Muir Mhòr Offshore Wind Farm

Environmental Impact Assessment Report

Volume 3, Appendix 14.1: Navigational Risk Assessment

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Muir Mhòr Offshore Wind Farm
Navigational Risk Assessment

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Glossary of Terms

Term	Definition
Allision	The act of striking or collision of a moving vessel against a stationary object.
Array	All Wind Turbine Generators, inter-array cables, mooring lines, floating sub-structures and supporting subsea infrastructure within the Array Area, as defined, when considered collectively, excluding the offshore export cable(s).
Array Area	The area in which the generation infrastructure (including Wind Turbine Generators and associated foundations and inter-array cables), Offshore Electrical Platform(s), and an interconnector cable will be located.
Automatic Identification System (AIS)	A system by which vessels automatically broadcast their identity, key statistics including location, destination, length, speed and current status, e.g., under power. Most commercial vessels and United Kingdom/European Union fishing vessels over 15m length are required to carry AIS.
Baseline	The existing conditions as represented by the latest available survey and other data which is used as a benchmark for making comparisons to assess the impact of the Proposed Development.
Collision	The act or process of colliding (crashing) between two moving objects.
Developer	Muir Mhòr Offshore Wind Farm Limited
Embedded Mitigation Measure	Mitigation measures to avoid or reduce environmental effects that are directly incorporated into the design for the Proposed Development.
Environmental Impact Assessment (EIA)	The process of evaluating the likely significant environmental effects of a proposed development over and above the existing circumstances (or 'baseline').
EIA Regulations	Collectively the term used to refer to The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, The Marine Works (Environmental Impact Assessment) Regulations 2007, and The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017.
Export Cable	The cable(s) that transmit electricity produced by the WTGs to landfall.
Formal Safety Assessment (FSA)	A structured and systematic process for assessing the risks and costs (if applicable) associated with shipping activity.
Future Case	The assessment of risk based on the predicted growth in future shipping densities and traffic types as well as foreseeable changes in the marine environment.
Landfall	The location where the export cable(s) from the Array Area, as defined, are brought onshore and connected to the onshore export cables (as defined) via the transition joint bays (TJB).
Main Commercial Route	Defined transit route (mean position) of commercial vessels identified within each study area.
Marine Guidance Note (MGN)	A system of guidance notes issued by the Maritime and Coastguard Agency (MCA) which provide significant advice relating to the improvement of the safety of shipping at sea, and to prevent or minimise pollution from shipping.
Navigational Risk Assessment (NRA)	A document which assesses the hazards to Shipping and Navigation of a proposed Offshore Renewable Energy Installation (OREI) based upon Formal Safety Assessment (FSA).

Term	Definition
Offshore Export Cable Corridor (offshore ECC)	The area within which the offshore export cable(s) will be installed.
Offshore Export Cable Corridor (offshore ECC) Study Area	A buffer of two nautical miles (nm) applied around the offshore ECC.
Offshore Renewable Energy Installation (OREI)	As defined by Marine Guidance Note (MGN) 654 (Merchant and Fishing) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response (Maritime and Coastguard Agency (MCA), 2021). For the purposes of this report and in keeping with the consistency of the Environmental Impact Assessment (EIA), OREI can mean offshore wind turbines and the associated electrical infrastructure such as offshore substations.
Project	Muir Mhòr Offshore Wind Farm – comprises the wind farm and all associated offshore and onshore components.
Proposed Development	The offshore Muir Mhòr Offshore Wind Farm project elements to which this Offshore EIA Report relates.
Radio Detection and Ranging (Radar)	An object-detection system which uses radio waves to determine the range, altitude, direction or speed of objects.
Regular Operator	Commercial operator whose vessel(s) are observed to transit through a particular region on a regular basis.
Safety Zone	A statutory marine zone demarcated for the purposes of safety around a possibly hazardous installation or works/construction area.
Scoping Opinion	The report adopted by the Marine Directorate – Licensing Operations Team (MD-LOT) on behalf of the Scottish Ministers.
Scoping Report	The report that was produced in order to request a Scoping Opinion from the Scottish Ministers.
Section 36 Consent	Consent to construct and operate an offshore generating station, under Section 36 (S.36) of the Electricity Act 1989. This includes deemed planning permission for onshore works.
Study Area	A buffer of ten nautical miles (nm) applied around the Array Area.
Unique Vessel	An individual vessel identified on any particular calendar day, irrespective of how many tracks were recorded for that vessel on that day. This prevents vessels being over counted. Individual vessels are identified using their Maritime Mobile Service Identity (MMSI).

Abbreviations Table

Abbreviation	Definition
AC	Alternating Current
AHTS	Anchor Handing Tug Supply
AIS	Automatic Identification System
ALARP	AS Low As Reasonably Practicable
ALB	All-Weather Lifeboats
ARPA	Automatic Radar Plotting Aid
ATBA	Area to be Avoided
AtoN	Aid to Navigation
AVCS	Admiralty Vector Chart Service
CAA	Civil Aviation Authority
CaP	Cable Plan
CBA	Cost Benefit Analysis
CCTV	Closed Circuit Television
CD	Chart Datum
COLREGs	The International Regulations for Preventing Collisions at Sea 1972
CTV	Crew Transfer Vessel
DECC	Department of Energy & Climate Change
DC	Direct Current
DF	Direction Finding
DfT	Department for Transport
DGC	Defence Geographic Centre
DP	Decommissioning Programme
DSC	Digital Selective Calling
DSLP	Development Specification and Layout Plan
ECC	Export Cable Corridor
ECDIS	Electronic Chart Display and Information System
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Electromagnetic Field
EMP	Environmental Management Plan
EPS	Eastern Pacific Shipping
ERCoP	Emergency Response Co-operation Plans

Abbreviation	Definition
ERRV	Emergency Response and Rescue Vessel
ESRI	Environmental Systems Research Institute
ETRS89	European Terrestrial Reference System 1989
FLiDAR	Floating Light Detection and Ranging
FLO	Fisheries Liaison Officer
FLS	Floating Light Detection and Ranging System
FPSO	Floating Production Storage and Offloading
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
GT	Gross Tonnage
HAT	Highest Astronomical Tide
HDD	Horizontal Directional Drilling
HF	High Frequency
HM	His Majesty
HSE	Health and Safety Executive
HVAC	High Voltage Alternating Current
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IHO	International Hydrographic Organization
ILB	Inshore Lifeboats
IMO	International Maritime Organization
IPS	Intermediate Peripheral Structures
kHz	Kilohertz
km	Kilometre
km²	Square Kilometre
kt	Knot
LAT	Lowest Astronomical Tide
LMP	Lighting and Marking Plan
LOA	Length Overall
m	Metre
m²	Square Metre

Abbreviation	Definition
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MD-LOT	Marine Directorate – Licensing and Operations Team
MECP	Marine Environment Protection Committee
MEHRA	Marine Environmental High Risk Areas
MF	Medium Frequency
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MoD	Ministry of Defence
MPS	Marine Policy Statement
MSI	Maritime Safety Information
NAVTEX	Navigational Telex
NLB	Northern Lighthouse Board
nm	Nautical Mile
nm^2	Square Nautical Mile
NRA	Navigational Risk Assessment
NSP	Navigational Safety Plan
NUC	Not Under Command
O&M	Operation and Maintenance
OEP	Offshore Electrical Platform
OOCL	Orient Overseas Container Line
OREI	Offshore Renewable Energy Installation
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OWF	Offshore Wind Farm
PEXA	Practice and Exercise Area
PLL	Potential Loss of Life
PNT	Positioning, Navigation and Timing
POB	Person on Board
PSV	Platform Supply Vessel
QHSE	Quality, Health, Safety and Environment
Racon	Radar beacon
Radar	Radio Detecting and Ranging
RAM	Restricted in Ability to Manoeuvre

Abbreviation	Definition
REZ	Renewable Energy Zone
RNLI	Royal National Lifeboat Institution
Ro-Pax	Roll-On/Roll-Off Passenger
Ro-Ro	Roll-On/Roll-Off Cargo
RYA	Royal Yachting Association
SAR	Search and Rescue
SCADA	Supervisory Control and Data Acquisition
SFF	Scottish Fishermen's Federation
SMS	Safety Management System
SOLAS	The International Convention for the Safety of Life at Sea
SONAR	Sound Navigation Ranging
SOV	Service Operation Vessels
SPFA	Scottish Pelagic Fishermen's Association
SPS	Significant Peripheral Structure
SWFPA	Scottish White Fish Producers Agency
TPV	Third Party Verification
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
VHF	Very High Frequency
VMNSP	Vessel Management Navigational Safety Plan
VMP	Vessel Management Plan
VTS	Vessel Traffic Service
WCS	Worst Case Scenario
WGS84	World Geodetic System 1984
WSP	Wet Storage Plan

1 Introduction

1.1 Background

1. Anatec Ltd was commissioned by Muir Mhòr Offshore Wind Farm (OWF) Limited, hereafter referred to as 'the Developer', to undertake a Navigational Risk Assessment (NRA) for the proposed Muir Mhòr OWF (the 'Project'). The NRA has been undertaken with respect to the offshore components of the Project (hereafter 'the Proposed Development') comprising the Array Area and the offshore Export Cable Corridor (ECC). This NRA presents information on the Proposed Development relative to the existing and estimated future navigational activity and forms the technical appendix to **Volume 2, Chapter 14 (Shipping and Navigation)**.

1.2 Navigational Risk Assessment

2. An Environmental Impact Assessment (EIA) is a process which identifies the environmental risks of a Proposed Development, both negative and positive. An important element/requirement of the EIA for offshore projects is the NRA. Following the relevant Maritime and Coastguard Agency (MCA) guidance, the 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 developments;
- Summary of the Proposed Development description relevant to Shipping and Navigation;
- Baseline characterisation of the existing environment;
- Discussions of potential risks on navigation, communication and position fixing equipment;
- Future case vessel traffic characterisation;
- Collision and allision risk modelling;
- Risk assessment (applying the Formal Safety Assessment (FSA) process);
- Outline of embedded and additional mitigation measures as necessary; and
- Outline of through life safety management features.

3. Potential hazards are considered for each phase of the Proposed Development as appropriate:

- Construction;
- Operation and maintenance (O&M); and
- Decommissioning.

4. The Shipping and Navigation baseline and risk assessment has been undertaken based upon the information available and responses received at the time of preparation, including the including the Worst Case Design Scenario (WCS) which has

been defined for the NRA based on the information detailed in **Volume 1, Chapter 3 (Project Description)**.

2 Guidance and Legislation

2.1 Legislation

5. As part of the EIA Directive (2011/92/EU, as amended by Directive 2014/52/EU), an Environmental Impact Assessment Report (EIAR) is required to be undertaken and submitted to support the application for the Section 36 consent for the Proposed Development. The MCA require that, as part of the EIAR, an NRA is undertaken to "*inform the Shipping and Navigation chapter of the EIAR*" (MCA, 2021).

2.2 Primary Guidance

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

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

7. MGN 654 highlights issues that shall be considered when assessing the risk to navigational safety from offshore renewable energy developments proposed in United Kingdom (UK) internal waters, territorial seas or Renewable Energy Zones (REZ).

8. 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 (Section 3.2). Across **Volume 2, Chapter 14 (Shipping and Navigation)** and the NRA, both base and future case levels of risk have been identified, in addition to the measures required to ensure that both the future case remains broadly acceptable or tolerable with mitigation.

9. It is noted that the MCA methodology discusses proportionality of the assessment and indicates that the requirements of a submission may be dependent upon the scale of the development being assessed.

2.2 Other Guidance

10. Other guidance documents used during the assessment include:

- *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) Recommendation O-139 on The Marking of Man-Made Offshore Structures* (IALA, 2021a);
- *IALA Guideline G1162 The Marking of Offshore Man-Made Structures* (IALA, 2021b);
- *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* (Department of Energy & Climate Change (DECC)), 2011);
- *Regulatory Expectations on Moorings for Floating Wind and Marine Devices* (MCA and Health and Safety Executive (HSE), 2017);
- *Sectoral Marine Plan for Offshore Wind Energy* (Scottish Government, 2020).
- *Scottish National Marine Plan (NMP)* (Scottish Government, 2015); and
- *UK Marine Policy Statement (MPS)* (His Majesty's (HM) Government, 2011).

2.3 Lessons Learnt

11. There is considerable benefit for the Developer in the sharing of lessons learnt within the offshore industry. The NRA, and in particular the risk assessment undertaken in **Volume 2, Chapter 14: (Shipping and Navigation)**, includes general consideration for lessons learnt and expert opinion from previous OWF developments and other sea users, capitalising upon the UK's position as a leading generator of offshore wind power.

3 Navigational Risk Assessment Methodology

3.1 Formal Safety Assessment Methodology

12. A Shipping and Navigation user can only be exposed to a risk caused by a hazard if there is a pathway through which a risk can 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 and is reliant upon data, defined risk assessment criteria and expert judgement. The assessments presented herein for Shipping and Navigation users have considered the following criteria:

- Baseline data and assessment;
- Expert opinion;
- Outputs of the Hazard Workshop;
- 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.

13. 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 (i.e., where gear is not deployed). A separate methodology and assessment have been applied in **Volume 2, Chapter 13 (Commercial Fisheries)** to consider hazards which are directly related to commercial fishing activity (as opposed to commercial fishing vessels in transit) including hazards of a commercial nature.

3.2 Formal Safety Assessment Process

14. In line with the standard approach to marine risk assessment, the IMO FSA process (IMO, 2018) as approved by the IMO in 2018 under Maritime Safety Committee – Marine Environment Protection Committee (MECP).2/circ.12/Rev.2 has been applied to the risk assessment within this NRA and informs **Volume 2, Chapter 14 (Shipping and Navigation)**.

15. The FSA process is a structured and systematic methodology based upon risk analysis and Cost Benefit Analysis (CBA) (if applicable) to reduce risks 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 analysis (investigation of the causes and initiating events and consequences of the more important hazards identified in Step 1);
- **Step 3** – Risk control options (identification of measures to control and reduce the identified hazards);

- **Step 4** – CBA (identification and comparison of the benefit and costs associated with the risk control options identified in Step 3; and
- **Step 5** – Recommendations for decision-making (defining of recommendations based upon Steps 1 to 4).

Figure 3-1 Flow Chart of the FSA Methodology

3.3 Hazard Workshop Methodology

16. 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 stakeholders. The Hazard Workshop was held in-person in Edinburgh on 22 April 2024 and provided local and national marine stakeholders the opportunity to identify and discuss potential Shipping and Navigation hazards. Further information on the Hazard Workshop is included in Section 4.3.

17. The risks associated with the identified hazards were ranked in the hazard log based upon the discussions held during the workshop, with appropriate embedded mitigation measures identified, including any additional measures required to reduce the risks to ALARP. Table 3-1 and Table 3-2 define the severity of consequence and the frequency of occurrence rankings that have been used to assess risks within the hazard log, completed based on the outputs of the Hazard Workshop.

Table 3-1 Severity of Consequences Ranking Definitions

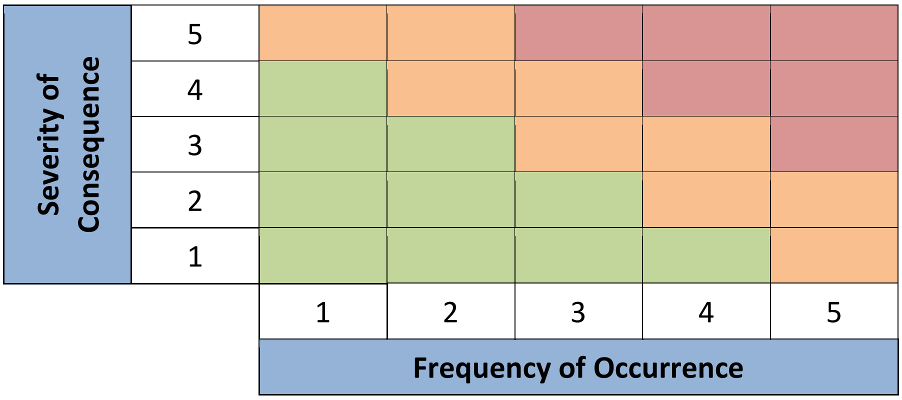
Rank	Description	Definition			
		People	Property	Environment	Business
1	Negligible	No perceptible impact	No perceptible impact	No perceptible impact	No perceptible impact
2	Minor	Slight injury(s)	Minor damage to property i.e., superficial damage	Tier 1 local assistance required	Minor reputational risks – limited to users
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	Less than 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 (with embedded mitigation measures in place) via a tolerability matrix approach as shown in Table 3-3. The significance of risk is defined as **Broadly Acceptable** (low risk), **Tolerable with Mitigation** (intermediate risk), or **Unacceptable** (high risk).

Table 3-3 Tolerability Matrix and Risk Rankings



	Unacceptable (high risk)
	Tolerable with Mitigation (intermediate risk)
	Broadly Acceptable (low risk)

19. Once identified, the significance of risk will be assessed with the inclusion of risk control measures (mitigations) to ensure it is ALARP. Further risk control measures may be required to further mitigate a hazard in accordance with the ALARP principles. Broadly Acceptable and Tolerable with Mitigation risks are ALARP, whilst Unacceptable and Tolerable risks are not considered to be ALARP.

3.4 Cumulative Risk Assessment Methodology

20. The hazards identified in the FSA are also assessed for cumulative risks with the inclusion of other projects and proposed developments. Given the varying type, status and location of developments, a tiered approach to cumulative risk assessment has been undertaken, which splits developments into tiers depending upon project status, proximity to the Proposed Development and the level to which they are anticipated to cumulatively impact relevant users. It also considers data confidence, 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 undertaken for each tier included. It is noted that an aggregate of the criterion is used to determine the tier of each development. For example, if a development is located within 25 nautical miles (nm) of the Proposed Development and may impact a main commercial route within 1 nm (1.85 kilometre [km]) of the Array Area but the development is only scoped, it may still be allocated to Tier 1.

Table 3-4 Cumulative Development Screening Summary

Tier	Minimum Development Status	Criterion	Data Confidence Level	Level of Cumulative Risk Assessment
1	Consented or under determination	▪ May impact a main commercial route passing within 1 nm (1.85 km) of the Array Area and/or interacts with traffic which may be directly displaced by the Array Area. ▪ Raised as having possible cumulative effect during consultation. ▪ OWFs up to 25 nm (46.3 km). ▪ Oil and gas infrastructure up to 5 nm (9.26 km). ▪ Subsea cables up to 2 nm (3.70 km).	High or medium	Quantitative cumulative re-routeing of main commercial routes
2	Consented or under determination	▪ May impact a main commercial route passing within 1 nm (1.85 km) of the Array Area and/or interacts with traffic which may be directly displaced by the Array Area. ▪ OWFs between 25 and 50 nm (46.3 and 92.6 km). ▪ Oil and gas infrastructure between 5 and 10 nm (9.26 and 18.5 km). ▪ Subsea cables up to 2 nm (3.70 km).	High or medium	Qualitative cumulative re-routeing of main commercial routes
3	Scoped or under determination	▪ Does not impact a main commercial route passing within 1 nm (1.85 km) of the Array Area and does not interact with traffic which may be directly displaced by the Array Area. ▪ OWFs up to 50 nm (92.6 km). ▪ Oil and gas infrastructure up to 10 nm (18.5 km). ▪ Subsea cables up to 2 nm (3.70 km).	Low	Qualitative assumptions of routeing only

3.5 Study Areas

22. A buffer of up to 10 nm (18.5 km) has been applied around the Array Area (hereafter referred to as the 'study area'), as shown in Figure 3-2. This is a standard size of study area for Shipping and Navigation assessment, which was discussed with the MCA and NLB, and presented to various other consultees including at the Hazard Workshop (Section 3.3). The 10 nm (18.5 km) radius ensures that relevant routeing which may be affected is captured while still remaining specific to the area being studied.

23. An additional study area for the offshore ECC, hereafter referred to as the 'offshore ECC study area', has been defined as a 2 nm (3.70 km) offshore buffer of the offshore ECC and is also illustrated in Figure 3-2. This buffer, similar to that of the Array Area buffer, has been chosen to capture relevant routeing while still remaining specific to the offshore ECC. The offshore ECC study area has been cropped to exclude onshore areas and also excludes Peterhead Bay (UK) so that any vessels transmitting AIS while moored do not skew the analysis. This has been illustrated in Figure 3-3.

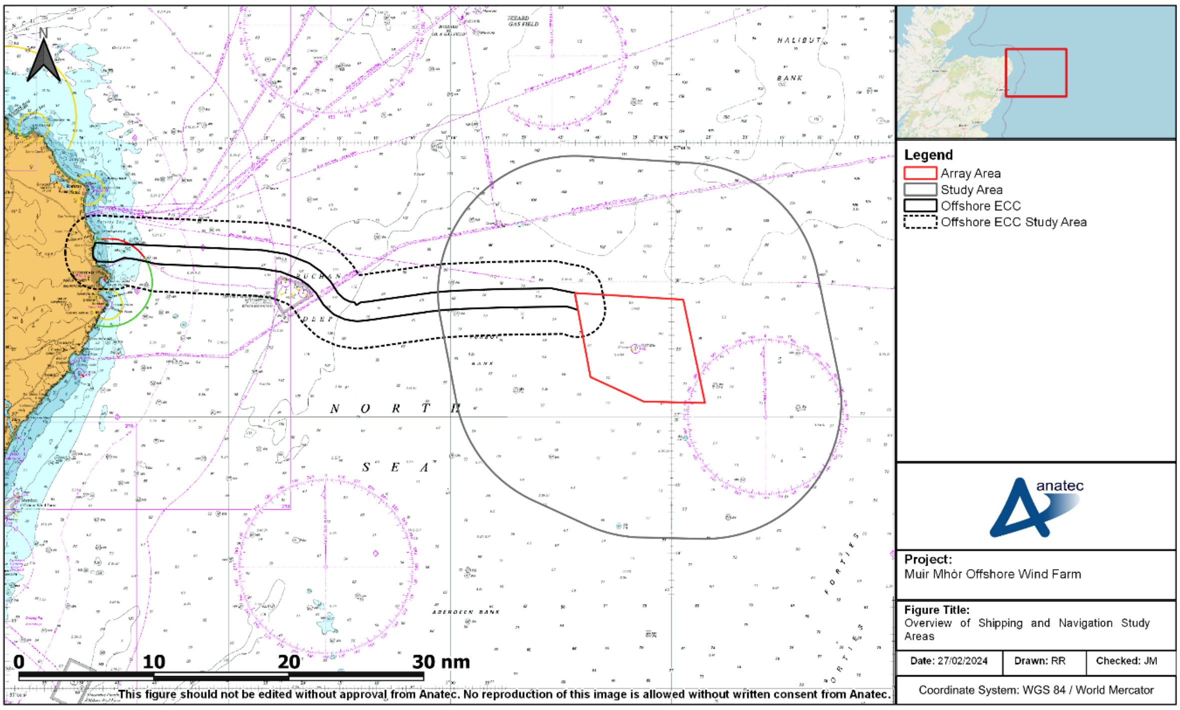


Figure 3-2 Overview of Shipping and Navigation Study Areas

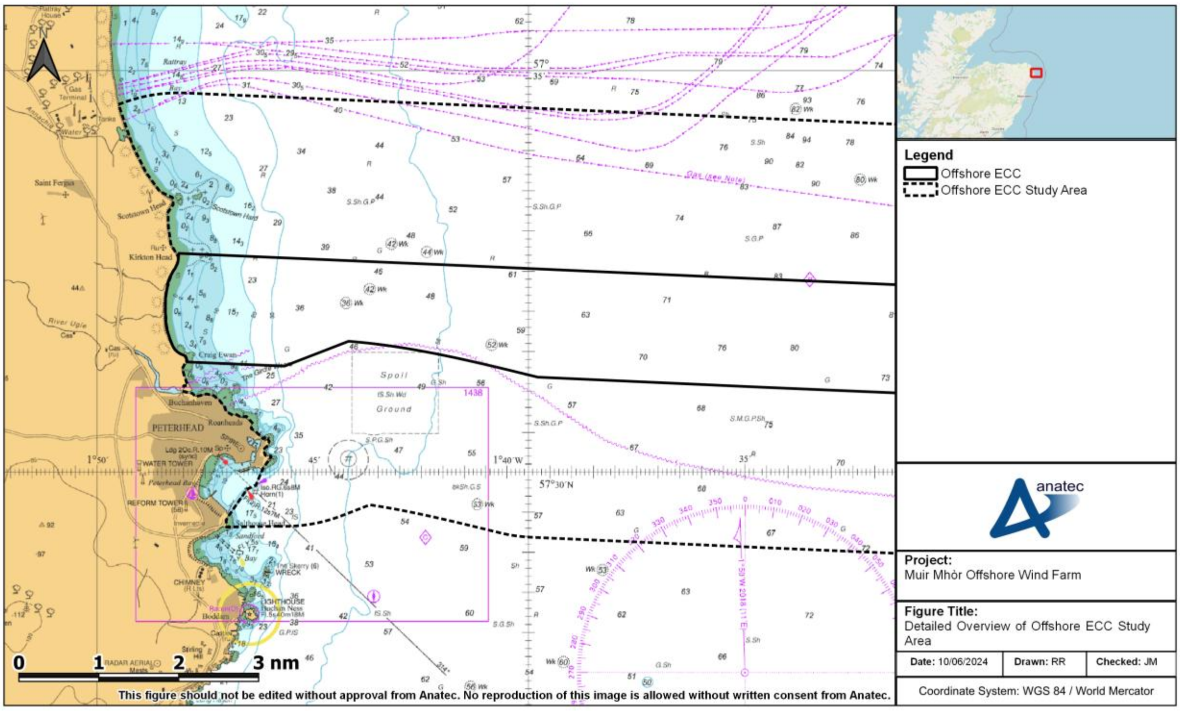


Figure 3-3 Detailed Overview of Offshore ECC Study Area

4 Consultation

4.1 Dedicated Meetings

24. Key Shipping and Navigation stakeholders have been consulted in the NRA process. Key discussion points and remarks from each meeting has been included and summarised within Table 4-1. The following stakeholders have been consulted via dedicated meetings (other than the Hazard Workshop – see Section 4.3):

- MCA;
- Northern Lighthouse Board (NLB); and
- UK Chamber of Shipping.

