency of occurrence of risks due to increased third-party with project vessel collision risk is **negligible** for the construction/decommissioning phases and **negligible** for the operations and maintenance phase.

#### 15.2.1.2 Severity of Consequence

353. The severity of consequence of risks due to increased third-party with project vessel collision risk is **serious** for the construction/decommissioning phases and **serious** for the operations and maintenance phase.

### 15.2.2 DBS East or DBS West In Isolation – All Users

354. Should only one DBS array area in isolation be developed, it would result in fewer project vessels being on-site for all phases, leading to fewer encounter opportunities. Additionally, more sea room would be available for third-party vessels to navigate and maintain a safe passing distance from project vessels. As a result, the likelihood of a collision would be lower than if both sites were to be built together.

### 15.2.3 Significance of Risk – DBS East and DBS West Together

355. The frequency of occurrence, severity of consequence, and resulting significance of risk resulting from increased third-party with project vessel collision risk for DBS East and DBS West together, is presented in Table 15.3.

**Table 15.3 Significance of Risk for Increased Third-Party with Project Vessel Collision Risk of DBS East and DBS West Together**

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| DBS East and DBS West together | Construction | Collision incident occurs with vessel damage, PLL, and/or pollution. | Negligible | Serious | **Broadly Acceptable** |
| | Operations and maintenance | | Negligible | Serious | **Broadly Acceptable** |
| | Decommissioning | | Negligible | Serious | **Broadly Acceptable** |

#### 15.2.3.1 Additional Mitigation Measures and Residual Significance of Risk

356. No additional mitigation measures are proposed for this hazard and therefore the residual significance of risk remains **Broadly Acceptable**.

### 15.2.4 Significance of Risk – DBS East and DBS West in Isolation

357. The frequency of occurrence, severity of consequence, and resulting significance of risk resulting from increased third-party with project vessel collision risk for DBS East and DBS West in isolation, is presented in Table 15.4.

**Table 15.4 Significance of Risk for Vessel Displacement and Third-Party Collision Risk of DBS East and DBS West Together**

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| DBS East and DBS West in isolation | Construction | Collision incident occurs with vessel damage, PLL, and/or pollution. | Negligible | Serious | **Broadly Acceptable** |
| | Operations and maintenance | | Negligible | Serious | **Broadly Acceptable** |
| | Decommissioning | | Negligible | Serious | **Broadly Acceptable** |

#### 15.2.4.1 Additional Mitigation Measures and Residual Significance of Risk

358. No additional mitigation measures are proposed for this hazard and therefore the residual significance of risk remains **Broadly Acceptable**.

## 15.3 Hazard 3 Creation of Vessel to Structure Allision Risk (Operation and Maintenance Phase)

359. The presence of surface piercing structures during the operation and maintenance phase may result in the creation of a risk of allision for vessels.

### 15.3.1 DBS East and DBS West Together – All Users

360. The main commercial route deviations and future case considerations described for the vessel displacement and collision risk hazard (see Section 15.1) have also been assumed for this hazard, noting that 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.

361. The presence of new surface structures introduces 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.

### 15.3.1.1 Powered Allision Risk

362. From historical incident data, there have been two instances of a third-party vessel alliding with an operational wind farm structure in the UK. These incidents both involved a fishing vessel, with an RNLI lifeboat attending on each occasion.

363. 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 risks given the promulgation of information relating to the Projects 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 may alert a vessel on a closing approach with a structure as required.

364. Should a powered allision incident occur, the consequences will depend on multiple factors including the energy of the allision, 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 hazard given the size and likely hull material of the small craft.

365. With consideration for lesson 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 a platform, resulting in foundering with PLL and pollution.

### 15.3.1.2 Drifting Allision Risk

366. A vessel adrift may only develop into an allision situation if in proximity to a wind farm structure. This is only the case where the adrift vessel is located internally within or in close proximity to the array and the direction of the wind and/or tide directs the vessel towards a structure.

367. Based on historical incident data, there have been no instances of a third-party vessel alliding with an operational wind farm structure whilst Not Under Command (NUC).

368. Should a vessel drift towards a structure, there are outcomes other than an allision incident which are more likely. A powered vessel may regain 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 hazards (such as anchor snagging on a sub-sea cable or pipeline).

369. Should a drifting allision occur, the consequences will be similar to those noted for the case of a powered allision, including the determining factors. However, a drifting vessel is likely to transit at a reduced speed compared to a powered vessel, thus reducing the allision energy and the likelihood of the worst case consequences arising.

370. The platforms again carry increased allision risk and consequences due to their greater size and resistant force, although this may again be mitigated by effective use of operational lighting and marking in accordance with requirements from Trinity House and MCA.

#### 15.3.1.3 Internal Allision Risk

371. As noted previously, based on experience at existing operational offshore wind farms, it is anticipated that:

- Commercial vessels will choose not to navigate internally within the arrays;
- Fishing vessels may choose to navigate internally within the arrays, particularly in summer months; and
- Recreational vessels are unlikely to choose to navigate internally within the arrays.

372. Therefore, the likelihood of an internal allision involving a commercial vessel is anticipated to be negligible.

373. Since the non-full build out array layout incorporates the minimum spacing between structures of 830m, it is considered for this element of the hazard. However, a minimum spacing of 830m is considered sufficient for safe internal navigation, allowing vessels to keep clear of the wind farm structures. This spacing is similar to many other consented offshore wind farms in the UK (Dogger Bank A and Dogger Bank B were consented with a minimum spacing of 700m (Forewind, 2013)) and is slightly greater than the minimum spacing at some consented offshore wind farms where evidence suggests that fishing vessels are comfortable operating internally in favourable conditions. Layout plans will be agreed with MMO, post-consent, following appropriate consultation with Trinity House and the MCA, and a safety justification for a SLoO layout will be completed should this be taken forward.

374. As with any passage, any vessel navigating within the array is expected to passage plan in accordance with SOLAS Chapter V (IMO, 1974) and promulgation of information including through ongoing liaison with fishing fleets via an appointed FLO will ensure that such vessels have good awareness of any maintenance works being undertaken. This includes the placement of safety zones of 500m radius which will be applied for around major maintenance activities which itself will assist safe navigation internally within the arrays by guiding vessels on a safe passing distance.

375. The Projects will exhibit lights, marks, sounds, signals and other aids to navigation as required by Trinity House, MCA and Civil Aviation Authority (CAA). This will include

unique identification marking of each wind farm structure in an easily understandable pattern to minimise the likelihood of a mariner navigating internally within the array becoming disoriented.

376. Should a recreational vessel under sail enter the proximity of a wind turbine, 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 wind turbines do reduce wind velocity downwind of a wind turbine (MCA, 2022) but that no negative effects on recreational craft have been reported on the basis of the limited spatial extent of the risk 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 users to date when operating in proximity to existing offshore wind developments.

377. For recreational vessels with a mast there is an additional allision risk when navigating internally within the array associated with the wind turbine blades. However, the minimum blade tip clearance is 34m above MSL which is above and beyond the minimum 22m clearance above MHWS the RYA recommend for minimising allision risk (RYA, 2019) and which is also noted in MGN 654.

378. Should an internal allision occur, the consequences will be similar to those noted for the case of a powered allision, including the determining factors. However, as with a drifting allision, the speed at which the contact occurs will likely be lower than for an external allision, resulting in reduced allision energy and a reduced likelihood of the worst case consequences arising.

#### 15.3.1.4 Frequency of Occurrence

379. The frequency of occurrence of risks due to creation of vessel to structure allision risk is **extremely unlikely** for the operations and maintenance phase.

#### 15.3.1.5 Severity of Consequence

380. The severity of consequence of risks due to creation of vessel to structure allision risk is **serious** for the operations and maintenance phase.

### 15.3.2 DBS East or DBS West In Isolation – All Users

381. Allision risk is heavily dependent upon the number of surface piercing structures. Therefore, should only one DBS array area in isolation be installed then the likelihood of an allision incident will be reduced. As DBS West has fewer routes passing in close proximity, it is likely that it will have less exposure than DBS East.

### 15.3.3 Significance of Risk – DBS East and DBS West Together

382. The frequency of occurrence, severity of consequence, and resulting significance of risk resulting from creation of vessel to structure allision risk for DBS East and DBS West together, is presented in Table 15.5.

Table 15.5 Significance of Risk for Creation of Vessel to Structure Allision Risk of DBS East and DBS West Together

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| DBS East and DBS West together | Operations and maintenance | Allision incident occurs with a platform with the vessel foundering, PLL, and/or pollution. | Extremely Unlikely | Serious | **Tolerable** |

#### 15.3.3.1 Additional Mitigation Measures and Residual Significance of Risk

383. No additional mitigation measures are proposed for this hazard and therefore the residual significance of risk remains **Tolerable**.

### 15.3.4 Significance of Risk– DBS East or DBS West in Isolation

384. The frequency of occurrence, severity of consequence, and resulting significance of risk resulting from creation of vessel to structure allision risk for DBS East and DBS West in isolation, is presented in Table 15.6.

Table 15.6 Significance of Risk for Creation of Vessel to Structure Allision Risk of DBS East and West in Isolation

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| DBS East and DBS West insolation | Operations and maintenance | Allision incident occurs with a platform with the vessel foundering, PLL, and/or pollution. | Negligible | Serious | **Broadly Acceptable** |

#### 15.3.4.1 Additional Mitigation Measures and Residual Significance of Risk

385. No additional mitigation measures are proposed for this hazard and therefore the residual significance of risk remains **Broadly Acceptable**.

## 15.4 Hazard 4 Reduction of Under-Keel Clearance due to Cable Protection (Operation and Maintenance Phase)

386. *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.*

### 15.4.1 DBS East and West Together – All Users

387. For the array, inter platform, and export cables the indicative target burial depth is between 0.5 and 1m. Seabed burial will be the primary means of cable burial and the burial depth of any external cable protection will be determined by the cable burial risk assessment.

388. Where cable burial is not possible, alternative cable protection methods may be deployed which will be determined within the cable burial risk assessment. It is noted that there are up to 40 cable or pipeline crossings anticipated for the array cables, up to six cable or pipeline crossings anticipated for the inter platform cables, and up to 12 cable or pipeline crossings anticipated for the offshore export cables. 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 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). With this guidance adhered to, the likelihood of an underwater allision is considered very low.

389. Should this percentage be exceeded, further assessment including consultation with the MCA and Trinity House may be required to determine whether any additional mitigation measures (e.g., post consent lighting and marking, charting, etc.) are necessary to ensure the safety of navigation.

390. Should an underwater allision occur, the consequences may include the grounding of the vessel. Minor damage incurred is the most likely consequence, and foundering of the vessel resulting in a PLL and pollution are the unlikely worst case consequences, with the environmental risks of the latter minimised by the implementation of the MPCP.

#### 15.4.1.1 Frequency of Occurrence

391. The frequency of occurrence of risks due to reduction of under-keel clearance is **extremely unlikely** for the operations and maintenance phase.

#### 15.4.1.2 Severity of Consequence

392. The severity of consequence of risks due to reduction of under-keel clearance is **minor** for the operations and maintenance phase.

### 15.4.2 DBS East and DBS West In Isolation – All Users

393. Under keel clearance risk is heavily dependent upon the number of cables installed and cable burial method used. Therefore, should only one DBS array area in isolation be installed, then the likelihood of an incident relating to reduced under-keel clearance will be reduced. However, it is acknowledged that the sub-sea footprint within the offshore export cable corridor may not be substantially different and so the lower likelihood of an incident relating to under keel clearance may be applicable to the array cables only.

### 15.4.3 Significance of Risk – DBS East and DBS West Together

394. The frequency of occurrence, severity of consequence, and resulting significance of risk resulting from reduction of under-keel clearance for DBS East and DBS West together, is presented in Table 15.7.

**Table 15.7 Significance of Risk for Reduction of Under-Keel Clearance of DBS East and DBS West Together**

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| DBS East and DBS West together | Operations and maintenance | Grounding incident occurs with the vessel foundering, PLL, and/or pollution. | Extremely Unlikely | Minor | **Broadly Acceptable** |

#### 15.4.3.1 Additional Mitigation Measures and Residual Significance of Risk

395. No additional mitigation measures are proposed for this hazard and therefore the residual significance of risk remains **Broadly Acceptable**.

### 15.4.4 Significance of Risk – DBS East and DBS West in Isolation

396. The frequency of occurrence, severity of consequence, and resulting significance of risk resulting from reduction of under-keel clearance for DBS East and DBS West in isolation, is presented in Table 15.8.

**Table 15.8 Significance of Risk for Reduction of Under-Keel Clearance of DBS East and DBS West**

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| DBS East and DBS | Operations and maintenance | Grounding incident occurs | Extremely Unlikely | Minor | **Broadly Acceptable** |

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| West in isolation | | with the vessel foundering, PLL, and/or pollution. | | | |

#### 15.4.4.1 Additional Mitigation Measures and Residual Significance of Risk

397. No additional mitigation measures are proposed for this hazard and therefore the residual significance of risk remains **Broadly Acceptable**.

## 15.5 Hazard 5 Anchor Interaction with Sub-sea Cables (Operation and Maintenance Phase)

398. *Presence of export cables, array cables, and inter-platform cables in the offshore environment may increase the potential for anchor interaction.*

### 15.5.1 DBS East and West Together – All Users

399. Up to 350nm of array cables may be located within the array areas alongside up to 208nm of inter-platform cables. Up to 598nm of offshore export cables may be located within the offshore export cable corridor. Where available, the primary means of cable protection will be by seabed burial, with a target burial depth of between 0.5 and 1m for all sub-sea cables. Indicatively, up to 20% of all sub-sea cables may require alternative cable protection with a height (including for crossings) of 1.0m for array cables and 1.4m for inter-array and offshore export cables. The burial depth will be informed by the cable burial risk assessment.

400. There are three anchoring scenarios which are considered for this hazard:

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

401. 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 due to the distance offshore.

402. Unlike for the array cables, the export cables may be crossed frequently by vessels on passage following the UK east coast. Given that an interaction risk exists only where the anchoring occurs in proximity to a sub-sea cable, the hazard is local in nature and has a short temporal overlap – vessels enroute will be located over the

export cables for only a short period of time. From the vessel traffic data, anchoring activity within and in proximity to the offshore export cable corridor was limited, with one instance of a vessel anchoring recorded approximately 1.4nm south of the offshore export cable corridor. There are no charted anchorage areas located in proximity to the offshore export cable corridor.

403. It is anticipated that the charting of infrastructure including all sub-sea cables will inform the decision to anchor, as per Regulation 34 of SOLAS (IMO, 1974). This includes in an emergency situation with general feedback from mariners indicating that even where time for decision-making is limited a key priority for the bridge crew whilst the anchor is being readied would be to check charts.

404. Anchor dragging features a relatively wider extent than planned or unplanned anchoring. However, from the vessel traffic data, the likelihood of a vessel dragging anchor close enough to interact with a sub-sea cable is very low. In such a circumstance, it is likely that the anchor dragging will be stopped prior to any interaction with a sub-sea cable becoming possible.

405. 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 sub-sea 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.

#### 15.5.1.1 Frequency of Occurrence

406. The frequency of occurrence of risks due to anchor interaction with sub-sea cables is **extremely unlikely** for the operations and maintenance phase.

#### 15.5.1.2 Severity of Consequence

407. The severity of consequence of risks due to anchor interaction with sub-sea cables is **minor** for the operations and maintenance phase.

### 15.5.2 DBS East or DBS West In Isolation

408. Anchor interaction risk is heavily dependent upon the number and length of sub-sea cables installed. Therefore, should only one DBS array area in isolation be installed then the likelihood of an anchor interaction incident will be reduced. However, it is acknowledged that the sub-sea footprint within the offshore export cable corridor may not be substantially different and so the lower likelihood of an anchor interaction incident may be applicable to the array cables only.

### 15.5.3 Significance of Risk – DBS East and DBS West Together

409. The frequency of occurrence, severity of consequence, and resulting significance of risk resulting from anchor interaction with sub-sea cables for DBS East and DBS West together, is presented in Table 15.9.

**Table 15.9 Significance of Risk for Anchor Interaction with Sub-Sea Cables of DBS East and DBS West Together**

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| DBS East and DBS West together | Operations and maintenance | Anchor snagging incident occurs with anchor and/or cable damage and compromised vessel stability. | Extremely Unlikely | Minor | **Broadly Acceptable** |

#### 15.5.3.1 Additional Mitigation Measures and Residual Significance of Risk

410. No additional mitigation measures are proposed for this hazard and therefore the residual significance of risk remains **Broadly Acceptable**.

### 15.5.4 Significance of Risk – DBS East and DBS West in Isolation

411. The frequency of occurrence, severity of consequence, and resulting significance of risk resulting from anchor interaction with sub-sea cables for DBS East and DBS West in isolation, is presented in Table 15.10.

**Table 15.10 Significance of Risk for Anchor Interaction with Sub-Sea Cables of DBS East and DBS West in Isolation**

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| DBS East and DBS West in isolation | Operations and maintenance | Anchor snagging incident occurs with anchor and/or cable damage and compromised vessel stability. | Extremely Unlikely | Minor | **Broadly Acceptable** |

#### 15.5.4.1 Additional Mitigation Measures and Residual Significance of Risk

412. No additional mitigation measures are proposed for this hazard and therefore the residual significance of risk remains **Broadly Acceptable**.