4.2 Regular Operators

25. As well as consulting with the organisations outlined above, 46 Regular Operators identified from the vessel traffic surveys and the long-term data analysis were provided with an overview of the Proposed Development and offered the opportunity to provide comment (the full Regular Operator letter is presented in Annex D). The full list of Regular Operators identified is provided below:

- Aggregate Industries;
- AIDA Cruises;
- Altera Infrastructure;
- Arklow Shipping;
- Aurora Offshore;
- BBC Chartering;
- Bibby Line Marine;
- Boskalis;
- Buksér og Berging;
- Cargow;
- Cruise Britain;
- DOF;
- Eastern Pacific Shipping (EPS);
- ESVAGT;
- Eurobulk;
- FEDNAV;
- Fletcher Group;
- Framar Shipping Ltd.;
- Golden Energy Offshore;
- Golden Ocean;
- Hapag-Lloyd;
- Helix Energy;
- Hoyoff Offshore;
- Island Offshore;
- Knutsen Group;
- Maersk;
- Nordic Bulkers;
- North Star Shipping;
- Olympic Subsea;
- Orient Overseas Container Line (OOCL);
- Østensjø Rederi;
- Remøy Shipping;
- Samskip;
- Sea Cargo;
- SIEM Offshore;
- Simon Mokster Shipping;
- Skansi Offshore;
- Smyril Line;
- Subsea 7;
- TechnipFMC;
- Tidewater Marine UK Ltd;
- TUI Cruises;
- Viking Supply;
- Volstad;
- Vroon;
- Wagenborg; and
- Wilsonship.

26. Shipping and Navigation responses and inputs were received by Tidewater Marine and have been included within Table 4-1.

4.3 Hazard Workshop

27. A key element of the consultation phase was the Hazard Workshop, a meeting of local and national marine stakeholders to identify and discuss potential Shipping and Navigation hazards. Using the information gathered from the Hazard Workshop, a hazard log was produced for use as input into the risk assessment undertaken in **Volume 2, Chapter 14 (Shipping and Navigation)**. This ensured that expert opinion and local knowledge was incorporated into the risk assessment process and that the hazard log was site-specific.

4.3.1 Hazard Workshop Attendance

28. The Hazard Workshop was held in-person in Edinburgh on 22 April 2024. The Hazard Workshop was attended by:

- MCA;
- NLB;
- RYA Scotland;
- Scottish White Fish Producers Agency (SWFPA); and
- Peterhead Port Authority.

29. NiMa Consultants also attended the Hazard Workshop as the lead author of **Volume 2, Chapter 13 (Commercial Fisheries)**. It is noted that the UK Chamber of Shipping could not attend the Hazard Workshop but a dedicated meeting was held on 9 May 2024.

30. Other commercial ports in proximity to the Proposed Development including Aberdeen Port, Montrose Port, Arbroath Port, Forth Ports, UK Major Ports Group, and British Ports Association were also invited to attend the Hazard Workshop but did not attend.

31. Regular operators identified in Section 4.2 were given the opportunity to attend the Hazard Workshop, but no operators attended.

32. The Scottish Pelagic Fishermen's Association (SPFA) and Scottish Fishermen’s Federation (SFF) were invited to attend the Hazard Workshop but did not attend.

4.3.2 Hazard Workshop Process and Hazard Log

33. During the Hazard Workshop, key maritime hazards associated with the construction, O&M and decommissioning of the Proposed Development were identified and discussed. Where appropriate, hazards were considered by vessel type to ensure risk control options could be identified on a type-specific basis.

34. Following the Hazard Workshop, the risks associated with the identified hazards were ranked in the hazard log based upon the discussions held during the workshop, with appropriate embedded mitigation measures identified, including any additional measures required to reduce the risks to ALARP. The hazard log was then provided to the key stakeholders, including those who attended the Hazard Workshop, for comment and their feedback incorporated into the NRA. The hazard log has been used to inform the risk assessment from Section 17 and is provided in full in Annex B.

4.4 Consultation Responses

35. Various responses have been received from stakeholders during consultation undertaken in the NRA process, either during dedicated meetings, via email correspondence, through the Scoping Opinion (Marine Directorate – Licensing and Operations Team (MD-LOT), 2023) (hereafter referred to as the 'Scoping Opinion') or via the Hazard Workshop.

36. The key points and where they have been addressed within the NRA or **Volume 2, Chapter 14 (Shipping and Navigation)** are summarised in Table 4-1. It is noted that the MD-LOT Scoping Opinion has been reviewed and responses align with input from Shipping and Navigation stakeholders including the MCA, UK Chamber of Shipping, and the RYA (which is summarised in Table 4-1).

Table 4-1 Summary of Key Points Raised During Consultation

Stakeholder(s)	Date and form of correspondence	Point raised	Response and where addressed in the NRA
MCA and NLB	7 February 2023, Dedicated Meeting	Both MCA and NLB are content with the vessel traffic survey dates as well as the methodologies.	Vessel traffic survey dates and methodologies are detailed in Section 5.2 and data analysed in Section 10.
		MCA noted the cumulative impacts of the Proposed Development in additional with other projects in the area is a significant issue and although the standard approach to cumulative assessment is suitable, this will be an area they will be paying particular attention to. NLB highlights Green Volt OWF which is in proximity to the Proposed Development.	The cumulative risk assessment methodology is detailed in Section 3.4 with the development screening process in Section 13, including consideration of Green Volt OWF. Cumulative projects are included in the Risk Assessment in Sections 18 to 20 where relevant.
		NLB noted the various ports and harbours in the area need to be considered.	Various commercial ports have been reached out to during the consultation phase and invited to the Hazard Workshop with Peterhead Port Authority attending (Section 4). Reduced access to local ports, harbours, and marinas is assessed in Sections 18 to 20.
UK Chamber of Shipping	19 May 2023, Dedicated Meeting	Loss of station should be considered within the risk assessment during the construction and decommissioning phases also, in particular when the structures are in transit.	Loss of station is assessed for all phases of the Proposed Development in the risk assessment in Sections 18 to 20.
		Agree with the relevant study areas used to detail the Shipping and Navigation assessment.	Shipping and Navigation study areas are detailed in Section 3.5.
		Consultation with Cruise Britain is advised.	Cruise Britain was contacted as part of the Regular Operator outreach (Section 4.2)

Stakeholder(s)	Date and form of correspondence	Point raised	Response and where addressed in the NRA
UK Chamber of Shipping	18 July 2023, Scoping Response	Chamber welcomes the 20-year Marine Accident Investigation Branch (MAIB) data analysis at NRA.	20-years of MAIB incident data is analysed in Section 9.4.
		In addition, should the development use floating turbines then wet storage areas need to be considered from a navigational risk perspective, including loss of station from a wet storage area as well as displacement of vessels.	Wet storage is acknowledged in Section 6.4 but given the planned locations is not scoped into the risk assessment for Shipping and Navigation.
		Given impacts scoped out of the decommissioning phase, it is assumed that the Developer is committing to remove all surface and sub-surface infrastructure, including cabling, a commitment the Chamber supports and should be required.	A Decommissioning Programme (DP) will be developed prior to the start of decommissioning works, with the nature of the works determined by legislation and guidance at the time (Section 23).
		The Developer should consider a Navigation Management Plan to manage interactions between third party vessels and project vessels to reduce navigational risk.	A Vessel Management Navigation Safety Plan (VMNSP) (**Volume 4, Appendix 5 (Outline Vessel Management and Navigational Safety Plan)**) is included as an embedded mitigation measure in the NRA (Section 23).
		Accept the assessment of potential effects in isolation covers transboundary effects but this should be extended to cumulative as well.	Cumulative risk assessment undertaken in the NRA will include consideration of transboundary effects where appropriate (Section 21).
		Disappointing not to see a figure showing the cumulative wider picture of other developments and Proposed Developments in the area given upward of 16 other offshore wind farms are proposed within a 50 nm (92.6 km) area.	A cumulative development screening exercise is undertaken in Section 13 with cumulative offshore wind farm developments considered up to 50 nm (92.6 km) from the Array Area in line with the cumulative methodology outlined in Section 3.4. Post wind farm routeing is then shown within this 50 nm (92.6 km) buffer in Section 14.6.

Stakeholder(s)	Date and form of correspondence	Point raised	Response and where addressed in the NRA
MCA	8 August 2023, Scoping Response	There should be as much detail as possible in relation to the possible impact on navigational issues for both commercial and recreational craft, specifically: ▪ Collision risk; ▪ Navigational safety; ▪ Visual intrusion and noise; ▪ Risk management and emergency response; ▪ Marking and lighting of site and information to mariners; ▪ Effect on small craft navigational and communication equipment; ▪ The risk to drifting recreational craft in adverse weather or tidal conditions; and ▪ The likely squeeze of small craft into the routes of larger commercial vessels.	Navigational issues outlined by the MCA have been addressed throughout the NRA and within the risk assessment in Sections 18 to 20.
		NRA to be submitted in accordance with MGN 654 and the MCA's methodology document. Should be accompanied by a detailed MGN Checklist	The NRA is compliant with MGN 654 and the MGN 654 Checklist is included in Annex A.
		It is suggested that vessel traffic data collection should be from a vessel-based survey using AIS, Radar and visual observations to capture all vessels navigating in the study area.	Two 14-day vessel traffic surveys were undertaken in 2023 using AIS, Radar and visual observations (Section 5.2).
		The turbine layout design will require MCA approval prior to construction to minimise the risks to surface vessels, including rescue boats, and Search and Rescue (SAR) aircraft operating within the site. Any additional navigation safety and/or Search and Rescue requirements, as per MGN 654 Annex 5, will be agreed at the approval stage.	The final array layout will be agreed with MCA, and NLB post consent and will comply with the requirements of MGN 654, noting that compliance with MGN 654 is considered as an embedded mitigation measure (Section 23).

Stakeholder(s)	Date and form of correspondence	Point raised	Response and where addressed in the NRA
		Attention should be paid to cabling routes and where appropriate burial depth for which a Burial Protection Index study should be completed and subject to the traffic volumes, an anchor penetration study may be necessary. If cable protection measures are required e.g., rock bags or concrete mattresses, the MCA would be willing to accept a 5% reduction in surrounding depths referenced to Chart Datum (CD).	A cable burial risk assessment will be undertaken to determine suitable burial depths and is considered as an embedded mitigation measure in the NRA (Section 23). As part of compliance with MGN 654, the MCA's advice on reduction in under keel clearance will be adhered to, noting that compliance with MGN 654 is also considered as an embedded mitigation measure in the NRA.
		Regulatory mooring expectations should be identified as a potential mitigation and MCA can confirm this guidance should be followed and that a third-party verification of the mooring arrangements will be required.	The Regulatory Expectations document is included as an embedded mitigation measure in the NRA (Section 23), noting that this guidance requires third-party verification of the mooring system.
		Particular consideration will need to be given to SAR including Emergency Response Co-operation Plans (ERCoP) and various technical requirements as covered in Annex 5 to MGN 654. A SAR Checklist will also need to be completed in consultation with the MCA.	Navigation, communication, and position fixing equipment is detailed in Section 15.The NRA is fully compliant with MGN 654 including commitment to the completion of a SAR Checklist post consent in consultation with the MCA (Section 23).
		Considering all the potential developments in the area, MCA is concerned regarding the general loss of navigable sea room, and we would request the Developer to factor in cumulative impacts into their NRA specifically with consideration of Bellrock, Morven, Ossian, and CampionWind.	The cumulative risk assessment methodology is detailed in Section 3.4 with the development screening process in Section 13 including consideration of Bellrock, Morven, Ossian, and Campion. Cumulative projects are included in the Risk Assessment in Sections 18 to 20 where relevant.
		As this project progress, we would welcome engagement with the Developer, and early discussion on the points raised above.	The MCA was consulted as part of the NRA process including via the Hazard Workshop (Section 4.3).

Stakeholder(s)	Date and form of correspondence	Point raised	Response and where addressed in the NRA
		MCA agree with the embedded commitment measure specified in the Scoping Report, we believe all the commitments are covered here, and if any bespoke commitments are required those will be agreed at the application stage.	Embedded mitigation measures are detailed in Section 23 and reflect those specified in the Scoping Report.
RYA Scotland	25 July 2023, Scoping Response	RYA Scotland agree that Shipping and Navigation should be scoped in and would wish to be involved with the NRA.	The RYA were consulted as part of the NRA Process at the Hazard Workshop (Section 4.3).
		Although the coverage of the UK Coastal Atlas of Recreational Boating published by the RYA does not extend as far as the site it does cover most of the offshore ECC. Sailing Directions for the East Coast of Scotland have recently been published by the Forth Yacht Clubs Association.	The UK Coastal Atlas of Recreational Boating and East Coast of Scotland Sailing Directions have been used as secondary sources to inform recreational vessel movements in the NRA (Section 5.1)
		Details of the scheme should be forwarded to the Forth Yacht Clubs Association once it has been consented so that the information can be included in updates to the Sailing Directions.	Promulgation of information has considered as an embedded mitigation measure in the NRA (Section 23) and dissemination of project details to the Forth Yacht Clubs Association will be ensured as part of this.
NLB	19 July 2023, Scoping Response	NLB have no objection to the content of the Scoping Report, and no suggestions for additional content.	Noted.
Ltd	24 November 2023, Regular Operator Outreach	All Tidewater vessels passage plan before departing from port or departing the offshore installation 500 metre (m) zone. These plans take into account all relevant navigational information including chart corrections. Navigational notices will be published/issued relating to the Project.	Promulgation of information has been considered as an embedded mitigation measure in the NRA (Section 23).

Stakeholder(s)	Date and form of correspondence	Point raised	Response and where addressed in the NRA
		Tidewater vessels working out of Peterhead and operating in the Central North Sea, and vessels operating out of Aberdeen working in the Central and Northern sector of the North Sea will have to avoid the Proposed Development. This will be done with due regard to clearing distances required, Notifications to Mariners, and the International Regulations for Preventing Collisions at Sea (COLREGs).	Promulgation of information has been considered as an embedded mitigation measure in the NRA (Section 23).
		Tidewater does not consider the Proposed Development will impact their vessels greatly as they are constantly adjusting their passage plans to meet new requirements and are used to the North Sea being comprised of, and routeing within, offshore permanent Installations, semi submersibles, Jack Ups, survey vessels, fishing vessels, other platform supply vessels (PSV), anchor handling tug supply (AHTS), projects, diving vessels, and general everyday shipping traffic.	Acknowledged in the assessment of vessel displacement in Sections 18 to 20.
		Tidewater vessels are constantly adjusting course and/or speeds to ensure the safety of crew and or cargo, as they are relatively small vessels with the majority of the cargo being carried on an open deck. This is particularly pertinent in the winter months in rough weather, but as long as they can safely pass between the Array Area and land maintaining the correct safe distance as required in the Notification to Mariners there would not be a problem.	Adverse weather routeing is detailed in Section 12 with further details of adverse weather transits provided by Tidewater Marine UK outlined.
		There is no cumulative effect to Tidewater vessels from cumulative developments.	Acknowledged in the cumulative risk assessment included in Section 21.

Stakeholder(s)	Date and form of correspondence	Point raised	Response and where addressed in the NRA
		If there was sufficient sea room to make safe passage whilst maintaining a safe distance from any hazard, then it is a possibility for vessels to transit through the Array Area.	Acknowledged in the assessment of vessel displacement and internal allision risk in Sections 18 to 20.
MCA	22 April 2024, Hazard Workshop	On a cumulative level, the MCA noted there is no concern over the gap between the Array Area and CampionWind and that commercial routes would still use this gap.	Commercial routeing in a cumulative scenario is detailed in Section 14.5.
		MCA requested context for the list of plans within the embedded mitigation measures for how each one is relevant to Shipping and Navigation.	Embedded mitigation measures are detailed in Section 23 and include detailed descriptions of what each entail. Mitigation is also noted where appropriate in the risk assessment in Sections 18 to 20.
		There have been challenges with wet storage and it is queried whether there is any consideration of areas out with port limits.	Details currently available relating to wet storage are provided in Section 6.4.
		Emergency towage and recovery are also important to address as well as wreck status if the structure was to be sank.	This will be addressed through emergency response protocols as acknowledged in the risk assessment in Section 19.
NLB	22 April 2024, Hazard Workshop	NLB highlighted the need for and location of O&M monitoring of the Proposed Development as the Array Area is out with the range of VHF and so there is increased risk.	A VMNSP (**Volume 4, Appendix 5 (Outline Vessel Management and Navigational Safety Plan)**) is included as an embedded mitigation measure in the NRA (Section 23).
		Consideration is needed of management of float-offs or failings of a significant structure including those that may have an aid to navigation (AtoN) and also moorings if a structure needs to be removed. This is also the case if a vessel was to get in trouble within the array and become a potential wreck.	Acknowledged in the risk assessment in Section 19.

Stakeholder(s)	Date and form of correspondence	Point raised	Response and where addressed in the NRA
		Any recreational vessels recorded as far offshore as the Array Area, including from out with UK waters, are expected to be experienced and undergo due diligence of the intended route.	Acknowledged in the risk assessment in Sections 18 to 20.
RYA Scotland	22 April 2024, Hazard Workshop	RYA Scotland noted there is a significant lag in provided information to the United Kingdom Hydrographic Office (UKHO) being updated on relevant nautical charts and most recreational users don't update charts often due to costs. There are various channels though to get this information across to recreational users.	Promulgation of information, including the issue of Notifications to Mariners, is considered as an embedded mitigation measure in the NRA (Section 23). Notifications to Mariners will be issued through Kingfisher.
		Further actions need to be implemented in regard to lighting and marking failure in the instance something goes wrong, and a backup is available.	An AtoN Management plan (**Volume 4, Appendix 6 (Outline AtoN Management Plan)**) is included as an embedded mitigation measure (Section 23).
		Vessel displacement should also consider increased voyages for recreational users which includes tiredness.	Vessel displacement is broken down per vessel type within the Hazard Log (Annex B) and this has been considered in the risk assessment in Sections 18 to 20.
		The sparse recreational vessel traffic within the Array Area from the vessel traffic survey data is representative given the distance offshore and no further data collection is required.	Acknowledged in the baseline characterisation of recreational traffic in Section 10.2.2.4.
		Peterhead Bay marina is a popular stop for transiting recreational vessels and vessels tend to transit closer to ports and shore to avoid commercial vessels further offshore.	Acknowledged in the baseline characterisation of recreational traffic in Section 10.2.2.4.
		Some recreational vessels may transit within the array during operation, including in adverse weather. They may also do so to avoid larger commercial vessels. However, internal transits are not expected at the distance offshore during winter periods.	Adverse weather transits by recreational vessels are considered in the identification of adverse weather routeing (Section 12) and the potential for internal navigation is addressed in the risk assessment in Section 19.

Stakeholder(s)	Date and form of correspondence	Point raised	Response and where addressed in the NRA
		It may be worthwhile assessing Royal National Lifeboat Institution (RNLI) maritime incident data to identify any incidents which may be involved in loss of power and entanglement of creel ropes, but the situations have improved since the regulation regarding gear marking.	RNLI incident data is assessed in Section 9.1 including consideration of such incidents.
		Potential export cable routes and interconnector cables will also have a cumulative impact.	Cables are included in the cumulative development screening process in Section 13 where data is available and the cumulative impact assessment assesses reduction in under keel clearance in Section 21.6.
		A high level of recreational vessels inshore will not be picked up via AIS. Current assumptions are that less than 50% of recreational vessels broadcast on AIS, however a greater number can receive AIS.	Acknowledged in the summary of data limitations for AIS in Section 5.4.1.
		Cable installation doesn't pose many problems for recreational vessels as the COLREGs will apply and vessels will work around any ongoing project works.	Acknowledged in the assessment of vessel displacement in Sections 18 to 20.
SWFPA	22 April 2024, Hazard Workshop	At a cumulative level, commercial vessels filtering into gaps between developments will affect fishing vessels and fishing grounds in the area, especially with vessels numbers increasing over time.	Commercial routeing in a cumulative scenario is detailed in Section 14.5. Fishing vessels displacement is detailed in the risk assessment in Sections 18 to 20, and in the cumulative risk assessment in Section 21.
		The location of construction ports as this will also increase vessel traffic in the area.	The NRA has identified both options of project vessel routeing from the north and the south as O&M ports have not yet been defined. A VMNSP is included as an embedded mitigation measure in the NRA (**Volume 4, Appendix 5 (Outline Vessel Management and Navigational Safety Plan)**) (Section 23).

Stakeholder(s)	Date and form of correspondence	Point raised	Response and where addressed in the NRA
		Large pelagic vessels (50-60 m) will not transit within the operational array with smaller vessel internal transits dependent on weather conditions, time of day, and skipper preference.	Acknowledged in the assessment of vessel displacement and internal collision risk in Sections 18 to 20.
		The level of transiting vessels is correct within the data shown for the Array Area, but levels of active fishing vessels are underrepresented.	Acknowledged in the baseline characterisation of fishing traffic in Section 10.1.2.3.
		There is a high volume of static fishing gear within 4 nm (7.40 km) of the shore and so the impact of fishing vessels being displaced will impact this static gear which in turn could also impact other vessel type as this gear will need to be relocated during construction to another site	Acknowledged in the baseline characterisation of fishing traffic in Section 10.2.2.2 and the assessment of vessel displacement in Sections 18 to 20 but will be assessed under the cable burial risk assessment which is included as an embedded mitigation measure within the NRA (Section 23).
		A lot of fishing traffic may be vessels coming in to land in Peterhead Port and then transit back to their home port of Fraserburgh.	Acknowledged in the baseline characterisation of fishing traffic in Section 10.2.2.2offshore ECC.
UK Chamber of Shipping	9 May 2024, Dedicated meeting	Concern was raised over safe Wind Turbine Generator (WTG) removal for maintenance given the 1,000 m spacing between structures and if this spacing is sufficient.	Acknowledged in the risk assessment in Section 19, noting that a dedicated risk assessment will be undertaken at the time of towage operations.
		Under keel risks are relevant for project vessels in addition to third-party vessels	Indicative transit route planning will be included as part of the VMNSP) (**Volume 4, Appendix 5 (Outline Vessel Management and Navigational Safety Plan)**) which is included as an embedded mitigation measure within the NRA (Section 23).

Stakeholder(s)	Date and form of correspondence	Point raised	Response and where addressed in the NRA
		Note the repurposing of oil and gas vessels and indicated that an increase in Service Operation Vessels (SOV) across the offshore wind industry will balance some of the reduction in oil and gas movements.	Future case vessel traffic for commercial vessels is detailed in Section 14.1 with the repurposing of oil and gas vessels considered.
		Loss of station being considered for construction and decommissioning phases in the risk assessment should be associated with loss of tow specifically.	Although acknowledged in the risk assessment in Sections 18 to 20, a separate risk assessment process at the time will be undertaken.
		The Chamber queried the near miss MAIB incident within the Array Area in regard to the Project Floating Light Detection and Ranging (FLiDAR) System (FLS).	The near miss incident occurred in 2016 whereas the FLS was deployed in 2023, i.e., no temporal overlap. This is detailed further in Section 9.4.

5 Data Sources

37. This section summarises the main data sources used to characterise the Shipping and Navigation baseline relative to the Proposed Development.

5.1 Summary of Data Sources

38. The main data sources used to characterise the Shipping and Navigation baseline relative to the Array Area and offshore ECC are outlined in Table 5-1.

Table 5-1 Data Sources Used to Inform Shipping and Navigation Baseline

Data	Source(s)	Purpose
Vessel traffic	Winter vessel traffic survey data consisting of AIS, Radar and visual observations for the study area (14 days, 10 to 26 February 2023) recorded from a dedicated survey vessel on-site.	Characterising vessel traffic movements within and in proximity to the boundary of the Array Area in line with MGN 654 (MCA, 2021) requirements.
	Summer vessel traffic survey data consisting of AIS, Radar and visual observations for the study area (14 days, 23 July to 6 August 2023) recorded from a dedicated survey vessel on-site.	
	AIS only dataset comprising the same data periods as the dedicated vessel traffic surveys but within the offshore ECC study area, recorded from the same dedicated survey vessel on-site for the Array Area and from coastal receivers. The offshore ECC data includes 17 full days of data to overlap the winter survey data and 15 full days for the summer survey period[1].	Characterising vessel traffic movements within and in proximity to the offshore ECC.
	AIS data for the study area (12 months, entirety of 2022) (hereafter the 'long-term vessel traffic data') recorded from satellite and coastal receivers.	Validation of the vessel traffic surveys and characterising seasonal variations and weather routeing.
	Anatec's ShipRoutes database (2024).	Secondary source for characterising vessel traffic movements including cumulatively within and in proximity to the boundary of the Array Area.
Maritime incidents	MAIB marine accidents database (2002 to 2021).	Review of maritime incidents within and in proximity to the boundary of the Array Area and offshore ECC.
	RNLI incident data (2008 to 2022).	

[1]The vessel traffic survey data included 14 full days per survey period (to align with MGN 654 requirements for a minimum of 28 days) but due to adverse weather and partial days being incorporated into the survey periods, to get a full overlap of vessel traffic full days have been included for the offshore ECC data and analysed as appropriate.

Data	Source(s)	Purpose
	Department for Transport (DfT) UK civilian SAR helicopter taskings (April 2015 to March 2023).	
Recreational traffic density and features	*UK Coastal Atlas of Recreational Boating 2.1* (RYA, 2019).	Characterising recreational activity within and in proximity to the Array Area and offshore ECC.
	East Coast of Scotland Sailing Directions (Andy Carnduff and Forth Yacht Clubs Association, 2023).	
Other navigational features	Admiralty Charts 115-0, 213-0 ,273-0, 278-0, and 1409-0 (UKHO, 2024).	Characterising other navigational features in proximity to the boundary of the Array Area and offshore ECC.
	Admiralty Sailing Directions North Sea (West) Pilot NP54 (UKHO, 2021).	
Weather	Wind direction data collected by the Developer.	Characterising weather conditions in proximity to Array Area for use as input in the collision and allision risk modelling.
	Significant wave height data recorded from FLS located within the Array Area during 2023.	
	Tidal data provided by Admiralty Charts 278 and 1409 (UKHO, 2023).	
	Visibility data provided in *Admiralty Sailing Directions North Sea (West) Pilot NP54* (UKHO, 2021).	
	Case Studies of Past Weather Events (Met Office, 2024).	Identifying periods of adverse weather in proximity to the Array Area.

5.2 Vessel Traffic Surveys

39. The vessel traffic surveys were undertaken by the survey vessel *Karima* (IMO number 7,427,403) for winter and by the standby emergency response and rescue vessel (ERRV) *Esvagt Castor* (IMO number 9,508,756) for summer. These vessels undertook surveys in agreement with the MCA and NLB. Each survey consisted of 14 full days of vessel traffic data collection via AIS, Radar, and visual observation which combined comply with MGN 654 requirements. The dataset from each survey was supplemented with AIS collected from alternate AIS receivers to ensure optimal coverage. Dates of these vessel traffic surveys were:

- Winter survey: 10 February to 26 February 2023; and
- Summer survey: 23 July to 6 August 2023.

40. During the winter survey period, the survey vessel had to leave site for approximately 27.5 hours due to adverse weather conditions. The vessel then returned to site with the survey resuming until a full 14 days of data was collected. This has been accounted for where relevant in the vessel traffic analysis in Section 10.

41. A number of vessel tracks recorded during the survey period were classified as temporary (non-routine), such as the tracks of the survey vessels and daughter craft (in the case of the *Esvagt Castor*), a construction vessel that was attending construction works for Seagreen OWF, and survey/research vessels that by their track behaviour and information broadcast on AIS were engaged in survey/research operations. It is standard practice for temporary traffic to be removed from the analysis which ensures the focus is on routine traffic and activities within the area only and is representative of the vessel traffic movements which may be expected at the time of the Proposed Development being constructed.

5.3 Long-Term Vessel Traffic Data

42. Although seasonally varied, 28 days of survey data in isolation may not fully capture all maritime activities or periods of relevance to Shipping and Navigation. Therefore, in line with good practice a long-term vessel traffic dataset has been analysed to ensure that a comprehensive characterisation of vessel traffic movements can be established, including any seasonal variation in vessel routeing or activity. The long-term vessel traffic data consisting of AIS covering 12 months for the entirety of 2022 was collected from coastal receivers. The assessment of this dataset has been used to support the vessel traffic survey data where relevant.

43. In line with the vessel traffic surveys (Section 5.2), any traffic deemed to be temporary and/or non-routine in nature based on the information transmitted via AIS has been excluded from the dataset.

44. The dataset is assessed in full in Annex E.

5.4 Data Limitations

5.4.1 Automatic Identification System Data

45. 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 500 GT not engaged on international voyages, passenger vessels irrespective of size built on or after 1 July 2002, and fishing vessels over 15 m length overall (LOA).

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

47. Throughout the winter survey, approximately 95% of vessel tracks were recorded via AIS with the remaining 5% recorded via Radar. Throughout the summer survey, approximately 92% of vessel tracks were recorded via AIS with the remaining 8% recorded via Radar. During consultation RYA Scotland indicated that current

assumptions are that less than 50% of recreational vessels broadcast on AIS (although this is likely to be higher at the distance offshore of the Array Area).

48. The long-term vessel traffic data – an AIS only dataset – assumes that vessels under a legal obligation to broadcast via AIS will do so. Both the long-term vessel traffic data and the AIS component of the vessel traffic survey data assume that the details broadcast via AIS is accurate (such as vessel type and dimensions) unless there is clear evidence to the contrary.

5.4.2 Historical Incident Data

49. Although all UK commercial vessels are required to report accidents to the MAIB, non-UK vessels do not have to report unless they are in a UK port or within 12 nm (22.2 km) territorial waters (noting that the study area is not located entirely within 12 nm (22.2 km) 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.

50. The RNLI incident data cannot be considered comprehensive of all incidents in the 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.

5.4.3 United Kingdom Hydrographic Office Admiralty Charts

51. The UKHO Admiralty Charts are updated periodically and therefore the information shown may not reflect the real time features within the region with total accuracy. For AtoNs, only those charted and considered key to establishing the Shipping and Navigation baseline are show. During consultation input has been sought from relevant stakeholders regarding the navigational features baseline. Navigational features are based upon the most recently available UKHO Admiralty Charts and Sailing Directions at the time of writing.

6 Project Design Relevant to Shipping and Navigation

52. The NRA reflects the information detailed in full in **Volume 1, Chapter 3 (Project Description)**. The following subsections outline the maximum extent of the Proposed Development for which any Shipping and Navigation hazards are assessed.

6.1 Proposed Development

53. The Array Area is located approximately 34 nm (62.9 km) east of the north-east coast of Scotland with the closest point at Peterhead. The total area covered by the Array Area is approximately 58 square nautical miles (nm^2) (198.9 square kilometres [km^2]) with depths ranging between 62 and 97 m. The total area covered by the offshore ECC is approximately 49 nm^2 (168 km^2) with landfall likely north of Peterhead. Charted water depths within the offshore ECC range from zero (nearshore) and 118 m below CD.

54. All surface piercing structures (wind turbines and offshore substation platforms) will be located entirely within the Array Area, inclusive of blade overfly. The key coordinates defining the boundary of the Array Area are illustrated in Figure 6-1 and provided in Table 6-1 using World Geodetic System 1984 (WGS84).

55. It is noted that there is a FLS located within the Array Area which was deployed by the Developer in February 2023 with removal anticipated 2025. More details on the FLS are included in Section 7.3.

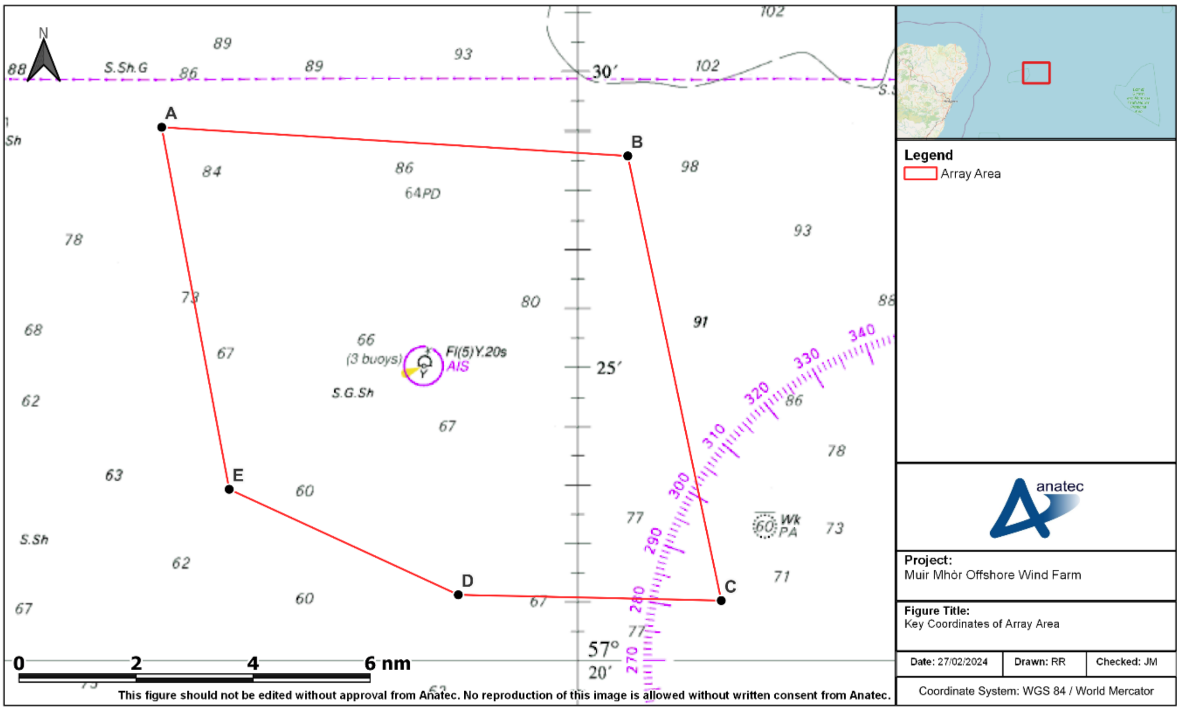


Figure 6-1 Key Coordinates of the Array Area

Table 6-1 Key Coordinates of the Array Area (WGS84)

Point	Latitude	Longitude
A	57° 29’03.73” North (N)	000° 43’06.91” West (W)
B	57° 28’34.53” N	000° 28’25.55” W
C	57° 21’01.27” N	000° 25’28.76” W
D	57° 21’07.16” N	000° 33’45.96” W
E	57° 22’54.85” N	000° 40’59.26” W

6.2 Surface Infrastructure

6.2.1 Indicative Worst-Case Layout

56. Up to 69 surface structures will be installed consisting of 67 WTGs and two Offshore Electrical Platforms (OEP). Although the final locations of infrastructure have not yet been defined, an indicative worst-case layout has been determined for Shipping and Navigation[2] and is presented in Figure 6-2.

57. The worst-case assumptions are for the purposes of modelling/risk assessment only and the final array layout will need to be agreed with the MCA and NLB post consent.

58. The minimum spacing between WTGs (measures centre-to-centre) is 1,000 m and a single line of orientation has been maintained.

[2] The Developer is also considering a 32 WTG layout option, however, the 67 WTG layout is considered worst-case for Shipping and Navigation given the maximum number for structures.

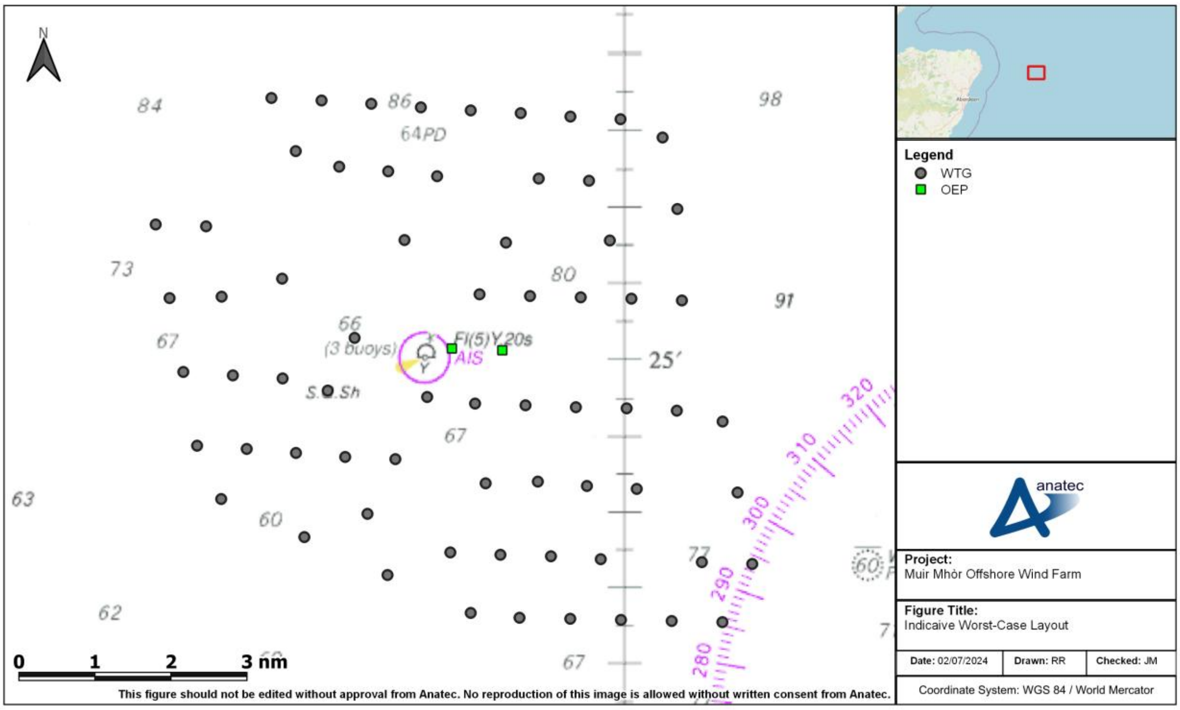


Figure 6-2 Indicative Worst-Case Layout for Shipping and Navigation

6.2.2 Wind Turbine Generators

59. The WTGs within the indicative layout each have a maximum rotor diameter of 300 m and a maximum blade tip height (above Lowest Astronomical Tide (LAT)) of 340 m, noting that these values represent a worst-case for Shipping and Navigation rather than the Proposed Development as a whole but fall within the scope of the Proposed Development design in **Volume 1, Chapter 3 (Project Description)**.

60. The WCS WTG measurements are provided in Table 6-2, noting that the values provided are specific to the worst-case selected for Shipping and Navigation and do not necessarily represent the maximum design overall.

Table 6-2 WCS for Shipping and Navigation – WTGs

Parameter	WCS for Shipping and Navigation
Maximum blade tip height (above LAT)	340 m
Minimum air gap (above Mean Sea Level (MSL))	30 m
Minimum air gap (above Mean High Water Springs (MHWS))	31.1 m
Maximum rotor diameter	300 m

6.2.3 Floating Foundations

61. Multi-tower semi-submersible floating foundations have been considered as the WCS for allision risk hazards as this foundation type provides the maximum structure dimensions at sea surface.

62. Barge floating foundations have been considered as the WCS for under keel clearance hazards. These give the minimum structure dimensions at sea surface which subsequently increases the overall distance of mooring lines in the water column, thus maximising under keel exposure.

63. The WCS floating foundation measurements for both options are provided in Table 6-2, noting that the values provided are specific to the worst-case selected for Shipping and Navigation and do not necessarily represent the maximum design overall.

64. As well as multi-tower semi-submersible floaters, the other foundation types under consideration include standard semi-submersibles, barge, tension-leg platform, and buoys. Descriptions of each foundation type under consideration are provided in **Volume 1, Chapter 3 (Project Description)**.

Table 6-3 WCS for Shipping and Navigation – Floating Foundations

Foundation Type	Parameter	WCS for Shipping and Navigation	Use within the NRA
Multi-tower semi-submersible floater	Dimensions at sea surface	150 × 140 m	Parameters used for allision risk modelling (Section 16)
	Floater height	70 m	
Barge floater	Dimensions at sea surface	86 x 86 m	Parameters used for under keel clearance risk modelling (Section 16.6)
	Floater height	45 m	

6.2.4 Mooring and Anchoring Systems

65. The floater will be attached to the seabed via a mooring and anchoring system. The maximum number of mooring lines within the Proposed Development design (**Volume 1, Chapter 3 (Project Description)**) is 12 and this is associated with a tension leg mooring system. However, tension leg moorings are not the WCS for any Shipping and Navigation hazards given they will be contained within the water column directly below the floater i.e., not exposed to third-party vessel navigation. The WCS for the Proposed Development consists of a maximum of nine taut mooring lines deployed with a maximum length of 1,600 m. It is noted that catenary and semi-taut are also being considered. As for loss of station, a minimum of three mooring lines is considered WCS and has been taken into consideration where relevant.

66. As a worst-case, the mooring lines will connect to the deck level on the floater at 25 m above the sea surface with a shallowest rate of descent to the seabed

demonstrated in Section 16.6. The overall footprint of the mooring lines will be around a 1,500 m radius centred on the floater.

67. In the case of a barge floater (used within the under keel risk modelling) the mooring line has been modelled from the edge of the floater, and so the footprint of the mooring lines will be around 1,457 m from the floater edge[3], this is illustrated in Figure 6-3.

68. Up to nine anchors will be deployed (corresponding to the mooring lines) with drag, plate, suction, gravity, and pile anchoring under consideration.

[3] This value is a result of the 1,500 m mooring line minus the half of the barge floater (43 m) as the mooring line is not modelled from the center of the floater.

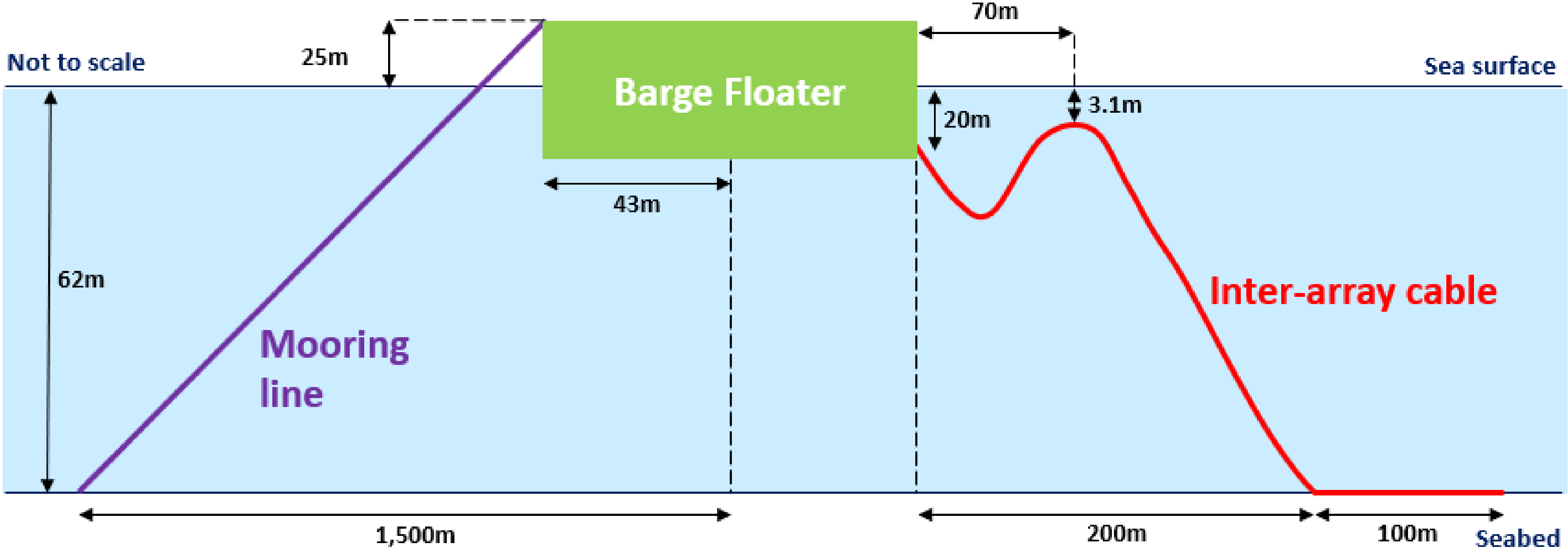


Figure 6-3 Indicative Barge Floater WCS Arrangements for Shipping and Navigation

6.2.5 Offshore Electrical Platforms

69. The OEP(s) will be installed on fixed foundations of either jackets with pin piles or suction caissons. The maximum topside dimensions for the OEP(s) at the sea surface will be 60 x 50 m.

6.3 Subsea Cables

70. Various types of subsea cables will be installed and can be categorised as follows: inter-array cables, interconnector cables, and export cables. Each of these categories is summarised in the following subsections.

6.3.1.1 Inter-Array Cables

71. The inter-array cables will connect individual WTGs to OEP(s). Up to 135 nm (250 km) of inter-array cables will be required with the final length dependent on the final array layout. All inter-array cables will be installed within the Array Area.

72. Inter-array cables will have a maximum length in the water column of 300 m, a maximum excursion to seabed connection (zero dynamic tension) of 300 m, touchdown at 100 m, and a minimum connection point depth below sea surface of 20 m.

73. As part of the WCS, a hog bend may be incorporated into the in situ inter-array cables. If so the minimum depth of the inter-array cable below the sea surface will be 3.1 m located at a maximum distance of 70 m from the floater, illustrated also in Figure 6-3.

6.3.1.2 Export Cables

74. The export cables will carry the energy generated by the WTGs from the Array Area to shore. Up to three export cables will be required with a combined total length of up to 146 nm (270 km) and will be installed within the offshore ECC. It is noted that the length of the three export cables (270 km) is *not* inclusive of the interconnector cable (3 km). A maximum of one interconnector cable will be required and provide interlink connections between the OEP(s), only if two OEP(s) are installed. The export cables will make landfall north of Peterhead. If multiple export cables are installed, the maximum spacing between cables within the offshore ECC will be 250 m.

6.3.1.3 Cable Burial

75. Where available, the primary means of cable protection will be by seabed burial. The extent and method by which the subsea cables will be buried will depend on the results of a detailed seabed survey of the final cable routes and associated cable burial risk assessment, but the most likely method will be ploughing. The inter-array cables will have a minimum burial depth of 1.0 m, and the interconnector cable and export cables will also have a minimum burial depth of 1.0 m.

76. Where cable burial is not possible, alternative cable protection methods such as rock placement, concrete mattressing, grout/rock bags, or fond mattresses may be deployed which will again be determined within the cable burial risk assessment and the maximum height of any cable protection will be 2.0 m for the inter-array cables. It is noted that there are no cable crossings anticipated for inter-array cables and up to three for the export cable.

77. Cable burial and protection is captured in the embedded mitigation measures (Section 23).

6.4 Wet Storage

78. Wet storage of assembled turbines could occur within port limits. In such instances it would be the responsibility of the relevant port authority to conduct its own risk assessment regarding wet storage operations and therefore this aspect of wet storage is also scoped out of the risk assessment.

6.5 Construction Phase

79. The offshore construction phase will last for up to approximately four years. Figure 6-4 outlines an indicative construction programme for the Proposed Development which indicates the maximum duration of construction for each element.

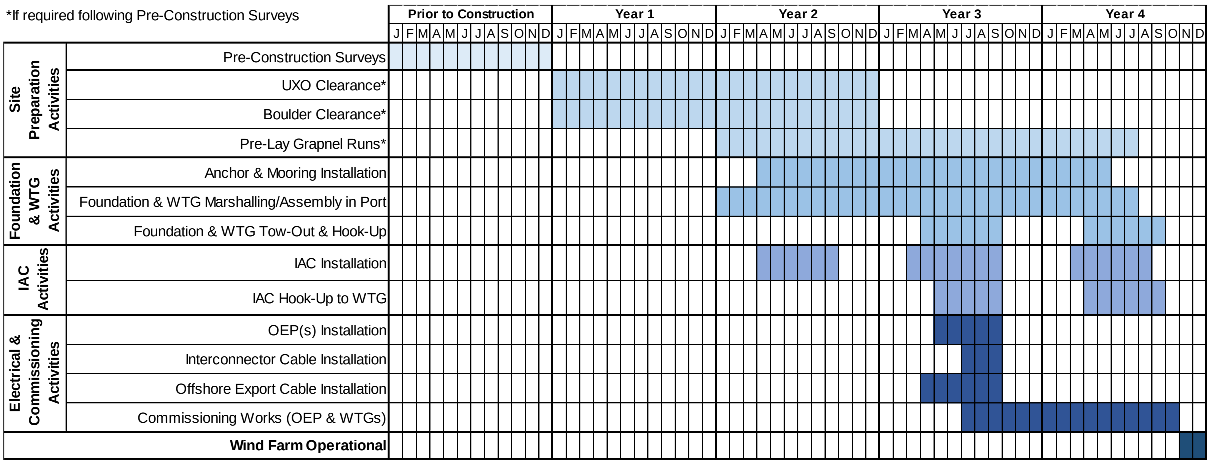


Figure 6-4 Indicative Construction Programme

6.6 Indicative Vessel and Helicopter Numbers

6.6.1 Construction Vessels

80. Up to 1,543 return trips by up to 49 construction vessels may be made throughout the construction phase, breaking down as summarised in Table 6-4.