## 15.6 Hazard 6 Reduction of Emergency Response Capability (Including SAR Access) (Operation and Maintenance Phase)

413. *The presence of surface structures and operation and maintenance activities associated with the Projects 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.*

### 15.6.1 DBS East and West Together – All Users

#### 15.6.1.1 Emergency Response Resources

414. The operation and maintenance phase may last for up to 32 years (for the sequential build out scenario) with up to 19 operation and maintenance vessels located on-site simultaneously and making up to 473 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.

415. There are various emergency response resources serving the region, including RNLI stations (closest at Flamborough approximately 55nm to the south-west) and SAR helicopter bases (closest at Humberside approximately 83nm to the south-west). Given the distances which would be travelled in the event of an emergency response incident in proximity to the DBS array areas, this hazard covers a regional spatial extent.

416. From historical incident data, there is a low rate of incidents in the region, with the likelihood of an incident relating to the Projects occurring at the same time being unlikely. Additionally, based on the number of collision and allision incidents associated with UK offshore wind farms reported to date, there is an average of one incident per 1,508 operational wind turbine years (as of December 2022). Therefore, the Projects are not expected to result in a marked increase in the frequency of incidents requiring an emergency response.

417. Additionally, should an incident occur in proximity to the DBS array areas, it is likely that a project vessel (either for the Projects or the other Dogger Bank offshore wind farm developments) would be well equipped to assist under SOLAS obligations (IMO, 1974) and in liaison with the MCA, most likely as the first responder given the distance offshore. 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 offshore wind farm.

418. 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 the Projects leading to PLL, pollution, and vessel damage. However, this worst case scenario is highly unlikely.

#### 15.6.1.2 Search and Rescue Access

419. With a full build out of the DBS 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 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 risks.

420. From recent SAR helicopter taskings data, the frequency of UK SAR operations in proximity to the array areas is moderate, with incidents reported primarily occurring related to the Cygnus platforms. Due to the Cygnus platforms being further offshore, it is likely that SAR access may be hindered by the array areas due to the necessity of a longer flight path. However, the possibility remains of a SAR responder being able to fly over the array areas altogether, particularly in suitable weather conditions. Consideration of third-party helicopter access to/from oil and gas platforms is given in **Chapter 15: Aviation and Radar**.

421. The total area covered by the DBS array areas is approximately 288nm$^2$, which represents a relatively large area to search compared to other offshore wind farms. It is unlikely that a SAR operation will require the full extent of both DBS array areas to be searched; it is much more likely that a search could be restricted to a specific portion of the DBS array areas depending upon the information available regarding the casualty location (inclusive of any assumptions on the drift of the casualty).

422. When considering the non-full build out array layout, the minimum spacing between all structures of 830m is similar to many other consented offshore wind farms in the UK (Dogger Bank A and Dogger Bank B were consented with a minimum spacing of 700m (Forewind, 2013)). The array layout includes a SLoO and a safety justification for a SLoO layout will be completed should this be taken forward, including consideration of accessibility for SAR operations.

423. More fully, a layout plan will be agreed with the MMO following appropriate consultation with Trinity House and the MCA, with the final array layout agreed with the MCA and Trinity House post consent. However, the final array layout will be compliant with the requirements of MGN 654 (MCA, 2021), including:

- Safety justification for a SLoO (if taken forward);
- Inclusion of Helicopter Refuge Areas (HRA) as deemed necessary;
- Completion of a SAR Checklist;

- Completion of an Emergency Response Cooperation Plan (ERCoP); and
- Application of unique identification marking of structures in an easily identifiable pattern.

424. The SAR Checklist and ERCoP will remain live documents throughout the operation and maintenance phase.

425. 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.

#### 15.6.1.3 Existing Aids to Navigation

426. An indirect pathway to increasing the likelihood of an incident occurring which requires an emergency response is a risk to the use of existing aids to navigation due to the presence of the Projects.

427. There are no existing aids to navigation located within the DBS array areas or offshore export cable corridor. Additionally, the closest aids to navigation to the DBS array areas are the construction buoyage for Dogger Bank A which is expected to be removed by the operations and maintenance phase. Therefore, this element of the hazard is not considered notable.

#### 15.6.1.4 Frequency of Occurrence

428. The frequency of occurrence of risks due reduction of emergency response capability is **extremely unlikely** for the operations and maintenance phase.

#### 15.6.1.5 Severity of Consequence

429. The severity of consequence of risks due reduction of emergency response capability is **moderate** for the operations and maintenance phase.

### 15.6.2 DBS East and DBS West In Isolation – All Users

430. Should only one DBS array area in isolation be constructed, this may allow for easier SAR access to the Cygnus field, particularly if it is DBS West. In this case a direct flight path would still be able to be maintained - construction of solely DBS East in isolation would still result in a direct flight path being obstructed by the array. Fewer wind turbines would also allow for emergency responders to locate incidents more efficiently within the array and create more unoccupied sea room. In addition, construction of one site would lead to fewer on-site project vessels, reducing the likelihood that an incident would occur requiring emergency response.

### 15.6.3 Significance of Risk – DBS East and DBS West Together

431. The frequency of occurrence, severity of consequence, and resulting significance of risk resulting from reduction of emergency response capability for DBS East and DBS West together, is presented in Table 15.11.

**Table 15.11 Significance of Risk for Reduction of Emergency Response Capability of DBS East and DBS West Together**

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| DBS East and DBS West together | Operations and maintenance | Delay to a response request and inability to undertake an effective search leading to vessel damage, PLL, and pollution. | Extremely Unlikely | Moderate | **Broadly Acceptable** |

#### 15.6.3.1 Additional Mitigation Measures and Residual Significance of Risk

432. No additional mitigation measures are proposed for this hazard and therefore the residual significance of risk remains **Broadly Acceptable**.

### 15.6.4 Significance of Risk – DBS East and DBS West in Isolation

433. The frequency of occurrence, severity of consequence, and resulting significance of risk resulting from reduction of emergency response capability for DBS East and DBS West in isolation, is presented in Table 15.12.

**Table 15.12 Significance of Risk for Reduction of Emergency Response Capability of DBS East and DBS West in Isolation**

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| DBS East and DBS West in isolation | Operations and maintenance | Delay to a response request and inability to undertake an effective search leading to vessel | Extremely Unlikely | Moderate | **Broadly Acceptable** |

| Scenario | Phase | Worst Case Consequences | Frequency of Occurrence | Severity of Consequence | Significance of Risk |
|---|---|---|---|---|---|
| | | damage, PLL, and pollution. | | | |

### 15.6.4.1 Additional Mitigation Measures and Residual Significance of Risk

434. No additional mitigation measures are proposed for this hazard and therefore the residual significance of risk remains **Broadly Acceptable**.

# 16 Risk Control Log

435. Table 16.1 presents a summary of the risk assessment of shipping and navigation hazards. This includes (per hazard) the proposed embedded mitigation measures, frequency of occurrence, severity of consequence, and resulting significance of risk.

436. Any additional mitigation measures proposed are then listed per hazard alongside the residual risk.

## Table 16.1 Risk Control Log

| Hazard | Scenario | Phase | Embedded Mitigation Measures | Frequency of Occurrence | Severity of Consequence | Significance of Risk | Additional Mitigation Measures | Residual Risk |
|---|---|---|---|---|---|---|---|---|
| Vessel displacement and increased vessel to vessel collision risk between third-party vessels | DBS East and DBS West together | Construction | ▪ Application for safety zones;<br>▪ Charting of infrastructure;<br>▪ Compliance with MGN 654;<br>▪ Guard vessel(s);<br>▪ Lighting and marking;<br>▪ Pollution planning;<br>▪ Promulgation of information; and<br>▪ Traffic monitoring (construction phase and first three years of operations and maintenance phase only). | Reasonably Probable | Moderate | **Tolerable** | Consultation with Regular Operators including DFDS Seaways to allow further consideration of any adverse weather routeing in the region | **Tolerable with Mitigation** |
| | | Operations and maintenance | | Reasonably Probable | Moderate | **Tolerable** | | **Tolerable with Mitigation** |
| | | Decommissioning | | Reasonably Probable | Moderate | **Tolerable** | | **Tolerable with Mitigation** |
| | DBS East in isolation | Construction | | Reasonably Probable | Moderate | **Tolerable** | | **Tolerable with Mitigation** |
| | | Operations and maintenance | | Reasonably Probable | Moderate | **Tolerable** | | **Tolerable with Mitigation** |
| | | Decommissioning | | Reasonably Probable | Moderate | **Tolerable** | | **Tolerable with Mitigation** |
| | DBS West in isolation | Construction | | Remote | Moderate | **Tolerable** | | **Tolerable with Mitigation** |
| | | Operations and maintenance | | Remote | Moderate | **Tolerable** | | **Tolerable with Mitigation** |
| | | Decommissioning | | Remote | Moderate | **Tolerable** | | **Tolerable with Mitigation** |
| Increased vessel to | DBS East and DBS | Construction | | Negligible | Serious | **Broadly Acceptable** | None | **Broadly Acceptable** |