Table 6-4 Maximum Vessel Numbers per Construction Activity

Construction Activity	Maximum number of vessels	Maximum number of return trips
Anchor and mooring pre-lay	6	201
Floater tow-out and hook up	7	201
WTG installation	6	445
OEP installation	6	36
Interconnector and Export cable installation	7	60
Inter-array cable installation	9	100
Construction support	6	444
Miscellaneous	2	56
Total	**49**	**1,543**

81. No helicopters are anticipated to be utilised during the construction phase.

6.6.2 Operation and Maintenance Phase

82. Up to 259 return trips per year by up to a peak of 11 O&M vessels at any one time may be made throughout a maximum 35-year operational lifetime O&M phase, breaking down as summarised in Table 6-5.

83. During both the construction and O&M phases, logistics will be managed by a marine coordination team with an integrated Quality, Health, Safety and Environment (QHSE) management system in place to ensure control of all vessels and their respective works. The Proposed Development will be operational 24/7.

Table 6-5 Maximum Vessel Numbers per O&M Activity

O&M Activity	Maximum number of vessels	Maximum number of return trips per year
General O&M SOV	1	28
General O&M	3	200
Disconnect WTG for tow to port maintenance	1	5
Tugs for tow to port maintenance	3	5
Jack-up for maintenance works at shallow WTGs or OEP(s)	1	5

O&M Activity	Maximum number of vessels	Maximum number of return trips per year
Cable repairs, replacement and maintenance	1	10
Survey / inspection	1	6
Total	**11**	**259**

84. Additionally, up to 50 round trips by helicopters and 200 round trips by drones are possible.

6.6.3 Decommissioning Phase

85. The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels. The decommissioning duration of the offshore infrastructure is anticipated to take three years.

6.7 Worst Case Design Scenario

86. The Worst-Case Design Scenario (WCS)for each Shipping and Navigation hazard is provided in Table 6-6 and is based on the parameters described in the previous subsections.

Table 6-6 Worst Case Scenario for Shipping and Navigation by Hazard

Potential Hazard	Phase(s)	WCS for Shipping and Navigation	Justification
Vessel displacement and increased vessel to vessel collision risk between third-party vessels	Construction	▪ Maximum extent of buoyed construction areas; ▪ Use of 500 m construction safety zones and 50 m pre-commissioning safety zones; ▪ Maximum of three offshore export cables each 49 nm (90 km) in length; ▪ Peak of 49 construction vessels offshore; and ▪ Single phase offshore construction of approximately four years.	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.
	O&M	▪ Full buildout of Array Area; ▪ Up to 67 floating WTGs; ▪ Floater surface dimensions of up to 150 x 140 m (length x width); ▪ Up to two fixed OEP(s); ▪ OEP topside dimensions of up to 60 x 50 m (length x width); ▪ Up to 135 nm (250 km) of inter-array cables including use of dynamic cable sections; ▪ Buoyancy module section per dynamic cable up to 300 m in length; ▪ Use of 500 m major maintenance safety zones; and ▪ Operational life of 35 years.	
	Decommissioning	▪ Maximum extent of buoyed decommissioning areas; ▪ Use of 500 m decommissioning safety zones and 50 m pre-commissioning safety zones; ▪ Maximum of three offshore export cables each 49 nm (90 km) in length; ▪ Peak of 49 decommissioning vessels offshore; and ▪ Single phase offshore decommissioning of approximately three years.	
Vessel to vessel collision risk between a third party vessel and a project vessel	Construction	▪ Maximum extent of buoyed construction areas; ▪ Use of 500 m construction safety zones and 50 m pre-commissioning safety zones; ▪ Maximum of three offshore export cables each 49 nm (90 km) in length;	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities

Potential Hazard	Phase(s)	WCS for Shipping and Navigation	Justification
		▪ Peak of 49 construction vessels offshore; and ▪ Single phase offshore construction of approximately four years.	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.
	O&M	▪ Full buildout of Array Area; ▪ Up to 67 floating WTGs; ▪ Floater surface dimensions of up to 150 x140 m (length x width); ▪ Up to two fixed OEP(s); ▪ Use of 500 m major maintenance safety zones; ▪ Peak of 11 maintenance vessels offshore with up to 259 round trips to port per year; and ▪ Operational life of 35 years.	
	Decommissioning	▪ Maximum extent of buoyed decommissioning areas; ▪ Use of 500 m decommissioning safety zones and 50 m pre-commissioning safety zones; ▪ Maximum of three offshore export cables each 49 nm (90 km) in length; ▪ Peak of 49 decommissioning vessels offshore; and ▪ Single phase offshore decommissioning of approximately three years.	
Reduced access to local ports/harbours/and marinas	Construction	▪ Maximum extent of buoyed construction areas; ▪ Use of 500 m construction safety zones and 50 m pre-commissioning safety zones; ▪ Maximum of three offshore export cables each 49 nm (90 km) in length; ▪ Peak of 49 construction vessels offshore; and ▪ Single phase offshore construction of approximately four years.	Largest possible extent, greatest number of vessel activities associated with the Proposed Development and greatest duration resulting in the maximum spatial and temporal effect on access to local ports.
	O&M	▪ Full buildout of the Array Area; ▪ Maximum of three offshore export cables each 49 nm (90 km) in length; ▪ Use of 500 m major maintenance safety zones; ▪ Peak of 11 maintenance vessels offshore with up to 259 round trips to port per year; and	

Potential Hazard	Phase(s)	WCS for Shipping and Navigation	Justification
		▪ Operational life of 35 years.	
	Decommissioning	▪ Maximum extent of buoyed decommissioning areas; ▪ Use of 500 m decommissioning safety zones and 50 m pre-commissioning safety zones; ▪ Maximum of three offshore export cables each 49 nm (90 km) in length; ▪ Peak of 49 decommissioning vessels offshore; and ▪ Single phase offshore decommissioning of approximately three years.	
Loss of station	Construction	▪ Maximum extent of buoyed construction areas; ▪ Up to 67 floating WTGs; ▪ Minimum of three mooring lines per substructure; ▪ Taut mooring lines; ▪ Floater surface dimensions of up to 150 x 40 m (length x width); and ▪ Single phase offshore construction of approximately four years.	Maximum number of WTGs with greatest surface dimensions and greatest duration resulting in the maximum spatial and temporal effect on loss of station risk.
	O&M	▪ Full buildout of Array Area; ▪ Up to 67 floating WTGs; ▪ Minimum of three mooring lines per substructure; ▪ Taut mooring lines; ▪ Floater surface dimensions of up to 150 x 140 m (length x width); and ▪ Operational life of 35 years.	
	Decommissioning	▪ Maximum extent of buoyed decommissioning areas; ▪ Up to 67 floating WTGs; ▪ Minimum of three mooring lines per substructure; ▪ Taut mooring lines; ▪ Floater surface dimensions of up to 150 x 140 m (length x width); and ▪ Single phase offshore decommissioning of approximately three years.	

Potential Hazard	Phase(s)	WCS for Shipping and Navigation	Justification
Creation of vessel to structure allision risk (including powered, drifting and internal)	O&M	▪ Full buildout of Array Area; ▪ Up to 67 floating WTGs; ▪ Floater surface dimensions of up to 150 x 140 m (length x width); ▪ Up to two fixed OEP(s); ▪ OEP topside dimensions of up to 60 x 50 m (length x width); ▪ Use of 500 m major maintenance safety zones; ▪ Minimum spacing of 1,000 m between WTGs; and ▪ Operational life of 35 years.	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.
Reduction of under keel clearance as a result of cable protection, dynamic cables, and mooring lines	O&M	▪ Full buildout of Array Area; ▪ Up to 67 floating WTGs; ▪ Maximum of nine mooring lines per substructure; ▪ Taut mooring lines; ▪ Up to two fixed OEP(s); ▪ Up to 135 nm (250 km) of inter-array cables including use of dynamic cable sections with no cable crossings; ▪ Maximum of three offshore export cables each 49 nm (90 km) in length with up to three cable crossings; ▪ Single Interconnector cable 3km in length ▪ Buoyancy module section per dynamic cable up to 300 m in length; ▪ Inter-array cable touchdown at 100 m; ▪ Minimum burial depth of 1 m for non-dynamic sections of inter-array cables, interconnector cable and for the export cables; ▪ External protection where needed, with a height of up to 2 m; and ▪ Operational life of 35 years.	Largest possible extent of subsea infrastructure and greatest duration resulting in the maximum spatial and temporal effect on under keel clearance.
Anchor interaction with mooring lines and subsea cables	O&M	▪ Full buildout of Array Area; ▪ Up to 67 floating WTGs; ▪ Maximum of nine mooring lines per substructure;	Largest possible extent of subsea infrastructure and greatest duration resulting in the

Potential Hazard	Phase(s)	WCS for Shipping and Navigation	Justification
		▪ Taut mooring lines; ▪ Mooring line radius up to 1,500 m; ▪ Maximum of three offshore export cables each 49 nm (90 km) in length with up to three cable crossings; ▪ Single Interconnector cable 3 km in length ▪ Up to 135 nm (250 km) of inter-array cables including use of dynamic cable sections with no cable crossings; ▪ Buoyancy module section per dynamic cable up to 300 m in length; ▪ Minimum burial depth of 1 m for non-dynamic sections of inter-array cables, interconnector cable and for the export cables; ▪ External protection where needed, with a height of up to 2 m; and ▪ Operational life of 35 years.	maximum spatial and temporal effect on anchor interaction with subsea cables.
Reduction of emergency response capability including SAR access	O&M	▪ Full buildout of Array Area; ▪ Up to 67 floating WTGs; ▪ Maximum of nine mooring lines per substructure; ▪ Floater surface dimensions of up to 150 x 140 m (length x width); ▪ Up to two fixed OEP(s); ▪ OEPSP topside dimensions of up to 60 x 50 m (length x width); ▪ Peak of 11 maintenance vessels offshore with up to 259 round trips to port per year; and ▪ Operational life of 35 years.	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

87. An overview of navigational features within and in proximity to the Proposed Development is presented in Figure 7-1. Following this, Figure 7-2 presents the same navigational features in more detail surrounding the offshore ECC landfall location. Each of the features shown are discussed in the following subsections and have been identified using the most detailed UKHO Admiralty Charts available as well as information from *Admiralty Sailing Directions North Sea (West) Pilot NP54* (UKHO, 2021).

88. Stakeholders confirmed during dedicated meetings, and at the Hazard Workshop, that all expected navigational features in proximity to the Proposed Development were suitably characterised.

89. It is noted that no IMO routeing measures, marine aggregate dredging areas, military practice and exercise areas (PEXA), or anchorage areas were identified in proximity to the Proposed Development.

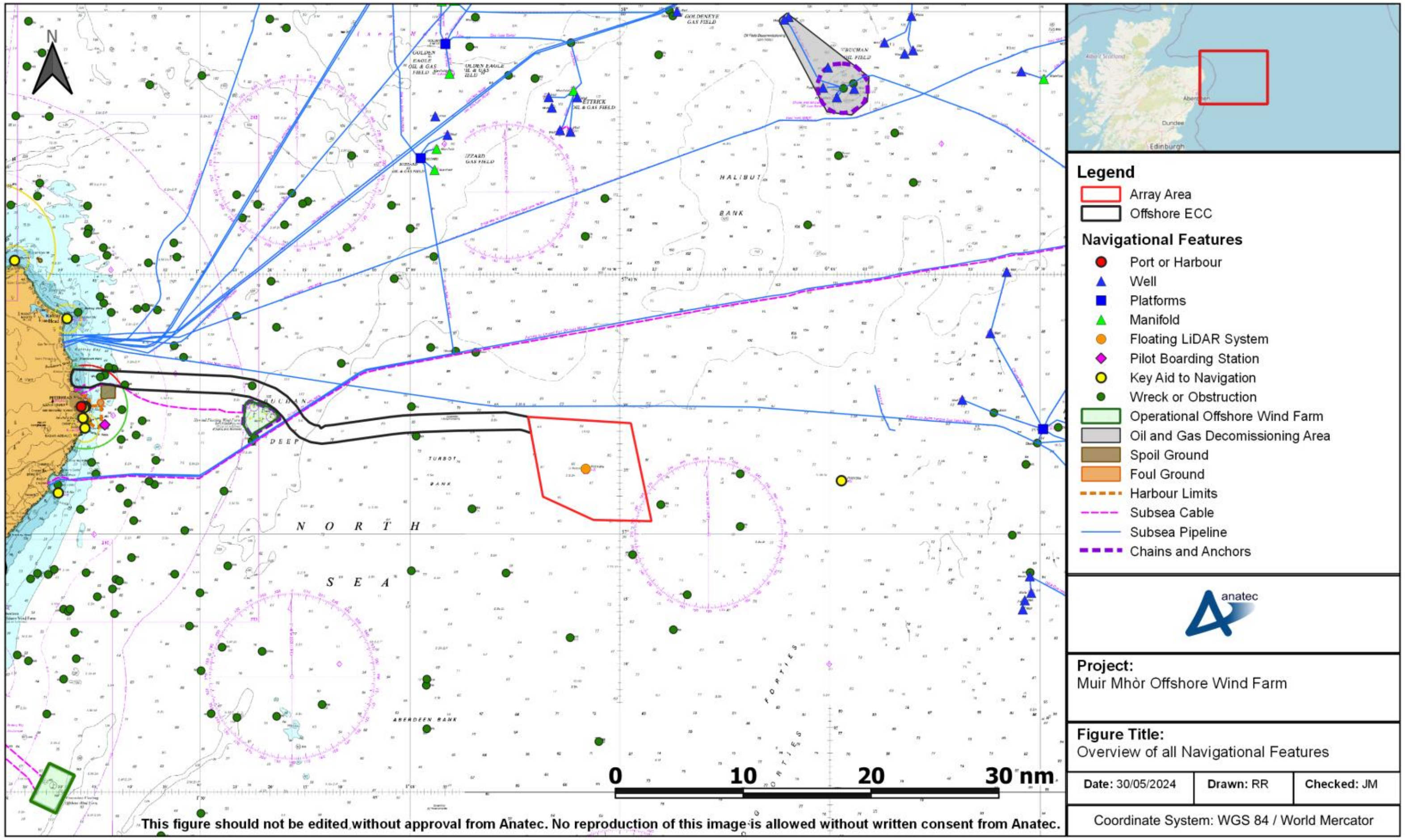


Figure 7-1 Overview of all Navigational Features

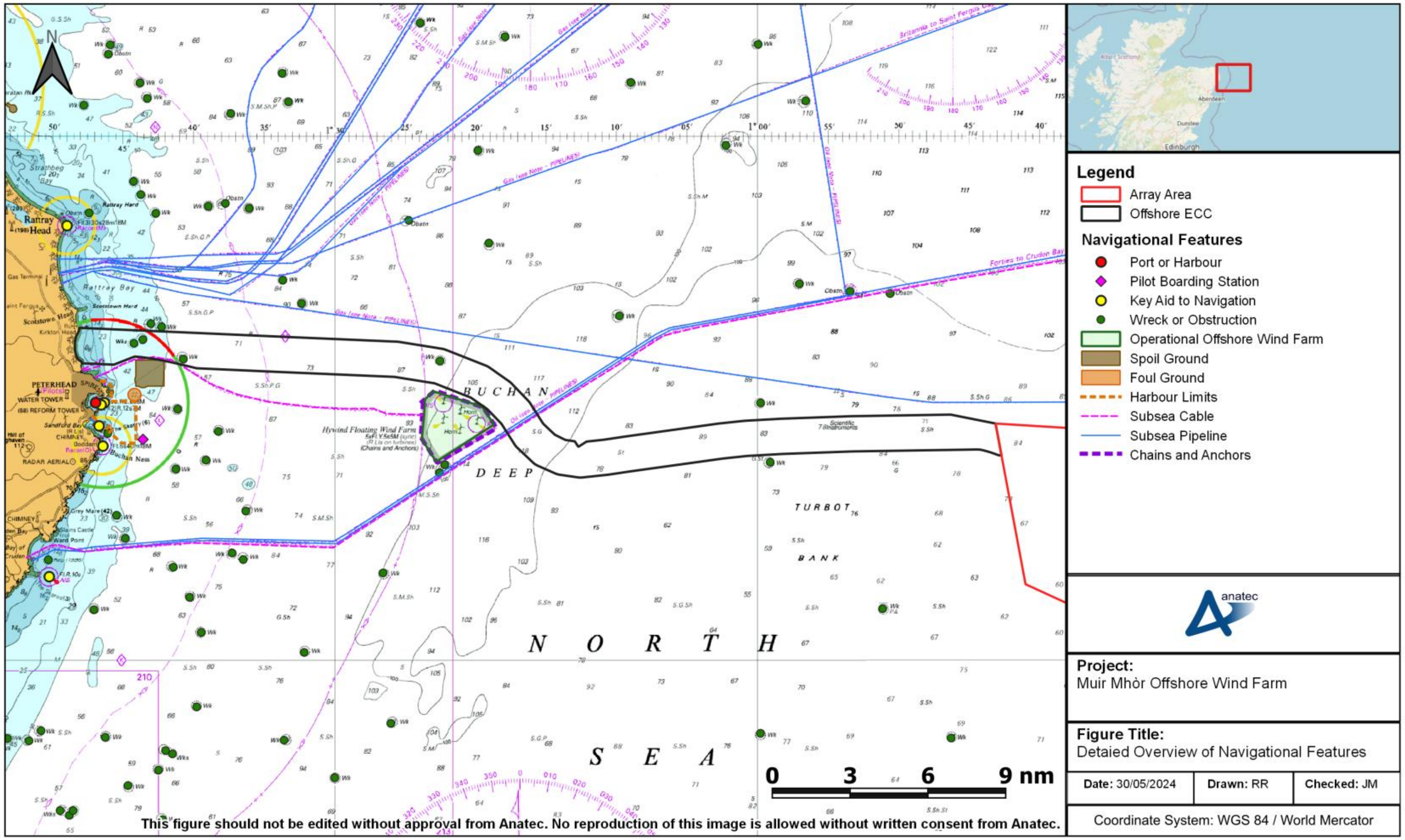


Figure 7-2 Detailed Overview of Navigational Features Near the Offshore ECC Landfall

7.1 Other Offshore Wind Farm Developments

90. Hywind Scotland floating OWF is situated approximately 19 nm (35.2 km) to the west of the Array Area and shares a point of its northern border with the offshore ECC at approximately 14 nm (25.9 km) offshore. Hywind has been operational since 2017 and its export cable makes landfall at Peterhead, south of the proposed landfall option for the Proposed Development; however, approximately 1 nm (1.85 km) of Hywind's export cable intersects the offshore ECC approximately 2.5 nm (4.6 km) offshore as illustrated in Figure 7-1 and Figure 7-2.

91. To the south-west of the Array Area, at approximately 42 nm (77.8 km), is Kincardine OWF which has been operational since 2021. Kincardine is situated approximately 29 nm (53.7 km) from the offshore ECC. Aberdeen Bay OWF is located north-west of Kincardine at approximately 43 nm (79.6 km) from the Array Area and 18 nm (33.3 km) from the offshore ECC.

7.2 Key Ports and Related Facilities

92. The key ports and harbours of relevance to the Proposed Development are presented in Figure 7-3, with the following subsections providing further detail on the ports and harbours most relevant to the Proposed Development.

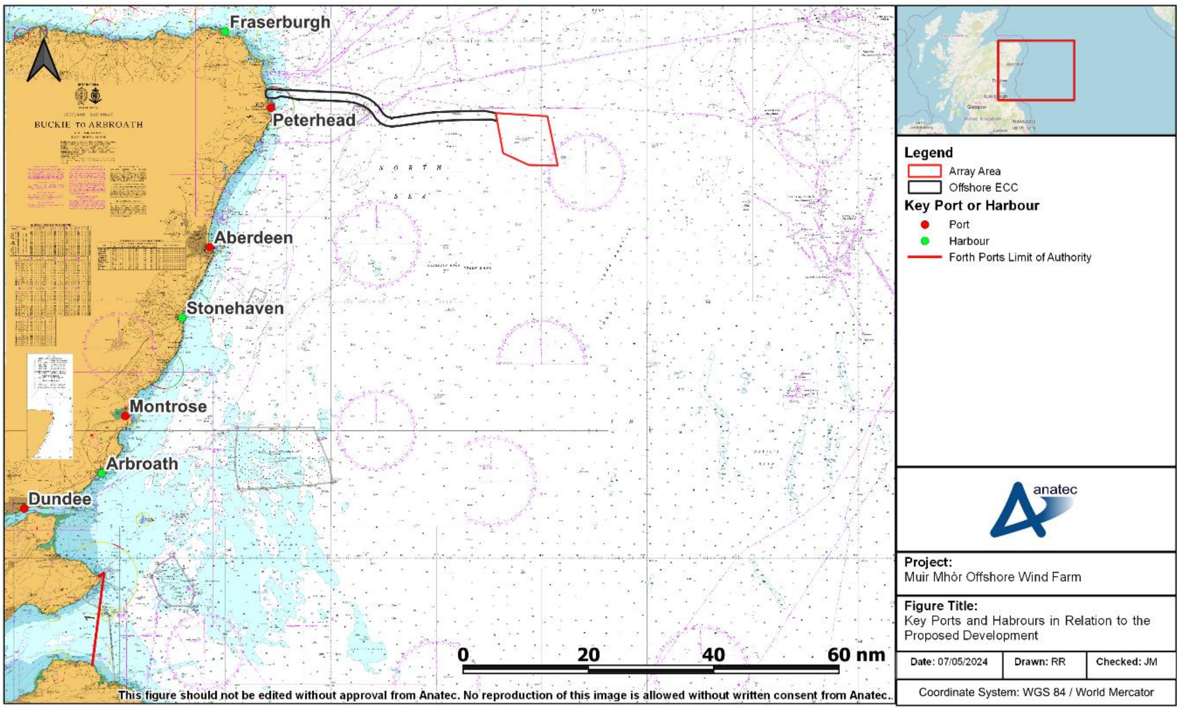


Figure 7-3 Key Ports and Harbours in Relation to the Proposed Development

7.2.1 Peterhead Port

93. Peterhead Port is the closest port to the Proposed Development at approximately 34 nm (62.9 km) to the west of the Array Area and 1 nm (1.85 km) south of the offshore ECC. Peterhead Port is the largest fishing port in Europe as well as being an important base for serving a range of commercial vessels (Peterhead Port Authority, 2024). A pilot boarding station is located approximately 2 nm (3.70 km) offshore from the port and pilotage is compulsory for:

- All vessels exceeding 3,500 GT;
- All tankers carrying oil in bulk as cargo;
- Vessels carrying hazardous cargoes or dangerous good in bulk in quantities of 100 tonnes or more;
- Vessels carrying more than one tonne of IMO Class 1 explosives;
- All vessels which, in the opinion of the Harbour Master or his appointed deputies, are defective, damaged or handicapped to such an extent that pilotage is required;
- When a pilot is required due to an obstruction in Peterhead Bay Harbour; and
- Vessels carrying more than 12 passengers.

94. Peterhead Port Authority operates a vessel traffic service (VTS) with Radar surveillance.

95. Anchoring within Peterhead Bay and the Peterhead VTS area is prohibited unless in an emergency or authorised by the Harbour Master or his deputies.

96. Within Peterhead Port is Peterhead Bay Marina which was noted by RYA Scotland at the Hazard Workshop as a common stopping point for transiting recreational vessels (Section 4.4).

7.2.2 Port of Aberdeen

97. The Port of Aberdeen is located approximately 47 nm (87.0 km) south-west of the Array Area and approximately 25 nm (46.3 km) south of the offshore ECC. The Port of Aberdeen is Scotland's largest berthage port which is classed as "*an international hub for energy, trade, and tourism"* (Port of Aberdeen, 2024a). The Port of Aberdeen facilitates oil and gas, renewables, decommissioning, cargo, cruise liners, and commercial ferry services. Aberdeen South Harbour was commissioned in August 2023 as an expansion of the Port offering "*1,500 m of deep-water berths to a maximum depth of -15 m, extensive heavy-lift capabilities, 125,000 square metres (m^2) of flexible laydown space, and ample project areas for vessels up to 300 m in length*" (Port of Aberdeen, 2024b).

98. The Port of Aberdeen operates a VTS and when vessels are 3 nm (5.56 km) from the Fairway Light Buoy, they must request permission to enter the VTS area.

7.2.3 Fraserburgh Harbour

99. Fraserburgh harbour is located approximately 43 nm (79.6 km) north-west from the Array Area and approximately 11 nm (20.4 km) north-west of the offshore ECC. Fraserburgh Harbour is primarily a fishing port with a large local fishing fleet which tend to land in Peterhead Port as noted by the SWFPA during the Hazard Workshop (Section 4.4).

7.3 Aids to Navigation

100. An FLS was deployed by the Developer in February 2023 within the Array Area. This FLS gathers metocean and wind data to inform the Developer and is anticipated to be removed in 2025. The FLS is equipped with a special top mark and flashing yellow light with a range of 5 nm (9.26 km) and carries AIS.

101. Excluding the temporary FLS, the closest AtoN to the Array Area is a spherical light buoy located 15 nm (27.8 km) to the east as illustrated in Figure 7-1. There are no AtoNs within the offshore ECC, with the closest the significant all round light on the north breakwater on approach to Peterhead Port and the Peterhead Lighthouse on the south breakwater, approximately 1.5 nm (2.78 km) south of the offshore ECC as illustrated in Figure 7-1 and Figure 7-2.

102. There is also a red light buoy south of Cruden Bay, highlighting the shallow, rocky reef of The Skares which is just north of the Buchan Ness Lighthouse situated approximately 3 nm (5.56 km) south of the offshore ECC as illustrated in Figure 7-1 and Figure 7-2.