| Hazard | Scenario | Phase | Embedded Mitigation Measures | Frequency of Occurrence | Severity of Consequence | Significance of Risk | Additional Mitigation Measures | Residual Risk |
|---|---|---|---|---|---|---|---|---|
| vessel collision risk between a third-party vessel and a project vessel | West together | Operations and maintenance | ▪ Application for safety zones;<br>▪ Fishing liaison;<br>▪ Guard vessel(s);<br>▪ Lighting and marking;<br>▪ Marine coordination for project vessels;<br>▪ Project vessel compliance with international marine regulations;<br>▪ Pollution planning; and<br>▪ Promulgation of information. | Negligible | Serious | **Broadly Acceptable** | | **Broadly Acceptable** |
| | | Decommissioning | | Negligible | Serious | **Broadly Acceptable** | | **Broadly Acceptable** |
| | DBS East or DBS West in isolation | Construction | | Negligible | Serious | **Broadly Acceptable** | | **Broadly Acceptable** |
| | | Operations and maintenance | | Negligible | Serious | **Broadly Acceptable** | | **Broadly Acceptable** |
| | | Decommissioning | | Negligible | Serious | **Broadly Acceptable** | | **Broadly Acceptable** |
| Creation of vessel to structure allision risk | DBS East and DBS West together | Operations and maintenance | ▪ Application for safety zones;<br>▪ Charting of infrastructure;<br>▪ Compliance with MGN 654;<br>▪ Fishing liaison;<br>▪ Layout plan;<br>▪ Lighting and marking;<br>▪ Minimum blade clearance;<br>▪ Pollution planning; and | Extremely Unlikely | Serious | **Tolerable** | None | **Tolerable** |
| | DBS East or DBS West in isolation | | | Negligible | Serious | **Broadly Acceptable** | | **Broadly Acceptable** |

| Hazard | Scenario | Phase | Embedded Mitigation Measures | Frequency of Occurrence | Severity of Consequence | Significance of Risk | Additional Mitigation Measures | Residual Risk |
|---|---|---|---|---|---|---|---|---|
| | | | ▪ Promulgation of information. | | | | | |
| Reduction of under-keel clearance due to cable protection | DBS East and DBS West together | Operations and maintenance | ▪ Cable burial risk assessment;<br>▪ Compliance with MGN 654;<br>▪ Pollution planning; and<br>▪ Promulgation of information. | Extremely Unlikely | Minor | **Broadly Acceptable** | None | **Broadly Acceptable** |
| | DBS East or DBS West in isolation | | | Extremely Unlikely | Minor | **Broadly Acceptable** | | **Broadly Acceptable** |
| Anchor interaction with sub-sea cables | DBS East and DBS West together | Operations and maintenance | ▪ Cable burial risk assessment;<br>▪ Charting of infrastructure;<br>▪ Guard vessel(s); and<br>▪ Promulgation of information. | Extremely Unlikely | Minor | **Broadly Acceptable** | None | **Broadly Acceptable** |
| | DBS East or DBS West in isolation | | | Extremely Unlikely | Minor | **Broadly Acceptable** | | **Broadly Acceptable** |
| Reduction of emergency response capability | DBS East and DBS West together | Operations and maintenance | ▪ Compliance with MGN 654;<br>▪ Layout plan;<br>▪ Lighting and marking;<br>▪ Marine coordination for project vessels; | Extremely Unlikely | Moderate | **Broadly Acceptable** | None | **Broadly Acceptable** |
| | DBS East or DBS | | | Extremely Unlikely | Moderate | **Broadly Acceptable** | | **Broadly Acceptable** |

| Hazard | Scenario | Phase | Embedded Mitigation Measures | Frequency of Occurrence | Severity of Consequence | Significance of Risk | Additional Mitigation Measures | Residual Risk |
|---|---|---|---|---|---|---|---|---|
| | West in isolation | | ▪ Pollution planning; and<br>▪ Project vessel compliance with international marine regulations. | | | | | |

# 17 Mitigation Measures

## 17.1 Embedded Mitigation Measures

437. As part of the design process for the Projects, a number of embedded mitigation measures have been adopted to reduce the risk of hazards identified, including those relevant to shipping and navigation. These measures have and will continue to evolve over the development process as the EIA progresses and in response to consultation.

438. These measures typically include those that have been identified as good or standard practice and include actions that will be undertaken to meet existing legislation requirements. As there is a commitment to implementing these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of the Projects.

439. The embedded mitigation measures within the design relevant to shipping and navigation are outlined in Table 17.1.

**Table 17.1 Embedded Mitigation Measures Relevant to Shipping and Navigation**

| Embedded Mitigation Measure | Details |
|---|---|
| Aids to navigation management plan | An aids to navigation management plan for the Projects will be agreed with Trinity House. |
| Application for safety zones | An application will be made for safety zones post consent including up to 500m around ongoing activities during construction, major maintenance, and decommissioning and up to 50m for installed structures pre commissioning. |
| Cable burial risk assessment | Where possible, cable burial will be the preferred option for cable protection with the cable burial depth to be informed by a cable burial risk assessment and detailed within the Cable Specification Plan. Any damage, destruction or decay of cables must be notified to MCA, Trinity House, Kingfisher and UKHO no later than 24 hours after discovered. |
| Charting of infrastructure | There will be appropriate marking of all offshore infrastructure associated with the Projects on UKHO admiralty charts. |
| Compliance with MGN 654 | The Projects will ensure compliance with MGN 654 and its annexes, where applicable, including completion of a SAR checklist. |
| Decommissioning Plan | A Decommissioning Plan will be developed prior to decommissioning. |
| Fishing liaison | Ongoing liaison with fishing fleets will be maintained during construction, maintenance, and decommissioning operations via an appointed FLO. |
| Guard vessel(s) | Where appropriate, guard vessels will be used to ensure adherence with safety zones or advisory passing distances. |
| Layout plan | A layout plan (including sub-sea cables) for the Projects will be agreed with the MMO following appropriate consultation with Trinity House and the MCA setting out proposed details of the offshore development areas. |

| Embedded Mitigation Measure | Details |
|---|---|
| Lighting and marking | Lights, marks, sounds, signals and other aids to navigation will be exhibited as required by Trinity House, MCA, and CAA including a buoyed construction area around the arrays. |
| Marine coordination for project vessels | Marine coordination will be implemented to manage project vessels throughout construction and maintenance periods. |
| Minimum blade clearance | There will be a minimum blade tip clearance (air draft height) of at least 34m above MSL. |
| Pollution planning | An MPCP will be developed outlining procedures to protect personnel working and to safeguard the marine environment. |
| Project vessel compliance with international marine regulations | Project vessels will ensure compliance with Flag State regulations including the COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974). |
| Promulgation of information | The Projects will ensure that local Notifications to Mariners are updated and reissued at weekly intervals during construction activities and at least five days before any planned operation and maintenance works and supplemented with VHF radio broadcasts agreed with the MCA in accordance with the construction and monitoring programme approved under the relevant Deemed Marine Licence (dML) condition. |
| | Advance warning and accurate location details of construction, maintenance and decommissioning operations (including details of vessel routes, timings and locations), associated safety zones and advisory passing distances will be given via Kingfisher Bulletins at least 14 days prior where possible. |
| Traffic monitoring | Monitoring of vessel traffic will be undertaken for the duration of the construction phase and during the first three years of the operation and maintenance phase. |
| Under keel clearance | Where scour protection is required, MGN 654 will be adhered to with respect to changes greater than 5% to the charted depths referenced to CD in consultation with the MCA and Trinity House. |

## 17.2 Additional Mitigation Measures

440. The following additional mitigation measure has been identified relevant to shipping and navigation within the risk assessment undertaken in Section 15:

- Consultation should be undertaken with Regular Operators including DFDS Seaways to allow further consideration of any adverse weather routeing in the region.

## 17.3 Marine Aids to Navigation

441. Throughout all phases, aids to navigation will be provided in accordance with Trinity House and MCA requirements, with consideration being given to IALA Guideline

G1162 (IALA, 2021 (a)), IALA Recommendation O-139 (IALA, 2021 (b)), and MGN 654 (MCA, 2021).

### 17.3.1 Construction and Decommissioning Phases

442. During the construction and decommissioning phases, buoyed construction and decommissioning areas will be established and marked, where required, in accordance with Trinity House requirements based on the IALA Maritime Buoyage System.

### 17.3.2 Operations and Maintenance Phase

443. Marking during the operation and maintenance phase will be agreed in consultation with Trinity House once the final array layouts has been selected post consent; however, the following subsections summarise likely requirements.