103. An all-round light Radar beacon (Racon) is also present at Rattray Head approximately 4 nm (7.40 km) north of the offshore ECC on the coastline as illustrated in Figure 7-1 and Figure 7-2.

7.4 Subsea Cables and Pipelines

104. The closest subsea cable to the Array Area is the electrical cable linking the Forties Field to Cruden Bay. This cable passes approximately 5.7 nm (10.5 km) north of the Array Area and intersects the offshore ECC approximately 15 nm (27.8 km) offshore. At the same point in the offshore ECC, the subsea pipeline also linking the Forties Field to Cruden Bay intersects. This is illustrated in Figure 7-1 and Figure 7-2

105. The closest subsea pipeline connecting the Fulmar Field to St. Fergus Terminal is the closest to the Array Area at approximately 0.8 nm (1.48 km) north, and passes 0.4 nm (0.74 km) north of the offshore ECC as illustrated in Figure 7-1 and Figure 7-2.

106. Hywind's export cable intersects the offshore ECC close to shore for approximately 1.2 nm (2.22 km) length of the Hywind export cable as aforementioned in Section 7.1.

7.5 Oil and Gas Surface Piercing Infrastructure

107. The Buzzard Field and associated surface platforms are situated approximately 20 nm (37.0 km) north of the Proposed Development with the Ettrick Field approximately 22 nm (40.7 km) north, although Ettrick does not contain any surface piercing platforms. The Kittiwake Field and associated surface piercing platform is located approximately 31 nm (57.4 km) east of the Array Area, with the Teal and Guillemot, Gannet, and Triton Oil fields and their relevant surface piercing platforms and Floating Production Storage and Offloading (FPSO) vessels are situated south of Kittiwake. Each of these fields are illustrated in Figure 7-1.

108. The Buchan Field to the north-east of the Proposed Development, as illustrated in Figure 7-1, at the time of writing, was undergoing decommissioning and as noted on the relevant UKHO chart "*During the works, aids to navigation may be unreliable and certain features may not be as shown. Consult local notices to mariners issued by oil/gas field operators for details of decommissioning process*." (UKHO, 2024).

109. There are many other oil and gas fields beyond those outlined above in which oil and gas vessels are recorded routeing to/from as outlined in Section 10.1.2.1.

7.6 Other Navigational Features

110. A foul ground is located approximately 0.6 nm (1.11 km) east of Peterhead Port and a spoil ground is located adjacently north of the foul ground. This spoil ground intersects the offshore ECC as illustrated in Figure 7-1 and Figure 7-2. Three other spoil grounds are located in proximity to Peterhead Port but are not intersecting the offshore ECC.

111. Four charted wrecks are located within the offshore ECC with the shallowest at 36 m below CD approximately 2 nm (3.70 km) offshore as illustrated in Figure 7-1 and Figure 7-2. No charted wrecks were recorded within the Array Area.

8 Meteorological Ocean Data

8.1 Wind Distribution

112. Based on wind direction data provided by the Developer, the distribution of wind direction data within each 30-degree interval is presented in Figure 8-1, in the form of a wind rose.

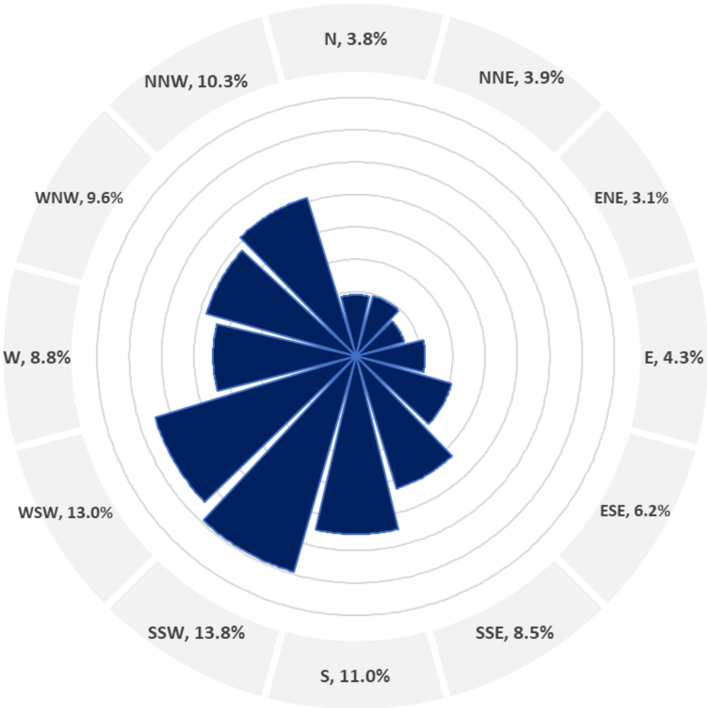


Figure 8-1 Wind Direction Distribution in Proximity to the Array Area

113. Winds are predominantly from the south-south-west (13.8%) and west-south-west (13.0%).

8.2 Significant Wave Height

114. Significant wave height data was recorded via the FLS located within the Array Area during 2023. Table 8-1 presents the proportion of the significant wave height within each of three defined ranges which are categorised as calm, moderate and severe sea states.

Table 8-1 Sea State Distribution in Proximity to Array Area

Significant Wave Height (m)	Sea State	Proportion (%)
Less than 1	Calm	30.2
1 to 5	Moderate	69.6

Significant Wave Height (m)	Sea State	Proportion (%)
More than or equal to 5	Severe	0.3

8.3 Visibility

115. The annual average incidence of poor visibility (defined as the proportion of a year where the visibility can be expected to be less than 1 km) is 2%. This is based upon information available within Admiralty Sailing Directions North Sea (West) NP54 Pilot (UKHO, 2021).

8.4 Tidal Speed and Direction

116. Table 8-2 presents the peak flood and ebb direction and speed values obtained from UKHO Admiralty Charts local to the Array Area.

Table 8-2 Peak Flood and Ebb Speed and Direction Data

UKHO Admiralty Chart	Tidal Diamond	Flood		Ebb	
		Direction (°)	Speed (kts)	Direction (°)	Speed (kts)
278	B	006	0.9	189	0.8
278	E	012	0.7	188	0.7
1409	J	014	1.0	192	0.9

117. Based upon the available data, no impacts are expected at high water that would not also be expected at low water, and vice versa. The wind farm structures are not expected to have any additional impact on the existing tidal streams in relation to their effect on existing Shipping and Navigation users.

9 Emergency Response and Incident Overview

118. This section summarises the existing emergency response resources (including SAR) and reviews historical maritime incident data to assess baseline incident rates in proximity to the Proposed Development.

9.1 Search and Rescue Helicopters

119. 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.

120. The SAR helicopter service is currently operated out of ten base locations around the UK, with the closest to the Proposed Development, Inverness, located approximately 108 nm (200 km) to the west. This base operates two Leonardo Agusta Westland 189 helicopters.

121. 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 2023.

122. The locations of SAR helicopter taskings within the combined study areas are presented in Figure 9-1, colour-coded by tasking type.

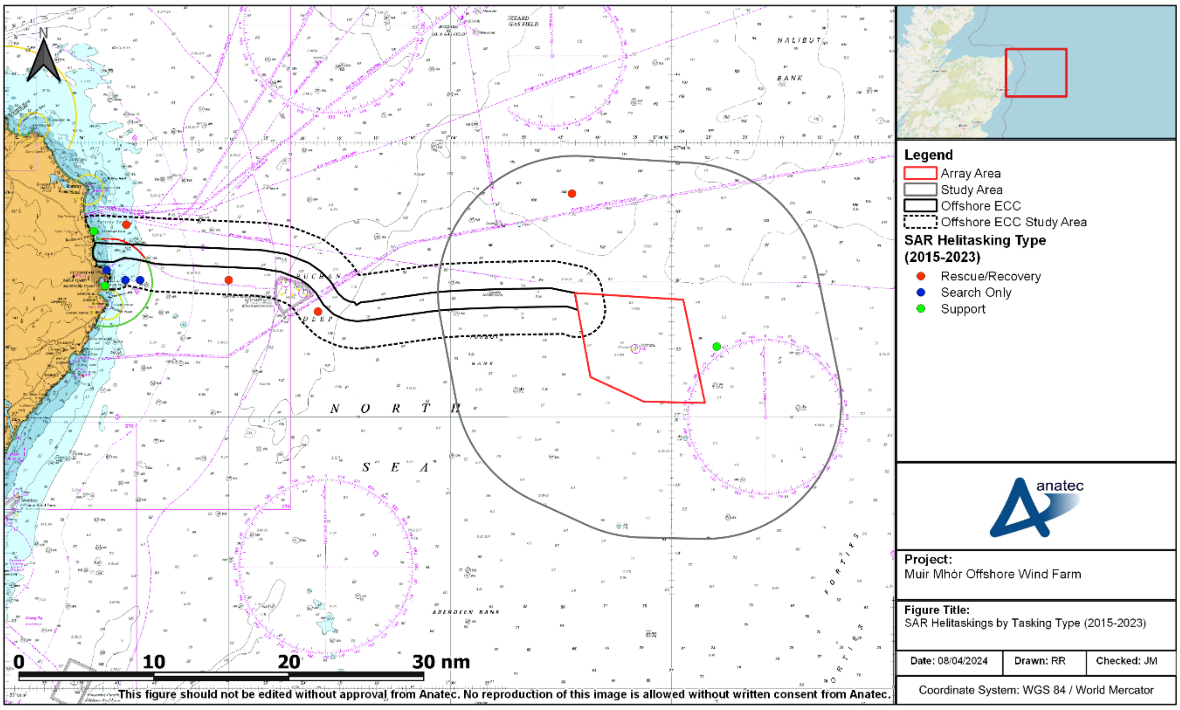


Figure 9-1 SAR Heli Tasking Data by Tasking Type (2015-2023)

123. Over the eight-year period, a total of 10 helicopter taskings were recorded within the combined study areas, equating to an average of one per year. Only two taskings occurred within the study area for the Array Area; a '*rescue/recovery*' and a '*support*', no taskings were recorded within the Array Area itself. Eight taskings were recorded within the offshore ECC study area with none of these taskings recorded within the offshore ECC itself. Of those eight taskings recorded within the offshore ECC study area, six were recorded within 3 nm (5.56 km) of the coast, with three of these on the coastline, in proximity to Peterhead.

124. Of the 10 tasking recorded, four were "*rescue/recovery*" (40%), three were "*support*" (33%), and three were "*search only*" (30%). Inverness responded to 90% of these incidents with one incident being responded to by the Stornoway base.

9.2 Royal National Lifeboat Institution

125. The RNLI is organised into six divisions, with the relevant region for the Proposed Development being the 'Scotland' division. 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). There are a number of RNLI stations in proximity to the Proposed Development, as illustrated in Figure 9-2.

126. The closest RNLI station to the Array Area is at Peterhead (1.1 nm [2.04 km] south of the offshore ECC and 34 nm [62.9 km] from the Array Area), where an ALB is in use. The Fraserburgh and Aberdeen RNLI stations are also within 50 nm (92.6 km) of the Array Area, where again an ALB is in use and an Inshore Lifeboat is also present at Aberdeen RNLI station.

127. Given that the RNLI have an operational limit of 100 nm (185 km), it is anticipated that an incident occurring in proximity to the Proposed Development may result in a response from an RNLI asset.

128. The incidents recorded within the RNLI dataset between 2013 and 2022 occurring within the study areas are presented in Figure 9-2, colour-coded by incident type. Following this, Figure 9-3 shows 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.

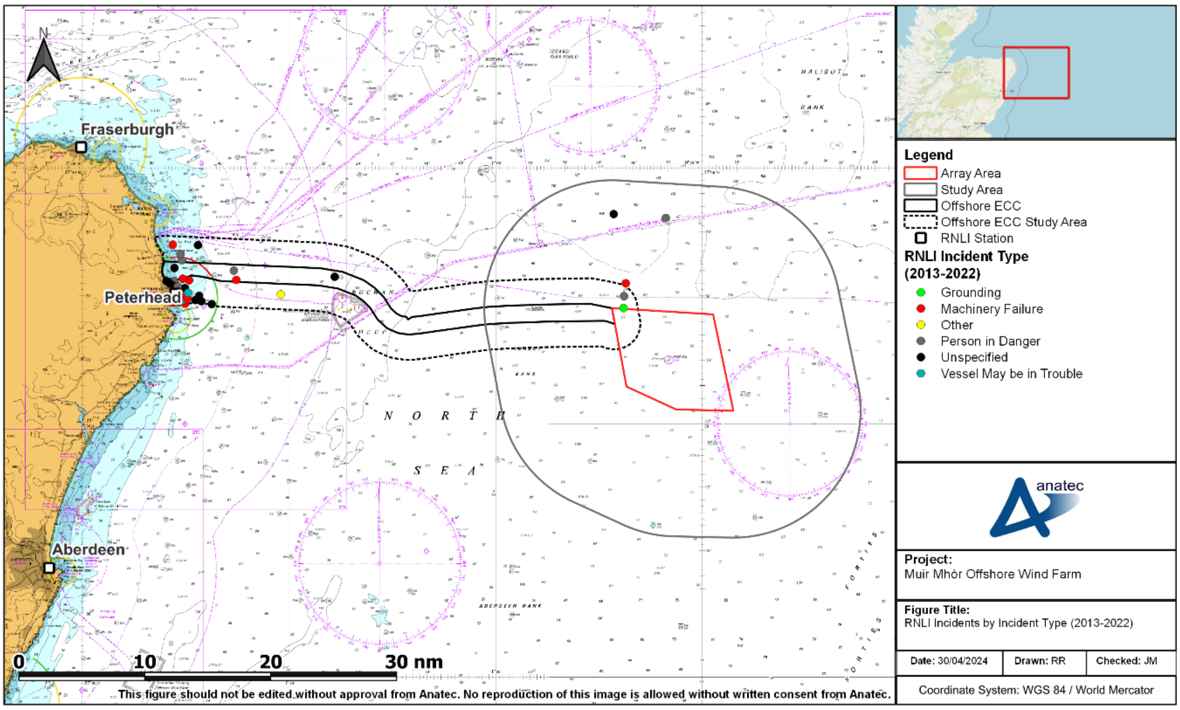


Figure 9-2 RNLI Stations and Incidents by Incident Type (2013-2022)

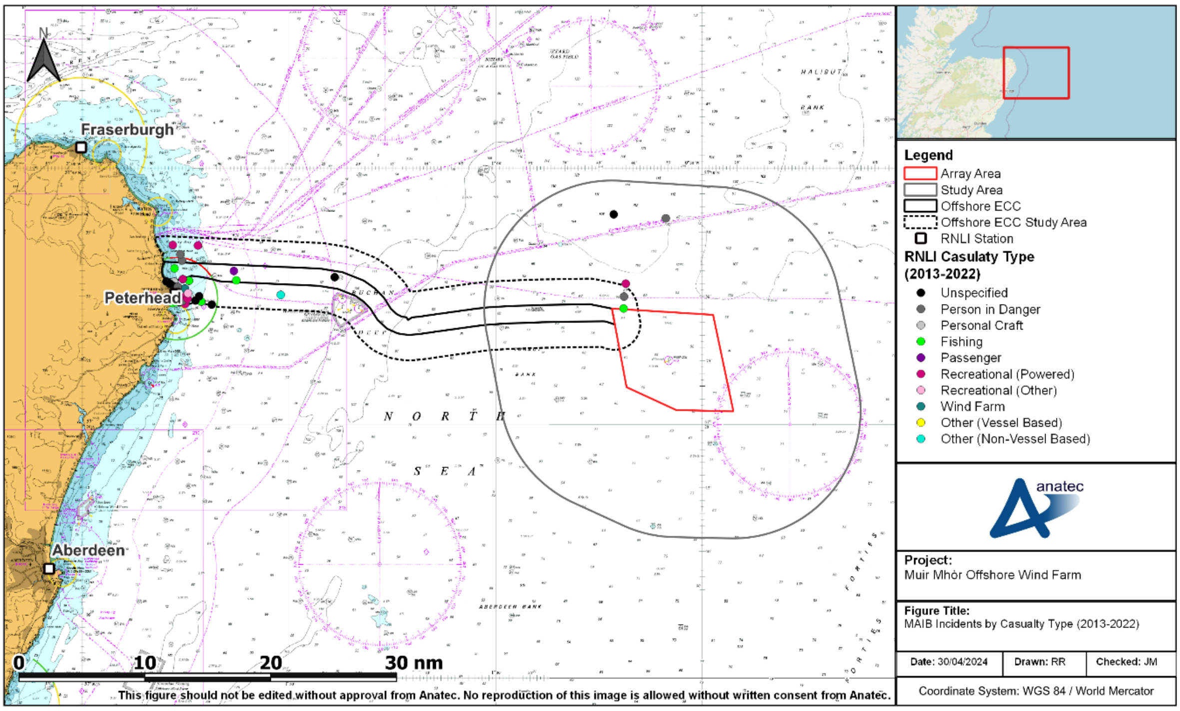


Figure 9-3 RNLI Stations and Incidents by Casualty Type (2013-2022)

129. A total of 46 incidents were responded to by the RNLI within the combined study areas between 2013 and 2022. This corresponds to an average of four to five incidents per year; however, it is noted that the majority of incidents (approximately

85%) occurred within 5 nm (9.26 km) of the coast whilst the number of incidents further offshore was much lower. Only five incidents were recorded within the study area, with no incidents occurring within the Array Area itself. A total of 43 incidents were recorded within the offshore ECC study area with only four of these incidents recorded within the offshore ECC.

130. The Peterhead RNLI station responded to 78% of all incidents with Fraserburgh (13%), Kessock (7%), and Invergordon (2%) responding to the remainder.

131. Incidents of an unspecified incident type were the most commonly recorded across the combined study areas (46%). Excluding unspecified incidents, the most common incident type recorded was "*machinery failure"* which accounted for 26% of all incidents recorded and "*person in dang*er" which accounted for 22% of all incidents recorded.

132. As for casualty type, the most common recorded was again unspecified casualty types which accounted for 37% of all incidents recorded. Excluding unspecified incidents, the most common casualty type recorded was recreational vessels (24%) with the majority of these vessels being powered recreational vessels. The high proportion of recreational vessels may be attributed to the high volume of recreational activity in the nearshore area where the RNLI is most likely to respond to an incident. Fishing vessels (15%) and person in danger (15%) were also commonly recorded.

133. As requested by RYA Scotland, this RNLI data was assessed for any information on entanglement of creel pot gear or loss of power due to inshore static fishing gear. There is one instance of machinery failure as a result of a fouled propeller during the data period, which was recorded from a powered recreational vessel inshore, within the area static fishing gear was highlighted to be present during the Hazard Workshop. There is insufficient data in the dataset to confirm this incident was due to fishing gear.

134. A review of older RNLI incident data within the combined study areas between 2008 and 2012 indicates that the number of incidents has remained steady, with 24 unique incidents recorded in the previous five-year period, corresponding to an average of five incidents per year. Of the recorded incidents all were responded to by Peterhead RNLI station and incident types were primarily "*machinery failure"* (54%), "*capsize*" (17%), and "*person in danger"* (13%). The main casualty type recorded was fishing vessels (42%), recreational vessels (all powered) (29%) and personal craft (13%). No incidents were recorded within the Array Area itself with only one incident within the study area for the Array Area. Of the 23 incidents within the offshore ECC study area, all incidents were recorded within 4 nm (7.41 km) of the coastline with five recorded within the offshore ECC itself.

9.3 Global Maritime Distress and Safety System

135. 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.

136. There are four GMDSS sea areas, and in the UK, it is the responsibility of the MCA to ensure VHF coverage from coastal stations within sea area A1. The Proposed Development is located approximately 34 nm (62.9 km) offshore and is likely within an A1 sea area, as shown in Figure 9-4. Therefore, in the event of an emergency involving a vessel located further offshore within sea area A1 or A2, vessels are able to contact coastal stations using High Frequency (HF) or Medium Frequency (MF) radio or otherwise contact other offshore resources.

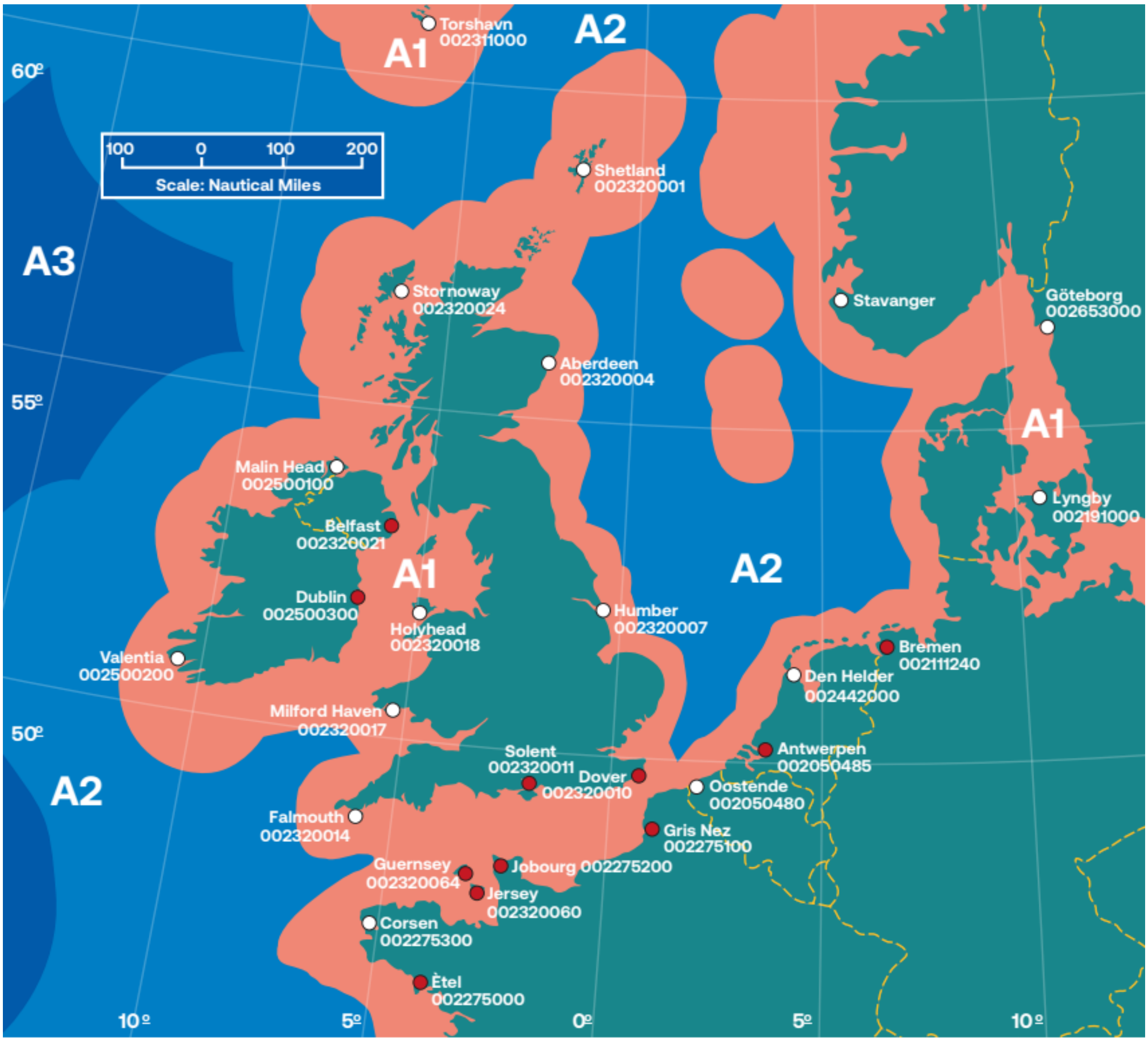


Figure 9-4 GMDSS Sea Areas (MCA, 2021).

9.4 Marine Accident Investigation Branch

137. All UK flagged vessels and non-UK flagged vessels in UK territorial waters (12 nm [22.2 km]), 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 2012 and 2021.

138. The incidents recorded within the MAIB dataset between 2012 and 2021 occurring within the combined study areas are presented in Figure 9-5, colour-coded by incident type. Following this, Figure 9-6 shows the same data colour-coded by the type of vessel(s) involved in each incident.