#### 17.3.2.1 Marking of Individual Array Structures

444. As per IALA Guideline G1162, each surface structure within the DBS array areas will be painted yellow from the level of Highest Astronomical Tide (HAT) to at least 15m above HAT. Each structure will also be clearly marked with a unique alphanumeric identifier which will be clearly visible from all directions. The MCA will advise post consent on the specific requirements for the identifiers, but a logical pattern with potential for additional visual marks may be considered by statutory stakeholders. Each identifier will be illuminated by a low-intensity light such that the sign is available from a vessel thus enabling the structure to be identified at a suitable distance to avoid an allision incident.

445. The identifiers will be situated such that under normal conditions of visibility and all known tidal conditions, they are clearly readable by an observer (with the naked eye), stationed 3m above sea level and at a distance of at least 150m from the wind turbine. The light will be either hooded or baffled so as to avoid unnecessary light pollution or confusion with navigational marks.

#### 17.3.2.2 Marking of Array as a Whole

446. The marking of the array(s) as a whole will be agreed with Trinity House once the final array layout has been selected and will be in line with IALA Guideline G1162 and Recommendation O-139. As per the IALA guidance, and in consultation with Trinity House, it will be ensured that:

- All corner structures will be marked as a Significant Peripheral Structure (SPS) and where necessary, to satisfy the spacing requirements between SPSs, additional periphery structures may also be marked as SPSs;
- Structures designated as an SPS will exhibit a flashing yellow five second (flash yellow every five seconds) light of at least 5nm nominal range and

omnidirectional fog signals as appropriate and where prescribed by Trinity House, and will be sounded at least when the visibility is 2nm or less;

- Further periphery structures may be marked as Intermediate Peripheral Structures (IPS) including a flashing yellow light with a distinctly different flash character from those displayed on the SPSs and at least 2nm nominal range;
- All lights will be visible to shipping through 360˚ and if more than one lantern is required on a structure to meet the all-round visibility requirement, then all the lanterns on that structure will be synchronised;
- All lights will be exhibited at the same height at least 6m above HAT and below the arc of the lowest wind turbine blades;
- All lights will be exhibited at least at night;
- Remote monitoring sensors using Supervisory Control and Data Acquisition (SCADA) will be included as part of the lighting and marking scope to ensure a high level of availability for all aids to navigation;
- Aviation lighting will be as per CAA requirements; and
- All lighting will be considered cumulatively with existing aids to navigation to avoid the potential for light confusion to passing traffic.

447. Consideration will also be given to the use of marking via AIS, or other electronic means (such as Radar Beacons (Racon)) to assist safe navigation particularly in reduced visibility. AIS transmitters or virtual buoys could also be considered internally to assist with safe navigation within the array areas.

448. Additionally, consideration will be given to the cumulative lighting and marking of the Projects alongside Dogger Bank A, again in consultation with Trinity House.

#### 17.3.2.3 Marking of Offshore Export Cables

449. No lighting or physical marking will be required during the operation and maintenance phase for the offshore export cables.

## 17.4 Design Specifications Noted in Marine Guidance Note 654

450. The individual wind turbines and other structures will have functions and procedures in place for generator shut down in emergency situations, as per MGN 654 (MCA, 2021).

# 18 Summary and Next Steps

451. Using baseline data, expert opinion, stakeholder concerns, and lessons learnt from existing offshore developments, hazards relating to shipping and navigation have been identified due to the presence of the Projects for all phases of the development (construction, operation and maintenance, and decommissioning). This has been fed into the risk assessment – which follows the FSA approach – undertaken in Section 15.

## 18.1 Consultation

452. Thus far, consultation has been undertaken with key shipping and navigation stakeholders, including dedicated meetings with:

- MCA;
- Trinity House;
- UK Chamber of Shipping; and
- MoD (Scoping response).

## 18.2 Baseline Characterisation

### 18.2.1 Navigational Features

453. The under construction Dogger Bank A development is located approximately 4nm north-east of the DBS array areas. Construction buoyage related to Dogger Bank A is currently present but will be removed once construction is completed. The Dogger Bank B, Sofia, and Dogger Bank C developments are expected to be constructed in the coming years.

454. Various oil and gas infrastructure associated with nearby gas fields exists in proximity to the Offshore Development Area, with the closest of these being the Cavendish platform, located 1.6nm to the south of the DBS East array area and within the offshore export cable corridor.

455. Six sub-sea pipelines pass through the DBS array areas, although four are disused. Two of the disused sub-sea pipelines also intersect the offshore export cable corridor. Currently under installation sub-sea cables for Dogger Bank A are located north and north-west of the DBS array areas and pass alongside the offshore export cable corridor for much of its length, including an intersection over a distance of approximately 6.2nm.

### 18.2.2 Maritime Incidents

456. From DfT SAR helicopter taskings data recorded between April 2015 and March 2022, there was an average of five SAR taskings per year within the DBS East study area, with most rescue / recovery incidents occurring in close proximity to the Cygnus gas

field. There was an average of one SAR tasking every one to two years in the DBS West study area.

457. Within the offshore export cable corridor study area there was an average of three SAR taskings per year, consisting primarily of rescue / recovery incidents closer to shore.

458. From RNLI incident data recorded between 2010 and 2019, there was a single documented incident responded to by the RNLI within the DBS East study area – a sailing vessel experiencing machinery failure. No documented incidents were responded to within the DBS West study area.

459. Within the offshore export cable corridor study area there was an average of five to six unique RNLI incidents per year with machinery failure (51%) and person in danger (14%) the most frequently recorded incident types.

460. From MAIB incident data recorded between 2010 and 2019, there were four recorded incidents within the DBS East study area and one incident recorded within the DBS West study area.

461. Within the offshore export cable corridor study area there was an average of one to two unique MAIB incidents per year with "*machinery failure*" (46%) and "*damage / loss of equipment*" (14%) the most frequently recorded incident types. Two MAIB incidents occurred within the offshore export cable corridor itself.

### 18.2.3 Vessel Traffic Movements

462. From 28 days of vessel traffic survey data recorded in July 2022 (summer) and October / November 2022 (winter) within the DBS East study area, there was an average of 14 unique vessels per day with an average of three unique vessels per day within the DBS East array area itself. In the DBS West study area there was an average of ten unique vessels per day with an average of three unique vessels per day within the DBS West array area itself.

463. Throughout both survey periods, the main vessel types recorded within the DBS East study area were cargo vessels (40%), oil and gas vessels (30%), tankers (14%), and fishing vessels (14%). The main vessel types recorded within the DBS West study area were cargo vessels (46%), tankers (18%), oil and gas vessels (14%), and fishing vessels (10%).

464. A total of ten main commercial routes were identified within the array routeing study area from the vessel traffic survey data. The most heavily trafficked main commercial route – with an average of two unique vessels per day – was between Immingham and Gothenburg, featuring RoRo cargo services operated by DFDS Seaways and Finnlines.

465. From 28 days of vessel traffic data recorded in July 2022 (summer) and October / November 2022 (winter) within the offshore export cable corridor study area, there was an average of 50 unique vessels per day with an average of 47 unique vessels per day within the offshore export cable corridor itself.

466. Throughout both survey periods, the main vessel types recorded within the offshore export cable corridor study area were cargo vessels (42%), tankers (24%), and fishing vessels (13%).

## 18.3 Future Case Vessel Traffic

467. Indicative 10% and 20% increases in vessel traffic associated with commercial vessels, commercial fishing vessels, and recreational vessels has been considered for the future case scenario. Additionally, transits made by project vessels have been considered.

468. Deviations due to the presence of the Projects would be required for five out of the ten main commercial routes identified with the level of deviation varying between a 0.1nm increase for routes between Tees and Gdynia / Grimsby and Thyborøn; and an increase of 10.7nm for a route between Rotterdam and Icelandic ports.

## 18.4 Preliminary Environmental Information Report Risk Statement

469. Using the baseline data, expert opinion, stakeholder concerns and lessons learnt from existing offshore developments, shipping and navigation hazards have been risk assessed in line with the FSA methodology. The full risk control log including details of hazards, embedded mitigation measures and significance of risk is presented in Section 16.

470. The significance of risk has been determined as either **Broadly Acceptable** or **Tolerable** for all shipping and navigation hazards assessed. With additional mitigation measures applied, the residual risk is **Broadly Acceptable** or **Tolerable with Mitigation** for all shipping and navigation hazards.

471. As acknowledged in Section 18.5, there are various additional steps which remain to be undertaken for the NRA submitted at the ES stage which will lead to further inputs being available to inform the risk assessment at the ES stage.