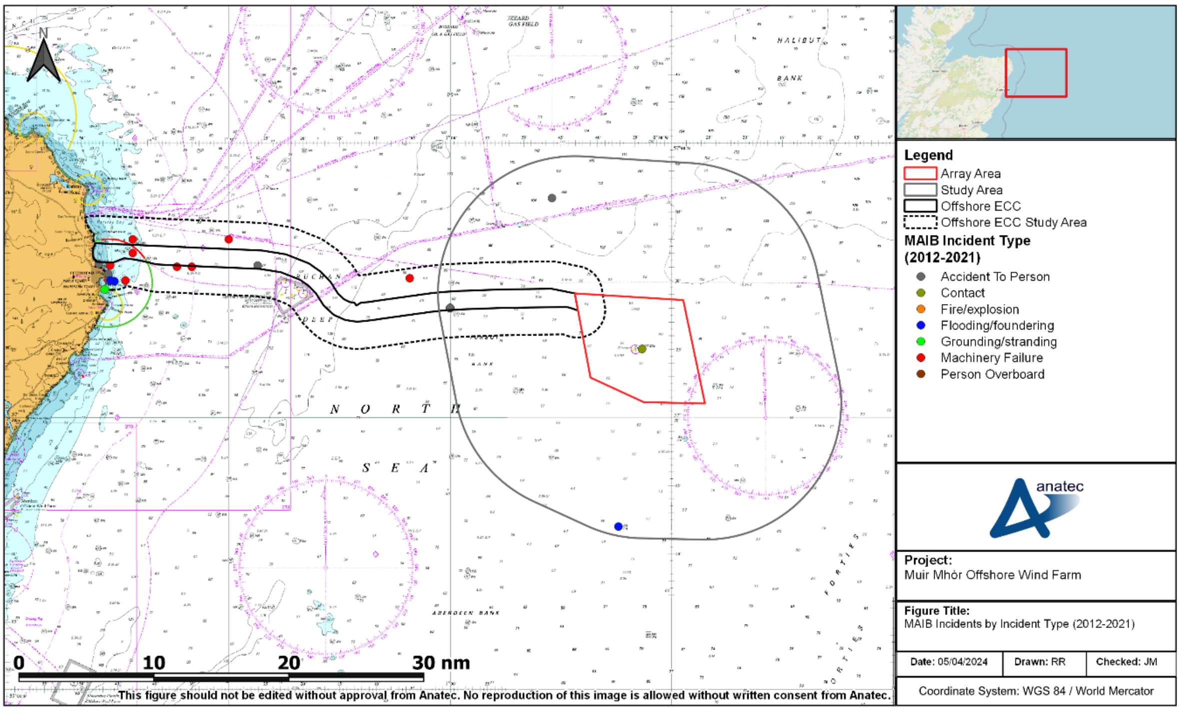


Figure 9-5 MAIB Incident Data by Incident Type (2012-2021)

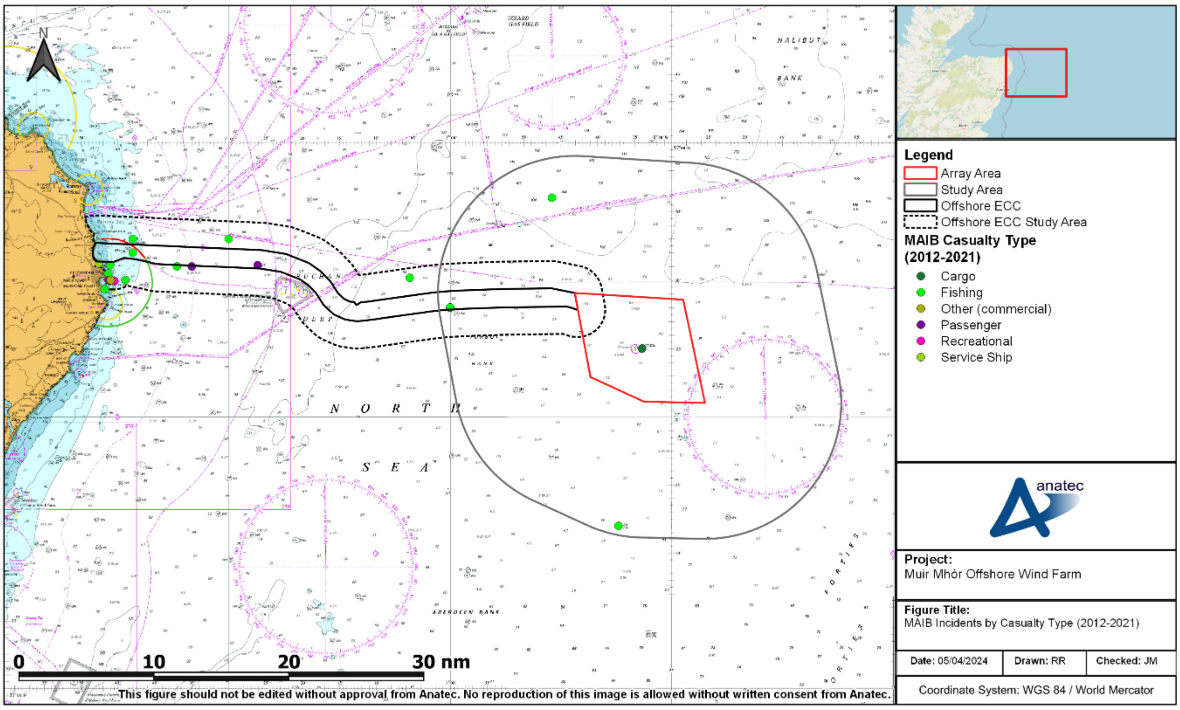


Figure 9-6 MAIB Incident Data by Vessel Type (2012-2021)

139. A total of 28 unique incidents were reported to the MAIB within the combined study areas between 2012 and 2021. This corresponds to an average of three incidents per year; however, it is noted that the majority of incidents (approximately 71%) occurred within 6 nm (11.1 km) of the coast whilst the number of incidents further offshore was much lower. Only three incidents were recorded within the Array Area study area, with one incident occurring within the Array Area itself and three incidents occurred within the offshore ECC.

140. The incident occurring within the Array Area was a near miss collision incident in 2016 involving a dry cargo vessel and a platform under tow. The vessel was on a collision path and the platform went to muster but avoided any contact when the cargo vessel altered course and was able to continue on its intended course clear of the platform. Although overlapping the FLS depicted on the most recent and up to date UKHO Admiralty chart in Figure 9-5 and Figure 9-6, the incident pre-dated the deployment of the FLS (Section 7.3) by nearly seven years, i.e., no temporal overlap.

141. The most common incident types recorded were "*accident to person*" (32%) and "*machinery failure*" (30%). The most common casualty type recorded was fishing vessels (59%).

142. A review of older MAIB incident data within the combined study areas between 2002 and 2011 indicates that the number of incidents has slightly decreased over time, with 41 unique incidents recorded in the previous 10-year period, corresponding to an average of four incidents per year. Of those incidents recorded, the main incident

types were "*machinery failure*" (29%) and "*accident to person*" (27%). The main casualty type recorded was fishing vessels (68%).

9.5 Historical Offshore Wind Farm Incidents

9.5.1 Incidents Involving UK Offshore Wind Farm Developments

143. As of July 2024, there are 42 operational OWFs in the UK, ranging from the North Hoyle OWF (fully commissioned in 2003) to the Hornsea Project Two OWF (fully commissioned in 2022). Between them, these developments encompass approximately 23,344 fully operational WTG years.

144. MAIB incident data has been used to collate a list of reported historical collision and allision incidents involving UK OWF developments[4], which is summarised in Table 9-1. 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.

Table 9-1 Summary of Historical Collision and Allision Incidents Involving UK OWF Developments

Incident Vessel	Incident Type	Date	Description of Incident	Vessel Damage*	Harm to Persons	Source
Project	Allision	7 August 2005	WTG installation vessel allision with WTG base whilst manoeuvring alongside it. Minor damage sustained to a gangway on the vessel, the WTG tower and a WTG blade.	Minor damage to gangway on the vessel	None	MAIB
Project	Allision	29 September 2006	Offshore services vessel allision with rotating WTG blade.	None	None	MAIB
Project	Allision	8 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	23 April 2011	Third-party catamaran collision with project guard vessel within harbour.	Moderate	None	MAIB
Project	Allision	18 November 2011	Cable-laying vessel allision with WTG foundation following watchkeeping failure. Two hull breaches to vessel.	Major	None	MAIB

[4] Includes only incidents reported to an accident investigation branch or an anonymous reporting service.

Incident Vessel	Incident Type	Date	Description of Incident	Vessel Damage*	Harm to Persons	Source
Project/ project	Collision	2 June 2012	Crew Transfer Vessel (CTV) collision with flotel. Nine persons safely evacuated and transferred to nearby vessel before being brought back into port.	Moderate	None	UK CHIRP
Project	Allision	20 October 2012	Project vessel allision with WTG monopile following human error (misjudgement of distance). Minor damage sustained by vessel.	Minor	None	MAIB
Project	Allision	21 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	21 November 2012	Work boat allision with unlit WTG transition piece at moderate speed following navigational error. Vessel able to proceed to port unassisted with no water ingress but some structural damage sustained.	Moderate	None	MAIB
Project	Allision	1 July 2013	Service vessel allision with WTG foundation following machinery failure. Minor damage sustained by vessel.	Minor	None	IMCA Safety Flash
Project	Allision	14 August 2014	Standby safety vessel allision with WTG 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	26 May 2016	Third-party fishing vessel allision with WTG following human error (autopilot). Lifeboat attended the incident.	Moderate	Injury	Web search (RNLI, 2016)
Project	Allision	16 January 2020	Project vessel allision with WTG. Injury sustained by crew member but vessel able to proceed to port unassisted.	None	Injury	Web search (Vessel Tracker, 2020)

Incident Vessel	Incident Type	Date	Description of Incident	Vessel Damage*	Harm to Persons	Source
Project	Allision	27 January 2020	Project vessel allision with WTG. Minor damage to vessel and WTG sustained, with no personal injuries.	Minor	None	Marine Safety Forum
Third-party	Allision	9 June 2022	Fishing vessel allision with WTG 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.

145. As of July 2024, there have been no third-party collisions directly as a result of the presence of an OWF in the UK. The only reported third-party collision incident in relation to a UK OWF involved a project vessel hitting a third party vessel whilst in harbour.

146. As of July 2024, there have been 13 reported cases of an allision between a vessel and a WTG (under construction, operational or disused) in the UK, with all but two 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 1,796 years per WTG allision incident in the UK, noting that this is a conservative calculation given that only operational WTG hours have been included (whereas allision incidents counted include non-operational WTGs).

147. On an individual development basis, there has been an average of 0.015 allision incidents per operational offshore wind farm year, noting this is an average across the 20-year period since the first UK offshore wind farm became operational.

148. The presence of offshore wind farms and associated activities does increase the likelihood of an incident occurring. This includes the Proposed Development given that it will represent new offshore infrastructure and activities. The analysis above incorporates only collision and allision incidents since these are more likely to result in notable consequences and thus are more comprehensively reported and are also of primary interest to the NRA. The worst consequences reported for vessels involved in a collision or allision incident involving a UK OWF development has been flooding, with no life-threatening injuries to persons reported.

149. Other types of incident (such as medical incidents) may also require emergency response and therefore the rates reported above should not be considered comprehensive for all emergency response incidents. An accident to person requiring medical attention (which may include emergency response) is considered the most likely type of incident that may occur at an OWF.

9.5.2 Incidents Involving Non-UK Offshore Wind Farms

150. There have also been collision and allision incidents involving non-UK OWF developments. However, it is not possible to maintain a comprehensive list of such incidents and the associated operational hours.

151. One high profile non-UK incident of relevance involved a bulk carrier in January 2022 which broke its anchor chain during a storm in Dutch waters and collided with a nearby 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 through an under construction OWF where it allided with a WTG foundation and a platform foundation before being taken under tow (Marine Safety Investigation Unit, 2024).

9.5.3 Incidents Responded to by Vessels Associated with UK Offshore Wind Farms

152. Although the presence of OWFs and associated activities does increase the likelihood of an incident requiring emergency response it is also acknowledged that the presence of project vessels can aid with emergency response efforts, particularly for OWFs located further offshore (such as the Proposed Development) where a project vessel is more likely to be able to serve as the first responder to an incident.

153. From news reports, web searches and experience working with existing OWF developments, a list has been collated of historical incidents responded to by vessels associated with UK OWF developments, which is summarised in Table 9-2. The initial cause of these incidents is not related to the OWF in question.

Table 9-2 Historical Incidents Responded to By Vessels Associated with UK OWF Developments

Incident Type	Date	Related Development	Description of Incident	Source
Capsize	21 June 2018	Walney	HM Coastguard 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 Race Bank reported to have assisted with the rescue which also involved a Belgian military helicopter and the RNLI.	Web search (British Broadcasting Corporation, 2018)
Vessel in distress	15 May 2019	London Array	Yacht in difficult sought shelter by tying up to a WTG 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	Web search (The Isle of Thanet News, 2019)

Incident Type	Date	Related Development	Description of Incident	Source
			Coastguard later instructed the support vessel to return to port and seek medical assistance for the casualty vessel's occupant.	
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 jet crashed into sea during routine flight. CTVs and SOVs 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 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)
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 WTG 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)

154. It is clear that the presence of OWFs create new emergency response resources which can be mobilized to attend a third-party incident in liaison with HM Coastguard. This includes the Proposed Development, with project vessel compliance with international marine regulations including SOLAS (IMO, 1974) and pollution planning included as embedded mitigation measures (see Section 23). Additionally, an ERCoP will be completed post consent in consultation with the MCA.

10 Vessel Traffic Movements

10.1 Array Area

155. This section presents an overview of vessel traffic movements within the study area, primarily based upon the findings of the winter and summer vessel traffic surveys undertaken in February and July/August 2023, respectively (Section 5.2). AIS vessel traffic recorded within the offshore ECC study area is analysed separately in Section10.2.

156. A plot of the vessel tracks recorded during the 14-day winter survey period within the study area, colour-coded by vessel type and excluding temporary traffic, is presented in Figure 10-1. Following this, Figure 10-2 presents the same data converted to a density heat map.

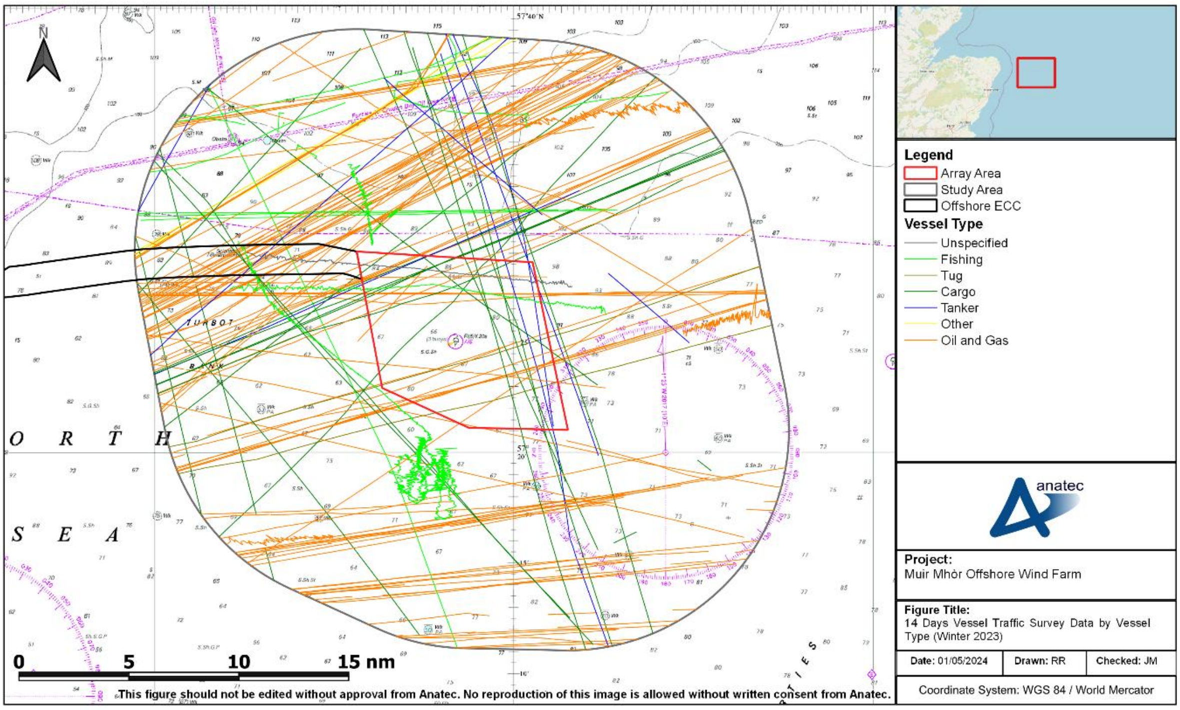


Figure 10-1 14-Day Vessel Traffic Survey Data by Vessel Type (Array Area, Winter 2023)

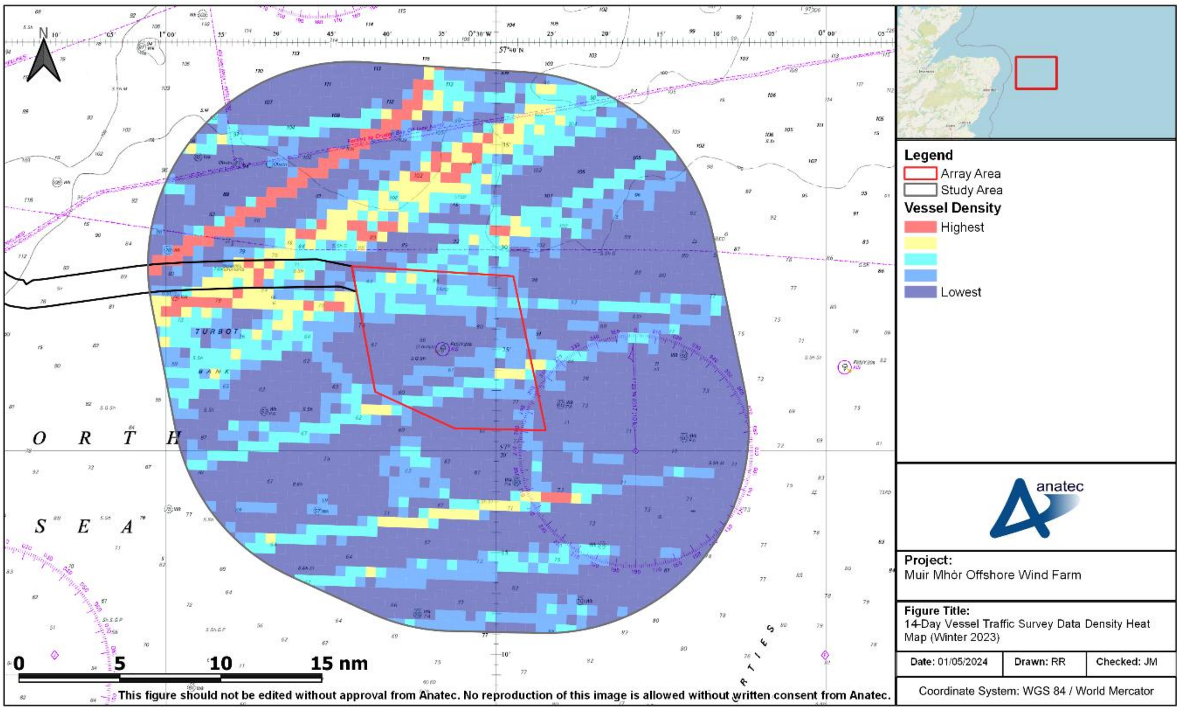


Figure 10-2 14-Day Vessel Traffic Survey Data Density Heat Map (Array Area, Winter 2023)

157. A plot of the vessel tracks recorded during the 14-day summer survey period within the study area, colour-coded by vessel type and excluding temporary traffic, is presented in Figure 10-3. Following this, Figure 10-4 presents the same data converted to a density heat map. The same vessel density ranges have been used for the summer survey data as were used in the winter survey data to allow for a direct comparison.

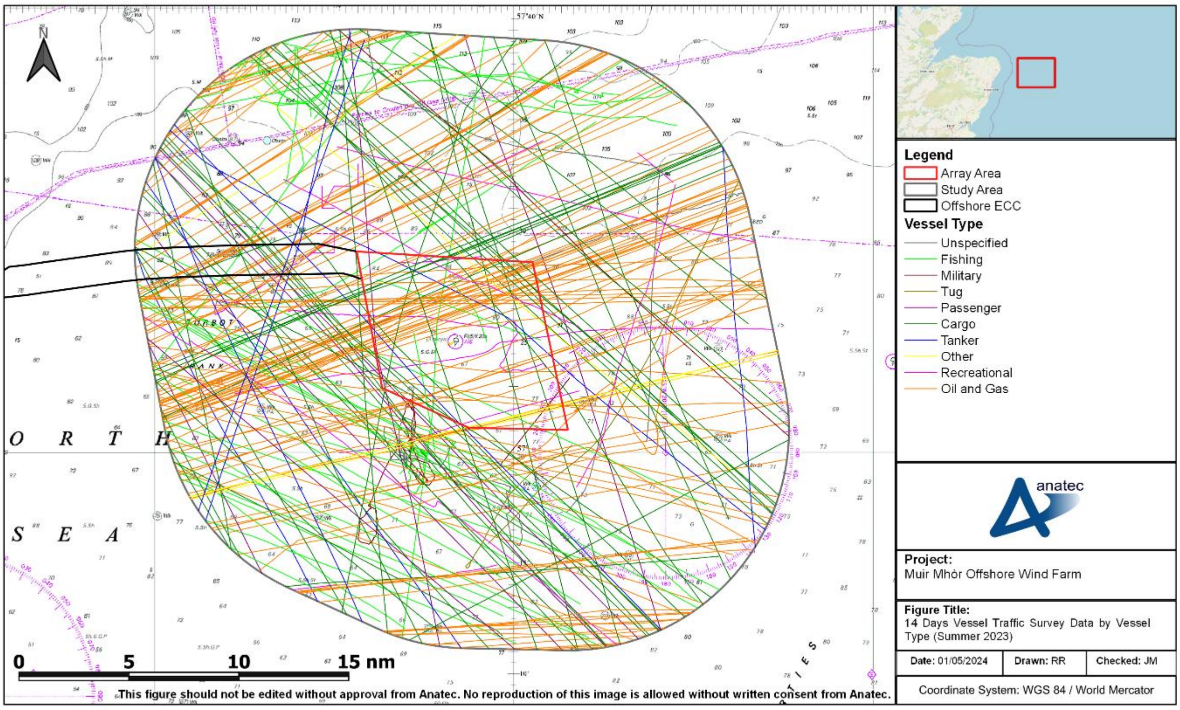


Figure 10-3 14-Days Vessel Traffic Survey Data by Vessel Type (Array Area, Summer 2023)

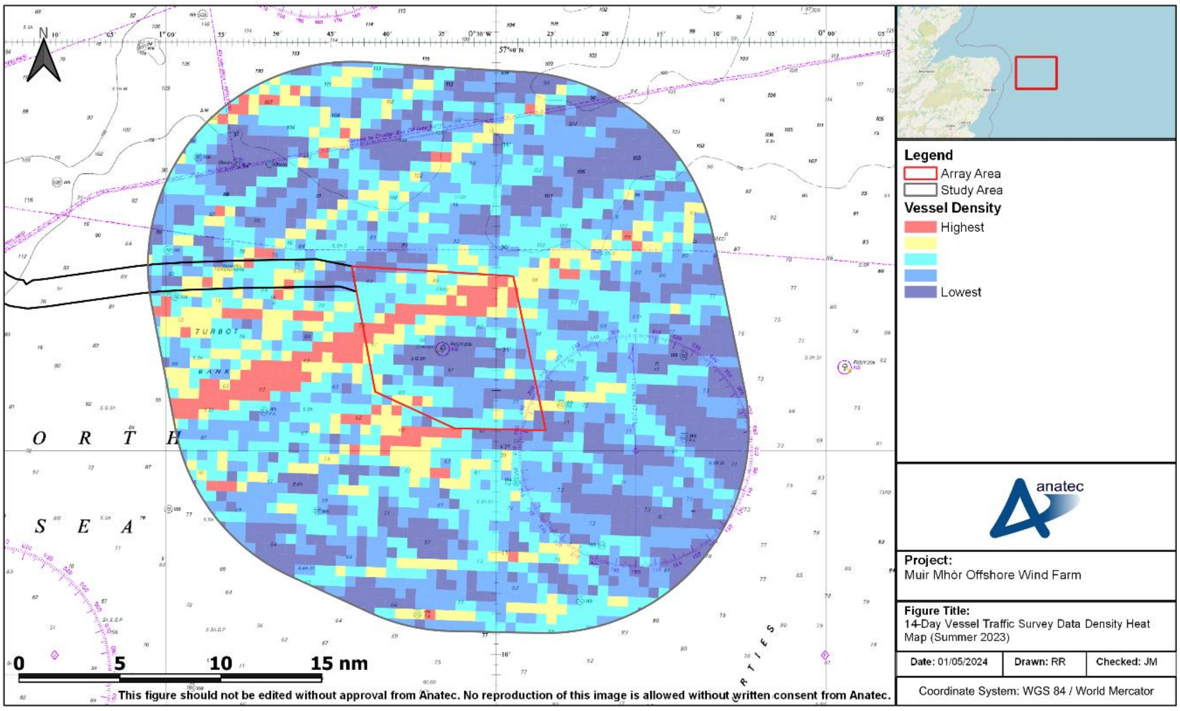


Figure 10-4 14-Day Vessel Traffic Survey Data Density Heat Map (Array Area, Summer 2023)

10.1.1 Vessel Counts

158. For the 14 days analysed in winter, there was an average of 12 unique vessels per day recorded within the study area. An average of three unique vessels per day were recorded intersecting the Array Area, or 26% of all vessel traffic recorded during the winter survey period.

159. Figure 10-5 illustrates the daily number of unique vessels recorded within the study area as well as intersecting the Array Area during the winter survey period. It is noted that partial survey days are represented by hatched colouring and have been taken into consideration where relevant during the analysis.

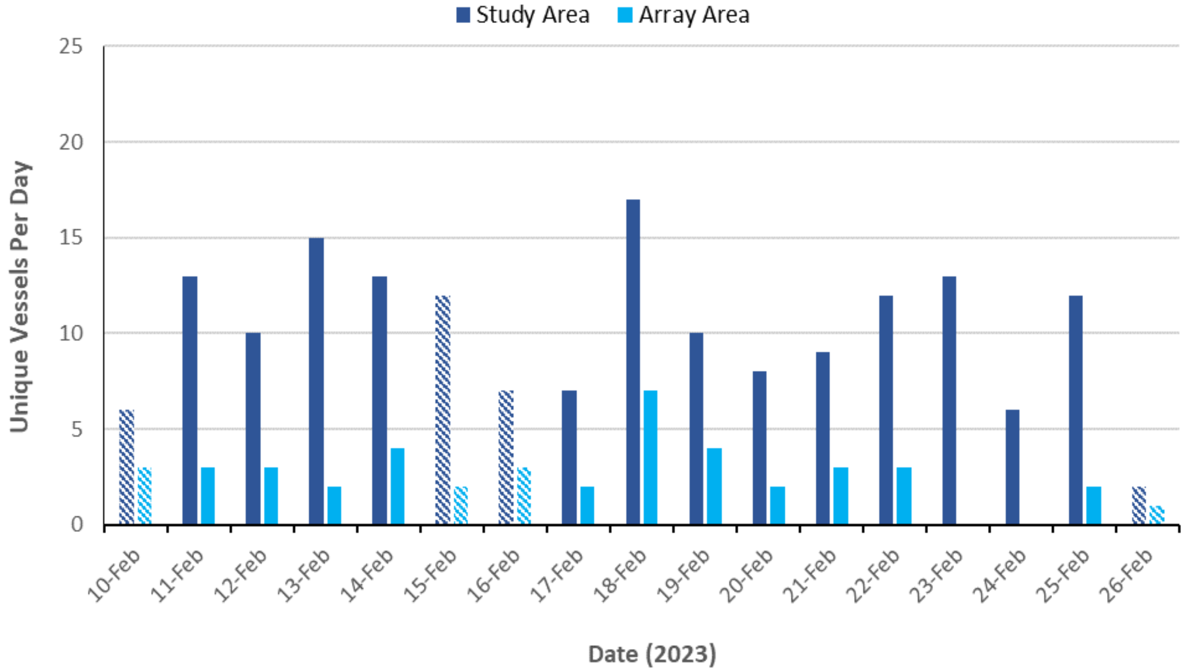


Figure 10-5 Daily Unique Vessel Counts within Study Area and Array Area (Winter 2023)

160. The busiest full day recorded within the study area throughout the winter survey period was 18 February, when 18 unique vessels were recorded. The busiest full day recorded during the winter survey period within the Array Area was also 18 February, when seven unique vessels were recorded.

161. The quietest full day recorded within the study area throughout the winter survey period was 24 February when six unique vessels were recorded. The quietest full day recorded during the winter survey period within the Array Area was also 24 February as well as 23 February, when no vessels were recorded.

162. For the 14 days analysed in summer, there was an average of 18 unique vessels per day recorded within the study area. An average of three unique vessels per day was recorded intersecting the Array Area, or 26% of all vessel traffic recorded during the summer survey period.

163. Figure 10-6 illustrates the daily number of unique vessels recorded within the study area as well as intersecting the Array Area during the summer survey period. Again, it is noted that partial survey days are represented by hatched colouring and have been taken into consideration where relevant during the analysis.

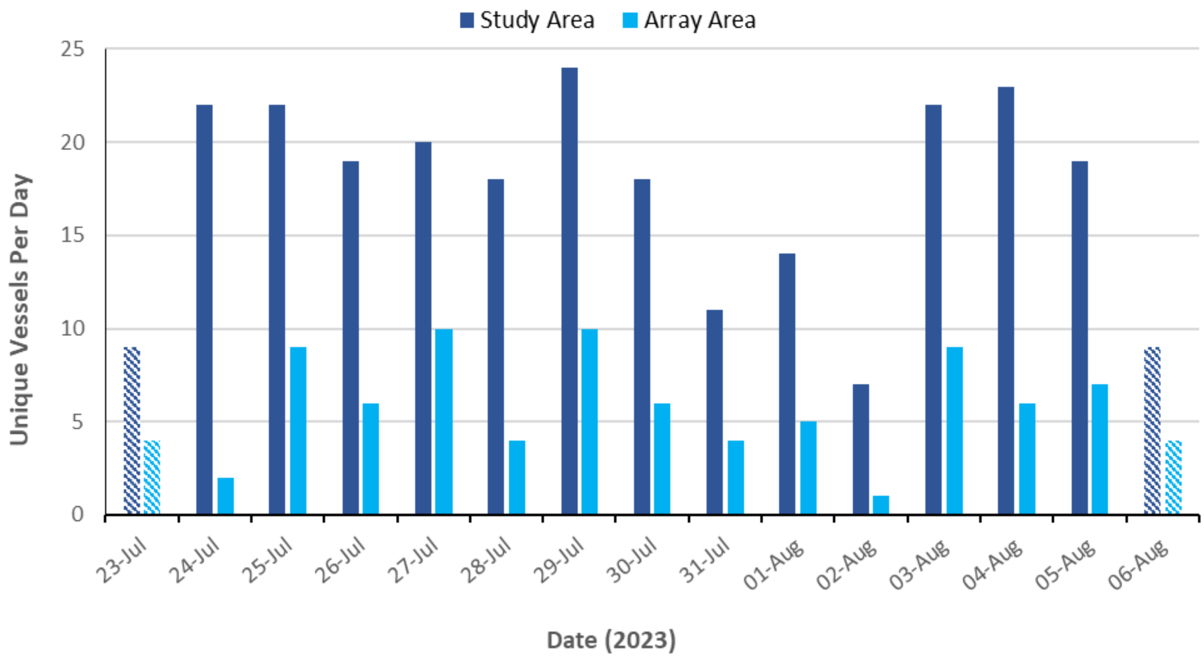


Figure 10-6 Daily Unique Vessel Counts within Study Area and Array Area (Summer 2023)

164. The busiest full day recorded within the study area throughout the summer survey period was 29 July, when 24 unique vessels were recorded. The busiest full day recorded during the summer survey period within the Array Area was 27 July and 29 July, when 10 unique vessels were recorded each day.

165. The quietest full day recorded within the study area throughout the summer survey period was 2 August when seven unique vessels were recorded. The quietest full day recorded during the summer survey period within the Array Area was also 2 August, when one unique vessel was recorded.

10.1.2 Vessel Type

166. The percentage distribution of the main vessel types recorded passing within the study area as well as intersecting the Array Area during the winter survey period is presented in Figure 10-7. The same distribution for the summer survey data is presented in Figure 10-8.

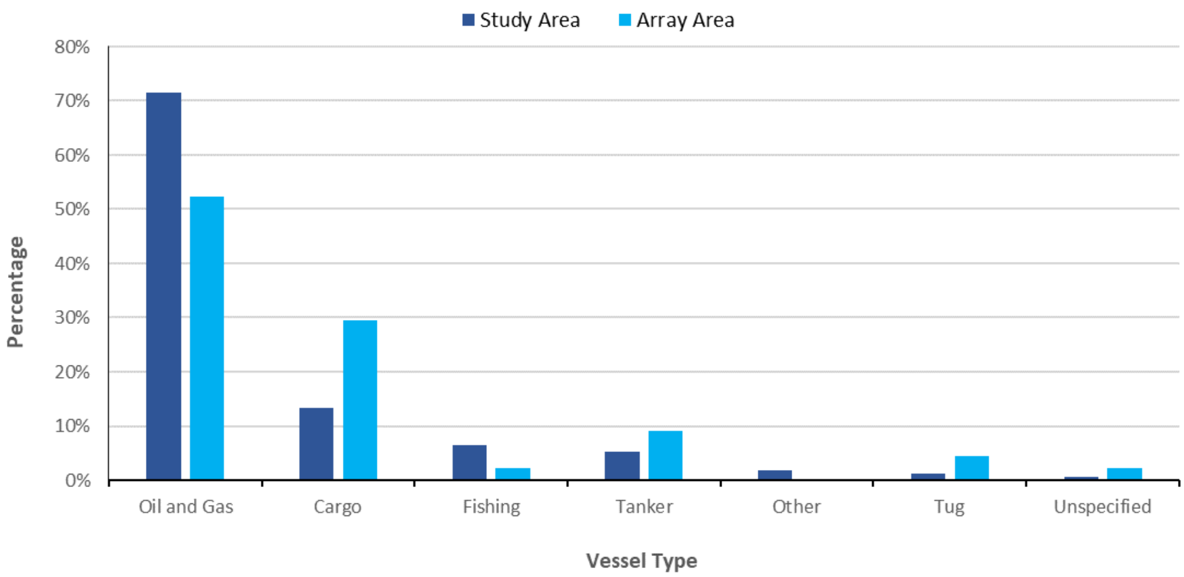


Figure 10-7 Vessel Type Distribution within Study Area and Array Area (Winter 2023)

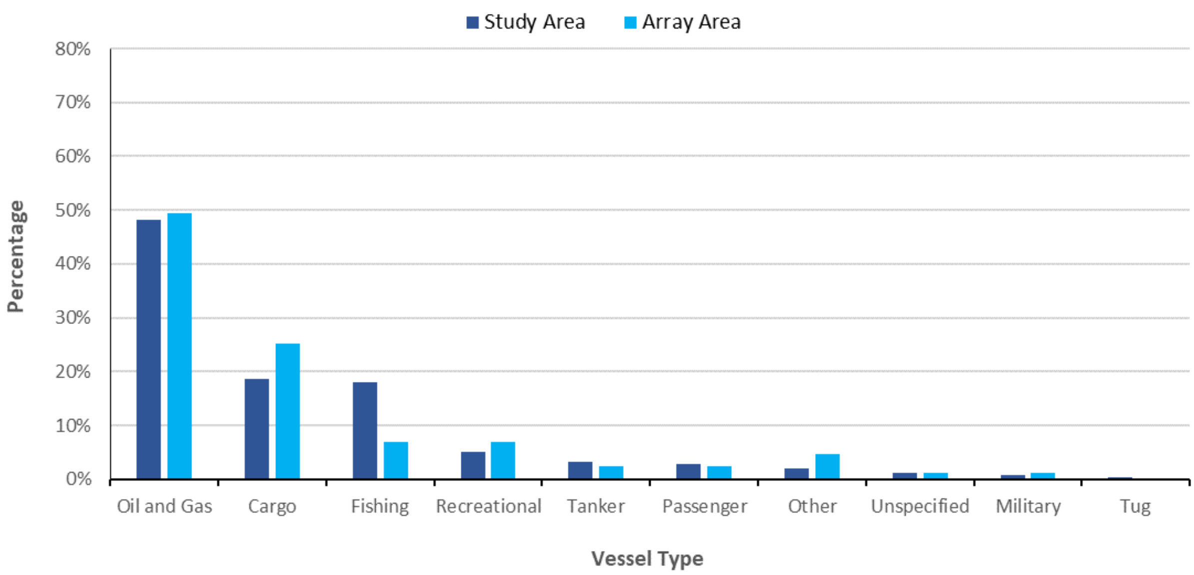


Figure 10-8 Vessel Type Distribution within Study Area and Array Area (Summer 2023)

167. Throughout the winter survey period, the main vessel types within the study area were oil and gas vessels which accounted for 72% of all vessels recorded. Cargo vessels (13%), fishing vessels (6%) and tankers (5%) were also recorded. No other vessel type accounted for more than 5% of all vessels recorded. There is a similar trend in vessel types intersecting the Array Area with oil and gas vessels (52% of all intersecting vessel traffic) and cargo vessels (30%) being the most commonly recorded vessel types.

168. It is noted that no recreational vessels were recorded during the winter survey period. This is expected given the distance offshore and unfavourable weather conditions.

169. Throughout the summer survey period, the main vessel types within the study area were also oil and gas vessels which accounted for 48% of all vessels recorded. Cargo vessels (19%), fishing vessels (18%) and recreational vessels (5%) were also recorded. No other vessel type accounted for more than 5% of all vessels recorded. There was a similar trend in vessel types intersecting the Array Area with oil and gas vessels (49% of all intersecting vessel traffic) and cargo vessels (25%) being the most commonly recorded vessel types.

170. The following subsections consider each of the main vessel types individually.

10.1.2.1 Oil and Gas Vessels

171. Oil and gas vessels recorded during the combined winter and summer survey periods are presented in Figure 10-9.

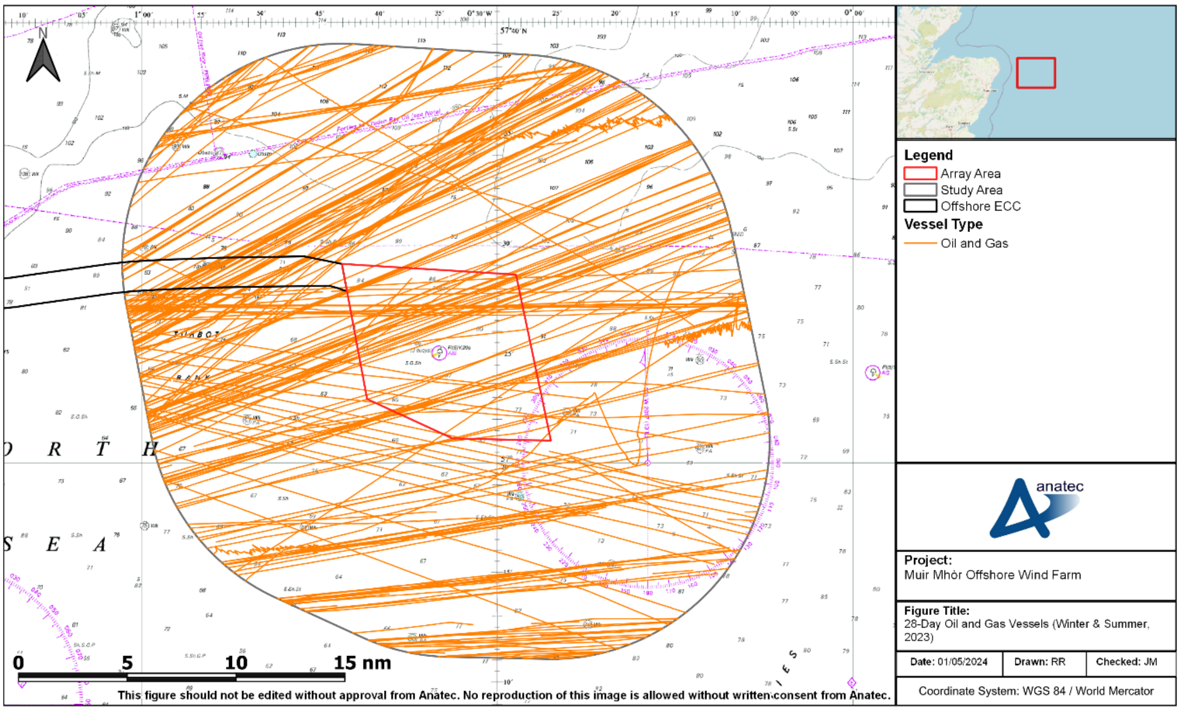


Figure 10-9 28-Day Oil and Gas Vessels (Array Area, Winter and Summer 2023)

172. An average of nine oil and gas vessels were recorded per day during the winter and summer survey period. There was no seasonality in oil and gas vessels and equal counts were recorded over each survey. An average of one to two unique oil and gas vessels intersected the Array Area per day during the winter survey period and an average of three unique oil and gas vessels intersected the Array Area per day during the summer survey period.

173. The majority of oil and gas vessels were routeing north-east south-west to/from ports on the east Scottish coast; primarily Aberdeen (UK) with Peterhead (UK) and Montrose (UK) also recorded, to oil and gas fields in the North Sea. Several routes intersect the Array Area and routeing of oil and gas vessels are detailed further in Section 11.2.

10.1.2.2 Cargo Vessels

174. Cargo vessels recorded during the combined winter and summer survey period are presented in Figure 10-10, colour-coded by sub-type.

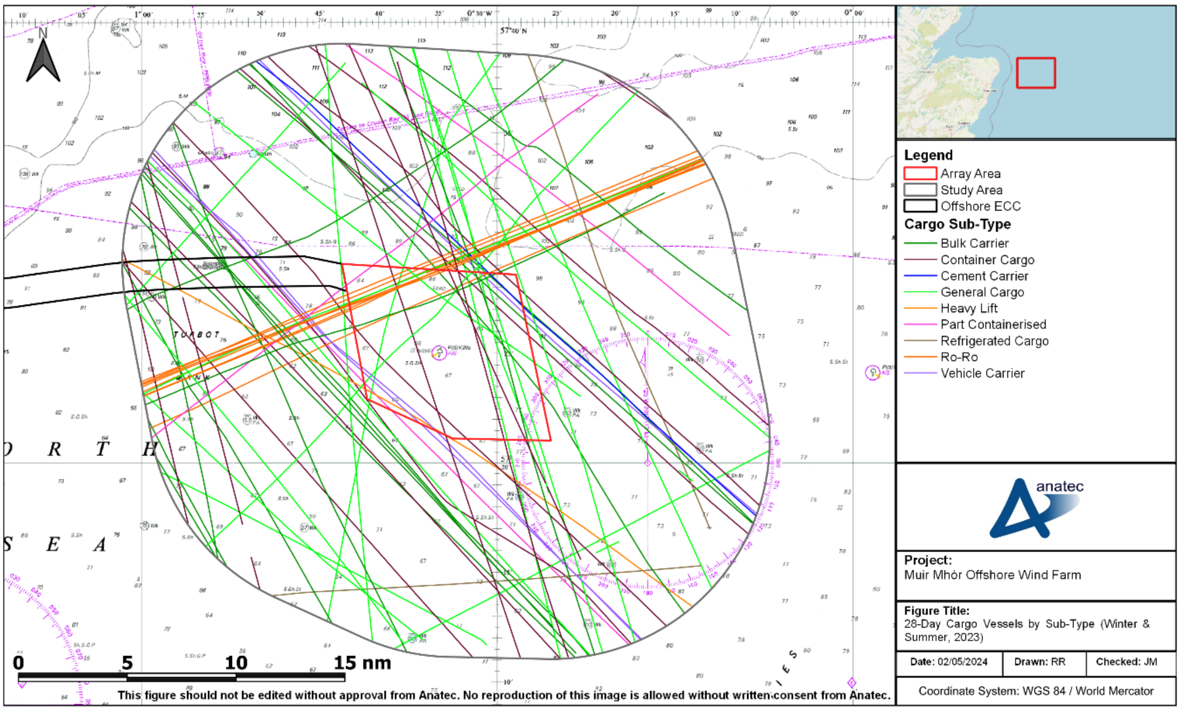


Figure 10-10 28-Day Cargo Vessels by Sub-Type (Array Area, Winter and Summer 2023)

175. Slight seasonality was noticed with greater numbers recorded during the summer period. An average of one to two unique cargo vessels were recorded per day during the winter survey period and an average of three per day were recorded during the summer survey period.

176. The main cargo sub-types recorded across the combined survey periods include general cargo (28%), bulk carriers (24%), container cargo (20%), and Roll-On/Roll-Off Cargo (Ro-Ro) (13%).

177. The majority of cargo vessels were on well-defined routes with vessels mainly routeing north-west south-east through the study area with routes intersecting the south west and north east corners of the Array Area. A Ro-Ro route was also recorded routeing between Aberdeen and Risavika (Norway) through the north of the Array

Area and consisted of one vessel operated by Sea Cargo. This was the only Ro-Ro vessel recorded during the combined survey periods.

10.1.2.3 Fishing Vessels

178. Fishing vessels recorded during the combined winter and summer survey periods are presented in Figure 10-11. It is noted that approximately 85% of all fishing vessels recorded were via AIS and the other 15% via Radar. The majority of Radar fishing vessels (77%) were recorded in the winter survey period. It was noted during consultation at the Hazard Workshop by the SWFPA that the survey data was representative of transiting fishing vessels this far offshore, but levels of active fishing vessels are underrepresented. To support this, fishing vessels across a 12 month period are assessed within the long-term data in Annex E. The 12 months of data covers all seasonal periods and so any seasonality in fishing activity will be observed. The only additional fishing activity, not already highlighted by the vessel traffic survey data, was noted to the south-west of the study area and is not in proximity to the Array Area. More consideration of baseline fishing activity is detailed in **Volume 2, Chapter 13 (Commercial Fisheries)**.

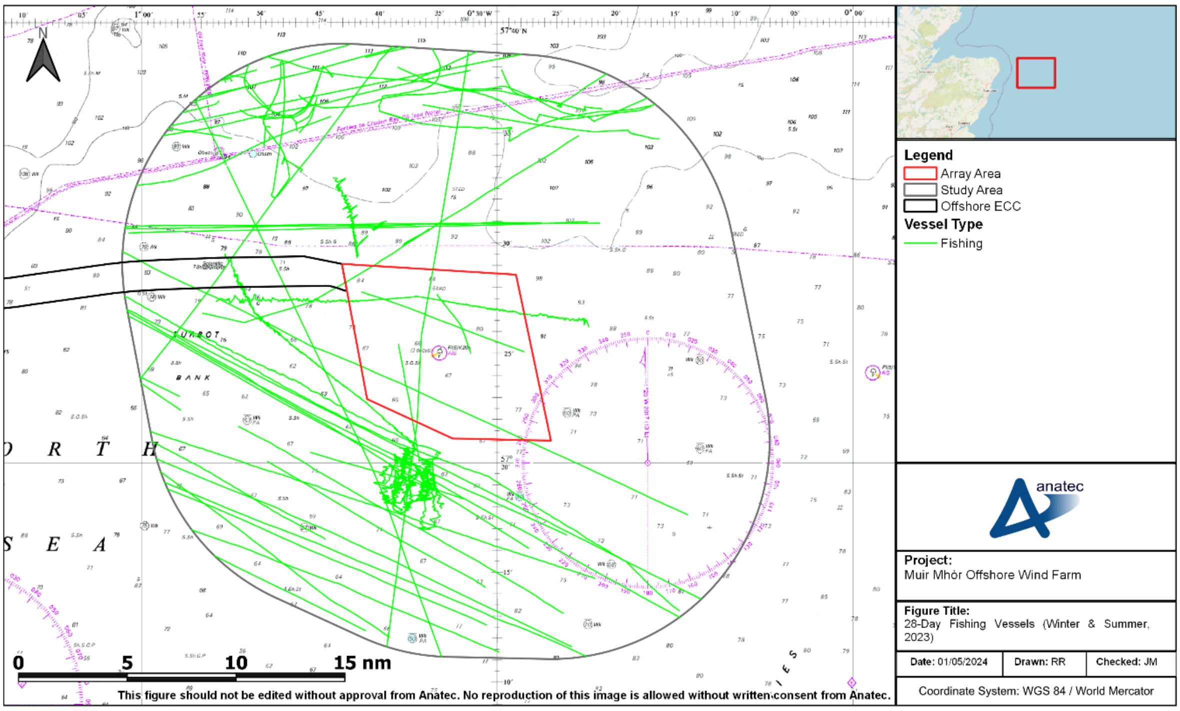


Figure 10-11 28-Day Fishing Vessels (Array Area, Winter and Summer 2023)

179. Seasonality was present with fishing vessels with greater numbers recorded during the summer period as expected given the distance offshore. An average of one unique fishing vessel was recorded per day during the winter survey period and an average of three per day were recorded during the summer survey period. Only one unique fishing vessel intersected the Array Area during the winter survey period and

an average of one unique fishing vessel every two days during the summer survey period.

180. The majority of fishing vessels were on transit as opposed to being engaged in fishing. Vessels transiting were primarily recorded south-west of the Array Area.

181. Vessels engaged in likely active fishing were identified through vessel behaviour, track speed and navigational status (for those commercial fishing vessels broadcasting via AIS). After these criteria were applied, vessels deemed to be engaged in likely active fishing were noted to the south of the Array Area; one seiner registered to Fraserburgh recorded during the winter survey period, and at the north of the study area; trawling carried out by three unique vessels during the summer survey period registered to Buckie, Banff, and Fraserburgh.