## 18.5 Next Steps

472. Although this NRA considers the requirements of the MGN 654 Checklist (see Appendix A), it is acknowledged that various additional steps will be required post-PEIR to ensure a comprehensive NRA is submitted at the ES stage. These include:

- Additional consultation with shipping and navigation stakeholders including Regular Operators;

- Completion of a Hazard Workshop with relevant stakeholders and subsequent hazard log;
- Analysis of meteorological ocean (metocean) data to inform the baseline and collision and allision risk modelling;
- Analysis of DfT vessel arrivals data to inform the baseline;
- Collection and analysis of MGN 654 compliant vessel traffic survey for a suitable study area around the RCP;
- Analysis of additional AIS data collected from an on-site vessel between April and July 2022;
- Consideration of the RYA Coastal Atlas of Recreational Boating (RYA, 2019) to inform the baseline;
- Modelling of collision and allision risk for the pre and post wind farm scenarios;
- Consequences assessment based on the outputs of the collision and allision risk modelling;
- Updating of the risk assessment based on the additional information gathered above including a full risk assessment for the RCP and/or electrical switching platform;
- Review of the cumulative screening for new information available; and
- Completion of a cumulative risk assessment including cumulative main commercial route deviations.

473. The completion of these additional steps will ensure that the risk assessment included in the NRA at the ES stage is as well informed and comprehensive as possible, including the significance of risk determined for each hazard.

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# Appendix A Marine Guidance Note 654 Checklist

474. The MGN 654 Checklist may be divided into two distinct checklists, one considering the main MGN 654 guidance document (MCA, 2021) and one considering the *Methodology for Assessing Marine Navigational Safety and Emergency Response Risks of OREIs* which serves as Annex 1 to MGN 654.

475. The checklist for the main MGN 654 guidance document is presented in Table A.1. Following this, the checklist for the MCA's methodology annex is presented in Table A.2. For both checklists, references to where the relevant information and / or assessment is provided in the NRA is given.

### Table A.1 MGN 654 Checklist for Main Document

| Issue | Compliance | Comments |
|---|---|---|
| **Site and Installation Coordinates.** Developers are responsible for ensuring that formally agreed coordinates and subsequent variations of site perimeters and individual OREI structures are made available, on request, to interested parties at relevant project stages, including application for consent, development, array variation, operation and decommissioning. This should be supplied as authoritative Geographical Information System (GIS) data, preferably in Environmental Systems Research Institute (ESRI) format. Metadata should facilitate the identification of the data creator, its date and purpose, and the geodetic datum used. For mariners' use, appropriate data should also be provided with latitude and longitude coordinates in WGS84 (European Terrestrial Reference System 1989 (ETRS89)) datum. | | |
| **Traffic Survey.** Includes: | | |
| All vessel types. | ✓ | **Section 9: Vessel Traffic Movements**<br>All vessel types are considered with specific breakdowns by vessel type given for the DBS array areas and offshore export cable corridor. |
| At least 28 days duration, within either 12 or 24 months prior to submission of the ES. | ✓ | **Section 5: Data Sources**<br>A total of 28 full days of vessel traffic survey data from July and October / November 2022 has been assessed within the respective study areas for the Offshore Development Area. |
| Multiple data sources. | ✓ | **Section 5: Data Sources**<br>The vessel traffic survey data includes AIS, visual observations and Radar for the summer and winter periods to ensure maximal coverage of vessels not broadcasting on AIS. |
| Seasonal variations. | ✓ | **Section 5: Data Sources**<br>A total of 28 full days of vessel traffic survey data from July and October / November 2022 has been assessed within the respective study areas for the Offshore Development Area. |
| MCA consultation. | ✓ | **Section 4: Consultation**<br>The MCA have been consulted as part of the NRA process. |
| General Lighthouse Authority (GLA) consultation. | ✓ | **Section 4: Consultation**<br>Trinity House have been consulted as part of the NRA process. |

| Issue | Compliance | Comments |
|---|---|---|
| UK Chamber of Shipping consultation. | ✓ | **Section 4: Consultation**<br>The UK Chamber of Shipping have been consulted as part of the NRA process. |
| Recreational and fishing vessel organisations consultation. | **To be included post-PEIR** | Will be undertaken post-PEIR document authoring as part of the Hazard Workshop (see Section 18.5). |
| Port and navigation authorities consultation, as appropriate. | **To be included post-PEIR** | Will be undertaken post-PEIR document authoring as part of the Hazard Workshop (see Section 18.5). |
| **Assessment of the cumulative and individual effects of (as appropriate):** | | |
| i. Proposed OREI site relative to areas used by any type of marine craft. | ✓ | **Section 9: Vessel Traffic Movements**<br>Vessel traffic data in proximity to the Projects has been analysed.<br><br>**Section 15: Risk Assessment**<br>The hazards due to the Projects have been assessed for each phase including for all relevant users. |
| ii. Numbers, types and sizes of vessels presently using such areas. | ✓ | **Section 9: Vessel Traffic Movements**<br>Vessel traffic data in proximity to the Projects has been analysed and includes breakdowns of daily vessel count, vessel type and vessel size. |
| iii. Non-transit uses of the areas, e.g., fishing, day cruising of leisure craft, racing, aggregate dredging, personal watercraft, etc. | ✓ | **Section 9: Vessel Traffic Movements**<br>Non-transit users were identified in the vessel traffic survey data and included fishing vessels engaged in fishing activities, support for oil and gas activities, and anchoring. |
| iv. Whether these areas contain transit routes used by coastal or deep-draught vessels on passage. | ✓ | **Section 9: Vessel Traffic Movements**<br>Main commercial routes have been identified using the principles set out in MGN 654 in proximity to the DBS array areas, with these routes accounting for coastal, deep draught and internationally scheduled vessels. |
| v. Alignment and proximity of the site relative to adjacent shipping lanes. | ✓ | **Section 7: Navigational Features**<br>There are no IMO routeing measures in proximity to the Offshore Development Area. |
| vi. Whether the nearby area contains prescribed routeing schemes or precautionary areas. | ✓ | **Section 7: Navigational Features**<br>There are no IMO routeing measures or precautionary areas in proximity to the Offshore Development Area. |
| vii. Proximity of the site to areas used for anchorage (charted or uncharted), safe haven, port approaches and pilot boarding or landing areas. | ✓ | **Section 7: Navigational Features**<br>There are no designated anchorage areas or ports / harbours in proximity to the Offshore Development Area. |
| viii. Whether the site lies within the jurisdiction of a port and / or navigation authority. | ✓ | **Section: Navigational Features**<br>There are no ports / harbours in proximity to the Offshore Development Area. |

| Issue | Compliance | Comments |
|---|---|---|
| ix. Proximity of the site to existing fishing grounds, or to routes used by fishing vessels to such grounds. | ✓ | **Section 9: Vessel Traffic Movements**<br>Commercial fishing vessel movements are considered within the respective study areas for the DBS array areas and offshore export cable corridor. |
| x. Proximity of the site to offshore firing / bombing ranges and areas used for any marine military purposes. | ✓ | **Section 7: Navigational Features**<br>Military practice and exercise areas in proximity to the Offshore Development Area have been identified. |
| xi. Proximity of the site to existing or proposed submarine cables or pipelines, offshore oil / gas platforms, marine aggregate dredging, marine archaeological sites or wrecks, Marine Protected Areas or other exploration / exploitation sites. | ✓ | **Section 7: Navigational Features**<br>Sub-sea cables and pipelines, oil and gas infrastructure, and charted wrecks and obstructions in proximity to the Offshore Development Area have been identified. There are no marine aggregate dredging areas in proximity to the Offshore Development Area. |
| xii. Proximity of the site to existing or proposed OREI developments, in cooperation with other relevant developers, within each round of lease awards. | ✓ | **Section 7: Navigational Features**<br>Other offshore wind farm developments in proximity to the Offshore Development Area have been identified. |
| xiii. Proximity of the site relative to any designated areas for the disposal of dredging spoil or other dumping ground. | ✓ | **Section 7: Navigational Features**<br>There are no spoil grounds or other dumping grounds in proximity to the Offshore Development Area. |
| xiv. Proximity of the site to aids to navigation and / or VTS in or adjacent to the area and any impact thereon. | ✓ | **Section 7: Navigational Features**<br>Key aids to navigation in proximity to the Offshore Development Area have been identified. |
| xv. Researched opinion using computer simulation techniques with respect to the displacement of traffic and, in particular, the creation of 'choke points' in areas of high traffic density and nearby or consented OREI sites not yet constructed. | **To be included post-PEIR** | Will be undertaken post-PEIR as part of the collision and allision risk modelling (see Section 18.5). |

| Issue | Compliance | Comments |
|---|---|---|
| xvi. With reference to xv. above, the number and type of incidents to vessels which have taken place in or near to the proposed site of the OREI to assess the likelihood of such events in the future and the potential impact of such a situation. | ✓ | **Section 8: Emergency Response and Incident Overview**<br>Historical vessel incident data published by the MAIB, RNLI and DfT in proximity to the Offshore Development Area has been considered alongside historical offshore wind farm incident data throughout the UK. |
| xvii. Proximity of the site to areas used for recreation which depend on specific features of the area. | ✓ | **Section 9: Vessel Traffic Movements**<br>Recreational vessel movements are considered within the respective study areas for the DBS array areas and offshore export cable corridor. |
| **Predicted effect of OREI on traffic and interactive boundaries**. Where appropriate, the following should be determined: | | |
| a. The safe distance between a shipping route and OREI boundaries. | ✓ | **Section 14: Future Case Vessel Traffic**<br>A methodology for post wind farm routeing is outlined and includes a minimum distance of 1nm from offshore installations and existing offshore wind farm boundaries. |
| b. The width of a corridor between sites or OREIs to allow safe passage of shipping. | ✓ | No navigation corridor with regular routeing by commercial vessels have been identified between offshore wind farm developments. |
| **OREI Structures**. The following should be determined: | | |
| a. Whether any feature of the OREI, including auxiliary platforms outside the main generator site, mooring and anchoring systems, inter-device and export cabling could pose any type of difficulty or danger to vessels underway, performing normal operations, including fishing, anchoring and emergency response. | ✓ | **Section 15: Risk Assessment**<br>The hazards due to the Projects have been assessed for each phase and include consideration of anchoring and emergency response. |
| b. Clearances of fixed or floating wind turbine blades above the sea surface are not less than 22m (above MHWS for fixed). Floating wind turbines allow for degrees of motion. | ✓ | **Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including a minimum blade tip clearance of at least 22m above MHWS. |
| c. Underwater devices:<br>i. Changes to charted depth;<br>ii. Maximum height above seabed; and<br>iii. Under keel clearance. | ✓ | **Section 6: Project Description Relevant to Shipping and Navigation**<br>Array and export cable specifications relevant to the MDS for shipping and navigation are provided. |

| Issue | Compliance | Comments |
|---|---|---|
| d. Whether structures block or hinder the view of other vessels or other navigational features. | ✓ | **Section 12: Navigation, Communication, and Position Fixing Equipment**<br>Hazards relating to the use of existing aids to navigation are considered.<br><br>**Section 15: Risk Assessment**<br>The hazards due to the Projects have been assessed for each phase and include consideration of visual hindrance to navigation. |
| **The effect of tides, tidal streams and weather**. It should be determined whether: | | |
| a. Current maritime traffic flows and operations in the general area are affected by the depth of water in which the proposed installation is situated at various states of the tide, i.e., whether the installation could pose problems at high water which do not exist at low water conditions, and vice versa. | ✓ | **Section 6: Project Description Relevant to Shipping and Navigation**<br>The range of water depths within the Offshore Development Area are provided.<br><br>**Section 9: Vessel Traffic Movements**<br>Vessel traffic data in proximity to the Offshore Development Area has been analysed. |
| b. The set and rate of the tidal stream, at any state of the tide, has a significant effect on vessels in the area of the OREI site. | **To be included post-PEIR** | Will be undertaken post-PEIR as part of the analysis of metocean data (see Section 18.5). |
| c. The maximum rate tidal stream runs parallel to the major axis of the proposed site layout, and, if so, its effect. | **To be included post-PEIR** | |
| d. The set is across the major axis of the layout at any time, and, if so, at what rate. | **To be included post-PEIR** | |
| e. In general, whether engine failure or other circumstance could cause vessels to be set into danger by the tidal stream, including unpowered vessels and small, low speed craft. | ✓ | **Section 15: Risk Assessment**<br>The hazards due to the Projects have been assessed for each phase and include consideration of drifting allision risk, noting that analysis of metocean data will further inform this assessment post-PEIR. |
| f. The structures themselves could cause changes in the set and rate of the tidal stream. | **To be included post-PEIR** | Will be undertaken post-PEIR as part of the analysis of metocean data (see Section 18.5). |

| Issue | Compliance | Comments |
|---|---|---|
| g. The structures in the tidal stream could be such as to produce siltation, deposition of sediment or scouring, affecting navigable water depths in the wind farm area or adjacent to the area. | ✓ | **Section 15: Risk Assessment**<br>The hazards due to the Projects have been assessed for each phase and include consideration of reduction in under keel clearance. |
| h. The site, in normal, bad weather, or restricted visibility conditions, could present difficulties or dangers to craft, including sailing vessels, which might pass in close proximity to it. | ✓ | **Section 9: Vessel Traffic Movements**<br>Vessel traffic data in proximity to the Offshore Development Area has been analysed including recreational vessels.<br><br>**Section 11: Adverse Weather Routeing**<br>Alternative routeing used during periods of adverse weather has been identified.<br><br>**Section 15: Risk Assessment**<br>The hazards due to the Projects have been assessed for each phase and include consideration of adverse weather routeing. |
| i. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer. | ✓ | **Section 15: Risk Assessment**<br>The hazards due to the Projects have been assessed for each phase and include consideration of vessels under sail. |
| j. In general, taking into account the prevailing winds for the area, whether engine failure or other circumstances could cause vessels to drift into danger, particularly if in conjunction with a tidal set such as referred to above. | ✓ | **Section 15: Risk Assessment**<br>The hazards due to the Projects have been assessed for each phase and include consideration of drifting allision risk, noting that analysis of metocean data will further inform this assessment post-PEIR. |
| **Assessment of access to and navigation within, or close to, an OREI**. To determine the extent to which navigation would be feasible within the OREI site itself by assessing whether: | | |
| a. Navigation within or close to the site would be safe: | | |
| i. For all vessels. | ✓ | **Section 4: Consultation**<br>Consultation with Regular Operators will be undertaken post-PEIR document authoring as part of the Hazard Workshop.<br><br>**Section 11: Adverse Weather Routeing**<br>Alternative routeing used during periods of adverse weather has been identified.<br><br>**Section 15: Risk Assessment**<br>The hazards due to the Projects have been assessed for each phase and include consideration of internal navigation. |
| ii. For specified vessel types, operations and / or sizes. | | |
| iii. In all directions or areas. | | |
| iv. In specified directions or areas. | | |

| Issue | Compliance | Comments |
|---|---|---|
| v. In specified tidal, weather or other conditions. | | |
| b. Navigation in and / or near the site should be prohibited or restricted: | | |
| i. For specified vessel types, operations and / or sizes. | ✓ | **Section 12: Navigation, Communication, and Position Fixing Equipment**<br>Hazards relating to the use of navigation, communication, and position fixing devices used in and around offshore wind farms are assessed.<br><br>**Section 15: Risk Assessment**<br>The hazards due to the Projects have been assessed for each phase and include consideration of internal navigation.<br><br>**Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including an application for safety zones. |
| ii. In respect of specific activities. | ✓ | |
| iii. In all areas or directions. | ✓ | |
| iv. In specified areas or directions. | ✓ | |
| v. In specified tidal or weather conditions. | ✓ | |
| c. Where it is not feasible for vessels to access or navigate through the site it could cause navigational, safety or routeing problems for vessels operating in the area, e.g., by preventing vessels from responding to calls for assistance from persons in distress. | ✓ | **Section 15: Risk Assessment**<br>The hazards due to the Projects have been assessed for each phase and include consideration of emergency response capability. |
| d. Guidance on the calculation of safe distance of OREI boundaries from shipping routes has been considered. | ✓ | **Section 14: Future Case Vessel Traffic**<br>A methodology for post wind farm routeing is outlined and includes consideration of the Shipping Route Template. |
| **SAR, maritime assistance service, counter pollution and salvage incident response**. | | |
| The MCA, through HM Coastguard, is required to provide SAR and emergency response within the sea area occupied by all OREIs in UK waters. To ensure that such operations can be safely and effectively conducted, certain requirements must be met by developers and operators. | | |
| a. An ERCoP will be developed for the construction, operation and decommissioning phases of the OREI. | ✓ | **Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including compliance with MGN 654, which requires the creation of an ERCoP. |

| Issue | Compliance | Comments |
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| b. The MCA's guidance document *Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for Search and Rescue and Emergency Response* (MCA, 2021) for the design, equipment and operation requirements will be followed. | ✓ | **Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including compliance with MGN 654, which requires fulfilment of requirements in the stated guidance document. |
| c. A SAR checklist will be completed to record discussions regarding the requirements, recommendations and considerations outlined in Annex 5 (to be agreed with MCA). | ✓ | **Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including compliance with MGN 654, which requires the completion of the SAR checklist. |
| **6. Hydrography**. In order to establish a baseline, confirm the safe navigable depth, monitor seabed mobility and to identify underwater hazards, detailed and accurate hydrographic surveys are included or acknowledged for the following stages and to MCA specifications: | | |
| i. Pre construction: The proposed generating assets area and proposed cable route. | ✓ | **Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including compliance with MGN 654, which requires the specified hydrographic surveys to be completed. |
| ii. On a pre-established periodicity during the life of the development. | ✓ | |
| iii. Post construction: Cable route(s). | ✓ | |
| iv. Post decommissioning of all or part of the development: the installed generating assets area and cable route. | ✓ | |
| **Communications, Radar and positioning systems**. To provide researched opinion of a generic and, where appropriate, site specific nature concerning whether: | | |
| a. The structures could produce radio interference such as shadowing, reflections or phase changes, and emissions with respect to any frequencies used for marine positioning, navigation, and timing (PNT) or communications, including GMDSS and AIS, whether ship borne, ashore, or fitted to any of the proposed structures, to: | | |
| i. Vessels operating at a safe navigational distance. | ✓ | **Section 12: Navigation, Communication, and Position Fixing Equipment** |

| Issue | Compliance | Comments |
|---|---|---|
| ii. Vessels by the nature of their work necessarily operating at less than the safe navigational distance to the OREI, e.g., support vessels, survey vessels, SAR assets. | ✓ | Hazards relating to the use of navigation, communication, and position fixing devices used in and around offshore wind farms are assessed. |
| iii. Vessels by the nature of their work necessarily operating within the OREI. | ✓ | |
| b. The structures could produce Radar reflections, blind spots, shadow areas or other adverse effects: | | |
| i. Vessel to vessel. | ✓ | **Section 12: Navigation, Communication, and Position Fixing Equipment**<br>Hazards relating to the use of navigation, communication, and position fixing devices used in and around offshore wind farms are assessed. |
| ii. Vessel to shore. | ✓ | |
| iii. VTS Radar to vessel. | ✓ | |
| iv. Racon to / from vessel. | ✓ | |
| c. The structures and generators might produce SONAR interference affecting fishing, industrial or military systems used in the area. | ✓ | **Section 12: Navigation, Communication, and Position Fixing Equipment**<br>Hazards relating to the risk of SONAR interference due to the Projects are assessed. |
| d. The site might produce acoustic noise which could mask prescribed sound signals. | ✓ | **Section 12: Navigation, Communication, and Position Fixing Equipment**<br>Hazards relating to the risk of noise due to the Projects are assessed. |
| e. Generators and the seabed cabling within the site and onshore might produce EMFs affecting compasses and other navigation systems. | ✓ | **Section 12: Navigation, Communication, and Position Fixing Equipment**<br>Hazards relating to the risk of electromagnetic interference due to the Projects are assessed. |
| **Risk mitigation measures recommended for OREI during construction, operation and decommissioning**. | | |
| Mitigation and safety measures will be applied to the OREI development appropriate to the level and type of risk determined during the EIA. The specific measures to be employed will be selected in consultation with the MCA and will be listed in the developer's ES. These will be consistent with international standards contained in, for example, SOLAS Chapter V (IMO, 1974), and could include any or all of the following: | | |
| i. Promulgation of information and warnings through notices to mariners and other appropriate MSI dissemination methods. | ✓ | **Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including the promulgation of information. |
| ii. Continuous watch by multi-channel VHF, including DSC. | ✓ | **Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including marine coordination for project vessels. |

| Issue | Compliance | Comments |
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| iii. Safety zones of appropriate configuration, extent and application to specified vessels[6]. | ✓ | **Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including an application for safety zones. |
| iv. Designation of the site as an Area to be Avoided (ATBA). | ✓ | **Section 6: Project Description Relevant to Shipping and Navigation**<br>It is not planned to designate the array areas as an ATBA. |
| v. Provision of aids to navigation as determined by the GLA. | ✓ | **Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including lighting and marking as required by Trinity House, MCA and CAA. |
| vi. Implementation of routeing measures within or near to the development. | ✓ | **Section 7: Navigational Features**<br>There are no IMO routeing measures in proximity to the Offshore Development Area. |
| vii. Monitoring by Radar, AIS, Closed Circuit Television (CCTV) or other agreed means. | ✓ | **Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including compliance with MGN 654, which requires discussions with the MCA regarding monitoring as part of the SAR checklist. |
| viii. Appropriate means for OREI operators to notify, and provide evidence of, the infringement of safety zones. | ✓ | **Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including an application for safety zones. The means for notifying and providing evidence of the infringement of safety zones will be provided in the safety zone application, submitted post consent. |
| ix. Creation of an ERCoP with the MCA's SAR Branch for the construction phase onwards. | ✓ | **Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including compliance with MGN 654, which requires the creation of an ERCoP. |
| x. Use of guard vessels, where appropriate. | ✓ | **Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including the use of guard vessels. |
| xi. Update NRAs every two years, e.g., at testing sites. | ✓ | Not applicable to the Projects. |

[6] As per SI 2007 No 1948 "The Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007.

| Issue | Compliance | Comments |
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| xii. Device-specific or array-specific NRAs. | ✓ | **Section 6: Project Description Relevant to Shipping and Navigation**<br>All offshore elements of the Projects are considered in this NRA including the DBS array areas and offshore export cable corridor infrastructure.<br><br>**Section 17: Mitigation Measures**<br>Embedded mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined including a cable burial risk assessment which will serve as additional assessment relating to shipping and navigation. |
| xiii. Design of OREI structures to minimise risk to contacting vessels or craft. | ✓ | There is no additional risk posed to craft compared to previous offshore wind farms and so no additional measures are identified. |
| xiv. Any other measures and procedures considered appropriate in consultation with other stakeholders. | ✓ | **Section 17: Mitigation Measures**<br>Additional mitigation measures to be implemented to reduce the significance of risk associated with shipping and navigation hazards are outlined and will be informed by consultation post-PEIR. |

## Table A.2 MGN 654 Annex 1 Checklist

| Item | Compliance | Comments |
|---|---|---|
| A risk claim is included that is supported by a reasoned argument and evidence. | ✓ | **Section 15: Risk Assessment**<br>The risk assessment provides a risk claim for a range of hazards based on a number of inputs including baseline data, expert opinion, stakeholder concerns and lessons learnt from existing offshore developments. Addition of metocean data, collision and allision risk modelling, and a hazard log will further inform the risk assessment once completed. |
| Description of the marine environment. | ✓ | **Section 7: Navigational Features**<br>Navigational features in proximity to the Projects have been described including (but not limited to) other offshore wind farm developments, key aids to navigation, oil and gas infrastructure, sub-sea cables and pipelines, and charted wrecks and obstructions.<br><br>**Section 13: Cumulative and Transboundary Overview**<br>Potential future offshore developments have been screened into the cumulative risk assessment (to be undertaken post-PEIR) where a cumulative or in combination activity has been identified based upon the location and distance from the Projects. Developments screened include other offshore wind farms, oil and gas infrastructure, marine aggregate dredging areas, and sub-sea cables. |

| Item | Compliance | Comments |
|---|---|---|
| SAR overview and assessment. | ✓ | **Section 8: Emergency Response and Incident Overview**<br>Existing SAR resources in proximity to the Offshore Development Area are summarised including the UK SAR operations contract, RNLI stations, and HMCG stations.<br><br>**Section 15: Risk Assessment**<br>The risk assessment includes consideration of how activities associated with the Projects may restrict emergency response capability. |
| Description of the OREI development and how it changes the marine environment. | ✓ | **Section 6: Project Description Relevant to Shipping and Navigation**<br>The maximum extent of the Projects for which any shipping and navigation hazards are assessed is provided including a description of the Offshore Development Area, associated infrastructure, construction phase programme, and indicative vessel and helicopter numbers during the construction and operation and maintenance phases. |
| Analysis of the vessel traffic, including base case and future traffic densities and types. | ✓ | **Section 9: Vessel Traffic Movements**<br>Vessel traffic data in proximity to the Offshore Development Area has been analysed and includes vessel density and breakdowns of vessel type.<br><br>**Section 14: Future Case Vessel Traffic**<br>Future vessel traffic levels have been considered, with consideration of increases in commercial vessel activity, commercial fishing vessel and recreational vessel activity, and traffic associated with the Projects operations. Additionally, worst case alternative routeing for commercial traffic has been considered. |
| Status of the hazard log:<br>▪ Hazard identification;<br>▪ Risk assessment;<br>▪ Influences on level of risk;<br>▪ Tolerability of risk; and<br>▪ Risk matrix. | **To be included post-PEIR** | Will be undertaken post-PEIR document authoring as part of the Hazard Workshop (see Section 18.5). |
| NRA:<br>▪ Appropriate risk assessment;<br>▪ MCA acceptance for assessment techniques and tools;<br>▪ Demonstration of results; and<br>▪ Limitations. | ✓ | **Section 2: Guidance and Legislation**<br>MGN 654 and the IMOs FSA guidelines are the primary guidance documents used for the assessment. Additional inputs to the NRA will be considered post-PEIR including metocean data, collision and allision risk modelling, and a hazard log. |

| Item | Compliance | Comments |
|---|---|---|
| Risk control log | ✓ | **Section 16: Risk Control Log**<br>Provides the risk control log which summarises the assessment of shipping and navigation hazards scoped into the risk assessment. This includes the embedded mitigation measures, frequency of occurrence, severity of consequence, and significance of risk, per hazard. |