10.1.2.4 Tankers

182. Tankers recorded during the combined winter and summer survey periods are presented in Figure 10-12.

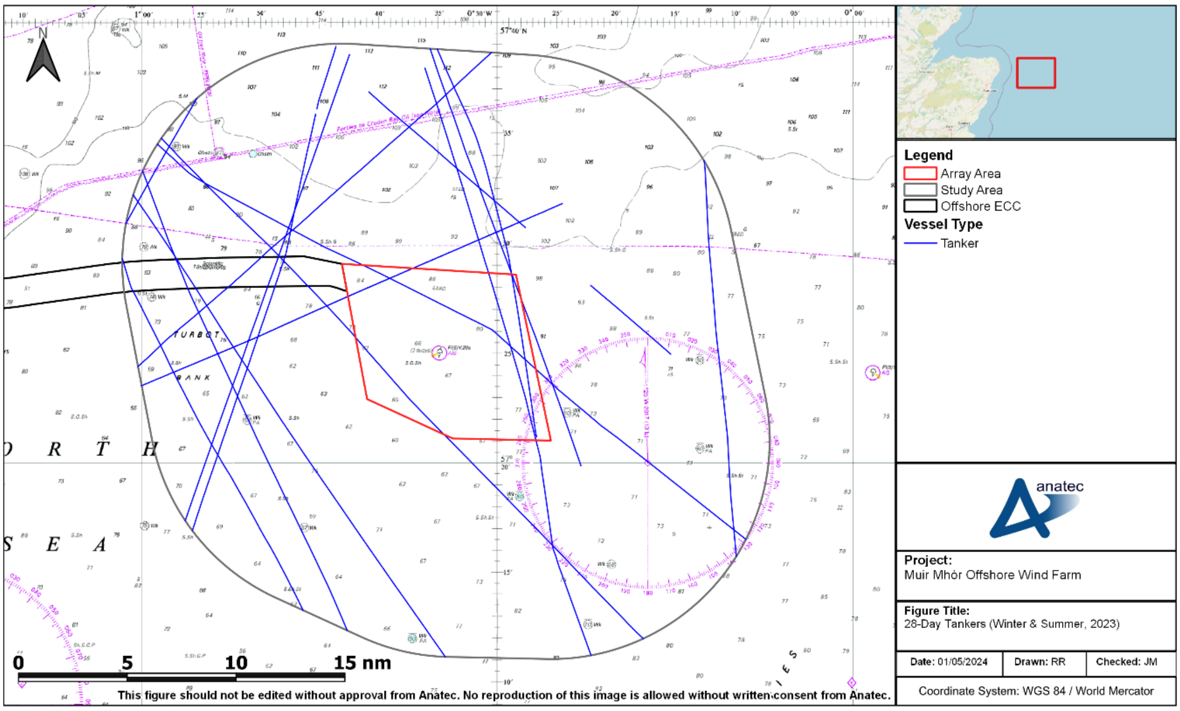


Figure 10-12 28-Day Tankers (Array Area, Winter and Summer 2023)

183. An average of one tanker was recorded every two days during the winter and summer survey period. There was no seasonality recorded in tanker activity and equal counts were recorded over each survey period. Four unique tankers intersected the Array Area during the winter survey period and two unique tankers intersected the Array Area during the summer survey period.

184. The main tanker sub-types recorded were shuttle tankers (28%), combined oil/chemical tankers (22%), and crude oil tankers (17%).

10.1.2.5 Recreational Vessels

185. Recreational vessels recorded during the combined winter and summer survey periods are presented in Figure 10-13. It is noted that approximately 65% of all recreational vessels recorded were via AIS and the other 35% via Radar. It was confirmed during consultation at the Hazard Workshop by RYA Scotland that the survey data was representative of recreational transits within the study area.

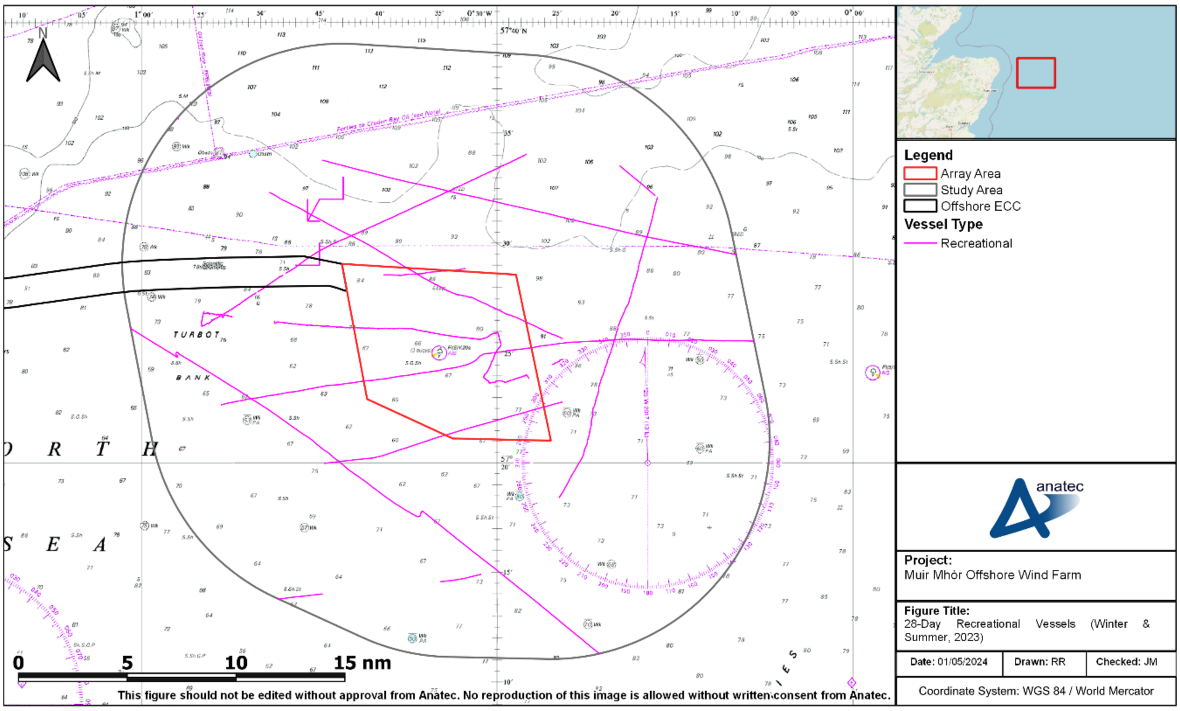


Figure 10-13 28-Day Recreational Vessels (Array Area, Winter and Summer 2023)

186. Recreational vessels were highly seasonal with no vessels recorded during the winter survey period. This is expected given the distance offshore and less favourable weather conditions expected in the winter months. The RYA Scotland also noted that although it cannot be predicted, recreational transits this far offshore during winter months is not expected.

187. During the summer survey period an average of one unique recreational vessel was recorded per day within the study area. An average of one unique recreational vessel intersected the Array Area every two days.

10.1.2.6 Passenger Vessels

188. Passenger vessels recorded during the combined winter and summer survey periods are presented in Figure 10-14.

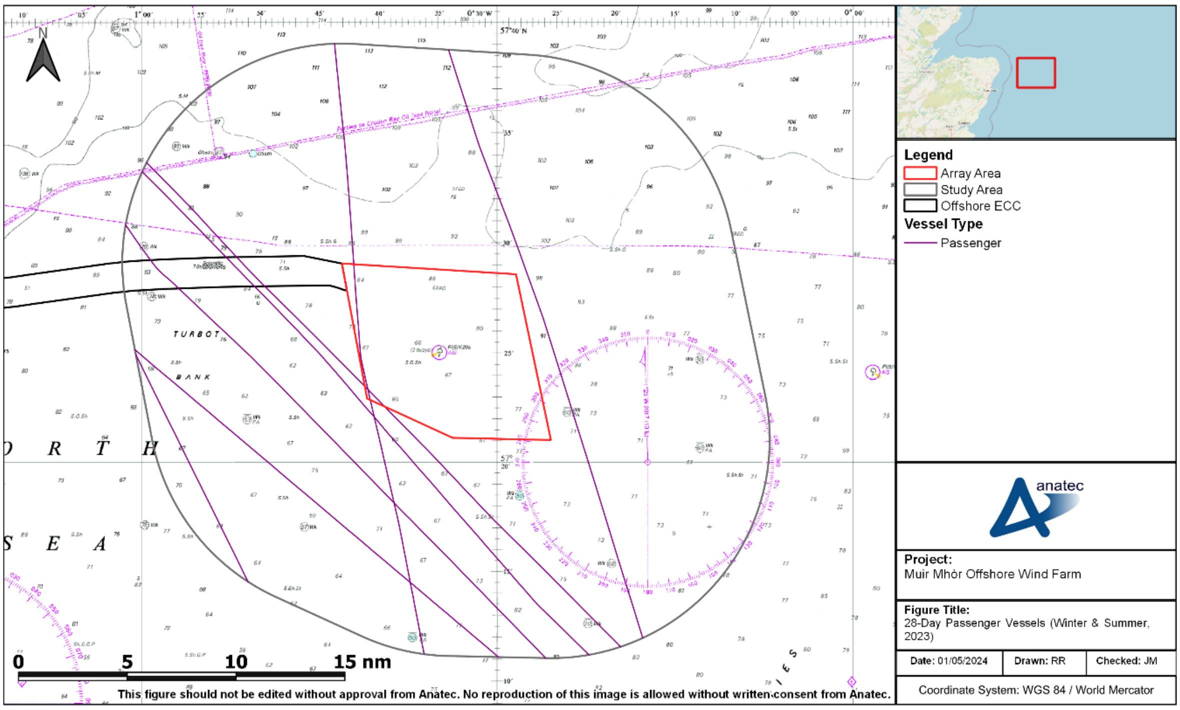


Figure 10-14 28-Day Passenger Vessels (Array Area, Winter and Summer 2023)

189. Although infrequent, passenger vessels were highly seasonal with no vessels recorded during the winter survey period. During the summer survey period an average of one unique passenger vessel was recorded every two days within the study area. Only two unique passenger vessels intersected the Array Area to the west.

190. All passenger vessels recorded were cruise liners with routeing recorded to the south-west of the Array Area by vessels on route to/from Invergordon in the Moray Firth (UK). Cruise liners routeing north south were routeing to the Faroe Islands and to Germany from the Northern Isles (Orkney/Shetland) (UK).

10.1.2.7 Anchored Vessels

191. Anchored vessels can be identified based upon the AIS navigational status which is programmed on the AIS transmitter on board a vessel. However, information is manually entered into the AIS and therefore it is common for vessels not to update their navigational status if only at anchor for a short period of time. For this reason, vessels which travelled at a speed of less than 1 knot (kt) for more than 30 minutes are assumed to potentially be at anchor. Such cases have therefore been identified and checked for likely anchoring activity along with vessel track behaviour and AIS broadcasted navigational status.

192. After applying the criteria, no vessels were deemed to be at anchor within the study area across the combined survey periods.

10.1.3 Vessel Size

10.1.3.1 Vessel Length

193. Vessel LOA was available for approximately 98% of vessels recorded throughout the combined winter and summer survey periods. Those vessels with unspecified vessel LOA were all recorded via Radar and LOA was not able to be obtained by crew onboard the survey vessel. These vessels with unspecified LOA have been removed from the analysis where relevant.

194. The combined 28-days vessel traffic survey data is presented in Figure 10-17, colour-coded by LOA. Following this, a distribution of these vessel LOA is presented in Figure 10-18.

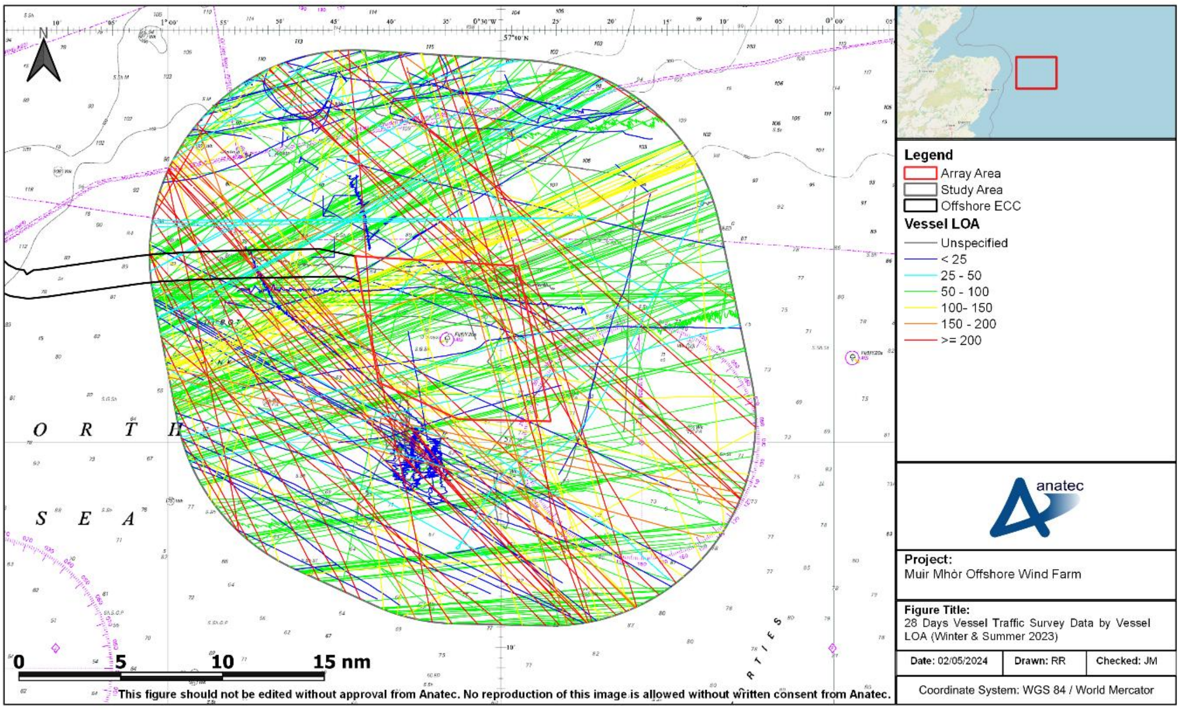


Figure 10-15 28-Day Vessel Traffic Survey Data by Vessel Length (Array Area, Winter and Summer 2023)

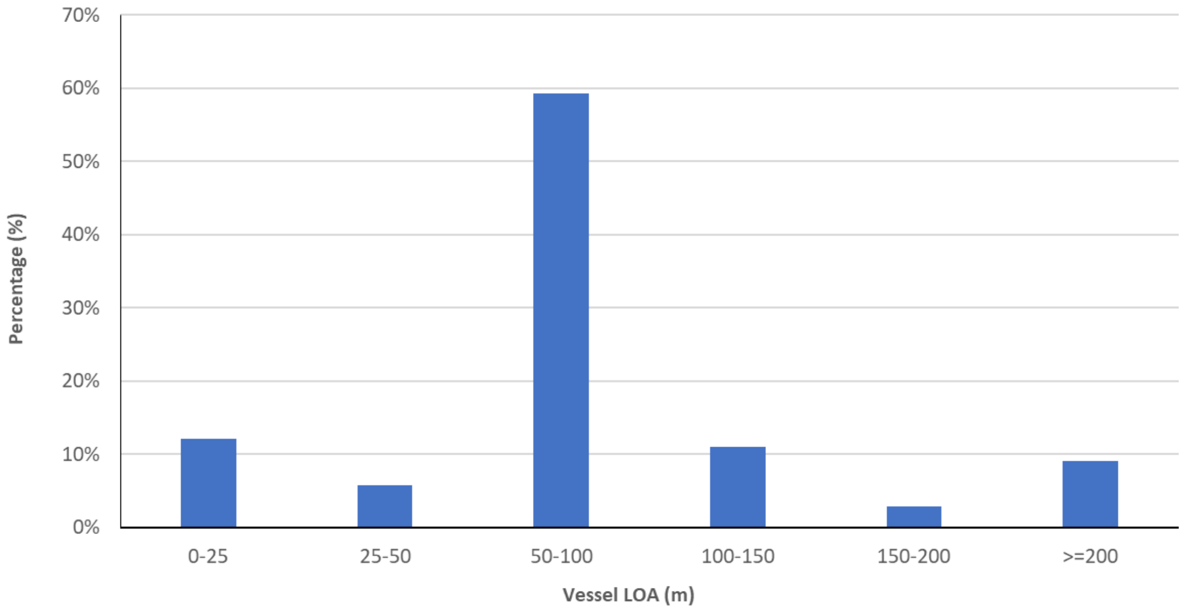


Figure 10-16 Vessel LOA Distribution (Array Area, Winter and Summer 2023)

195. Of vessels with a valid LOA, the average recorded was 95 m. Vessel LOA ranged from 10 m for a recreational sailing vessel to 333 m for a cruise liner; this cruise liner intersected the south-west of the Array Area during the summer survey period. The majority of vessels had a LOA which ranged between 50 to 100 m and mainly comprised of oil and gas vessels. Vessels with greater LOA were primarily passenger vessels and large cargo vessels with those of smaller LOA recreational and fishing vessels.

10.1.3.2 Vessel Draught

196. Vessel draught was available for approximately 86% of off vessels recorded throughout the combined winter and summer survey periods. Vessels with unspecified vessel draughts were recorded via Radar (46%) or AIS (54%) and were typically fishing vessels and recreational vessels, including those carrying AIS Class B which does not include the broadcast of draughts. Vessels with unspecified draughts have been removed from the analysis where relevant.

197. The combined 28-days vessel traffic survey data is presented in Figure 10-17, colour-coded by vessel draught. Following this, a distribution of these vessel draughts is presented in Figure 10-18.

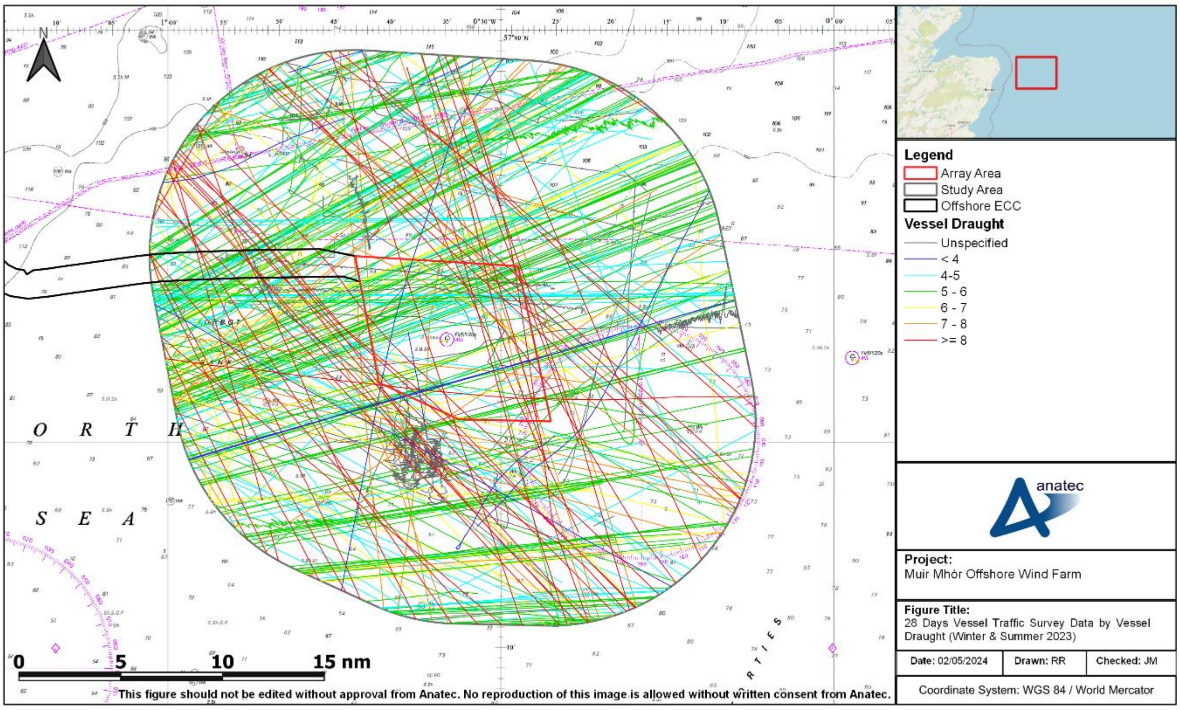


Figure 10-17 28-Day Vessel Traffic Survey Data by Vessel Draught (Array Area, Winter and Summer 2023)

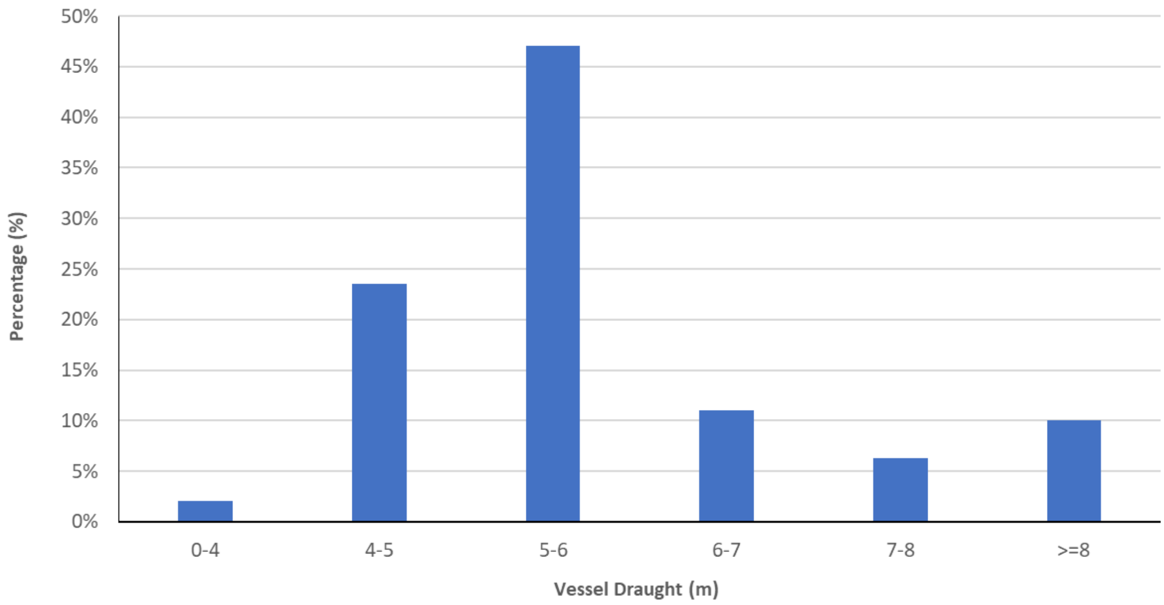


Figure 10-18 Vessel Draught Distribution (Array Area, Winter and Summer 2023)

198. Of vessels with a valid broadcast vessel draught, the average draught recorded was 5.7 m. Vessel draught ranged from 0.2 m for a fishing vessel to 14.7 m for a shuttle tanker; this tanker intersected the east of the Array Area whilst routeing north south during the winter survey period. The majority of vessels had a draught which ranged between 4 to 6 m and mainly comprised of oil and gas vessels. Vessels with a draught

8 m and above accounted for 10% and were larger cargo, tanker, and passenger vessels. Only 3% of vessels had a draught of 10 m or greater.

10.2 Offshore Export Cable Corridor

199. This section presents an overview of vessel traffic movements within the offshore ECC study area, primarily based upon the findings of the AIS data during the summer and winter data periods, the same period as the vessel traffic surveys for the Array Area (Section 5.2).

200. A plot of the vessel tracks recorded during the 17-day winter data period within the offshore ECC study area, colour-coded by vessel type and excluding temporary traffic, is presented in Figure 10-1. Following this, Figure 10-2 presents the same data converted to a density heat map.

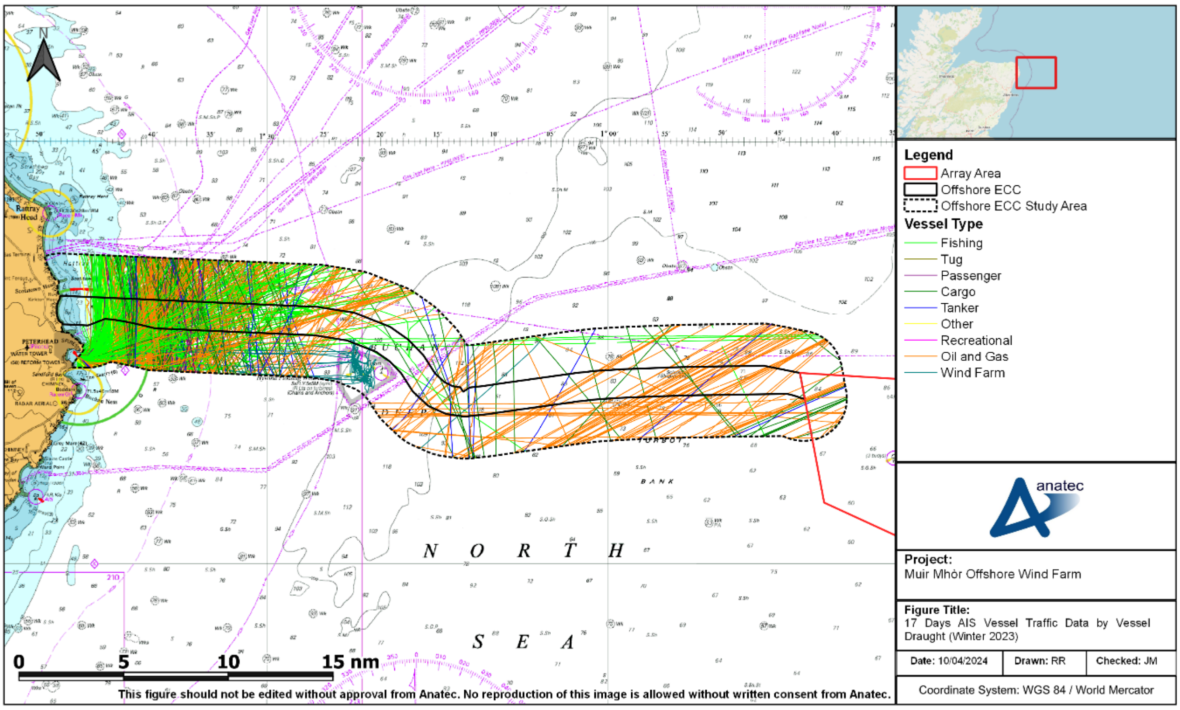


Figure 10-19 17-Day AIS Vessel Traffic Data by Vessel Type (Offshore ECC Winter 2023)

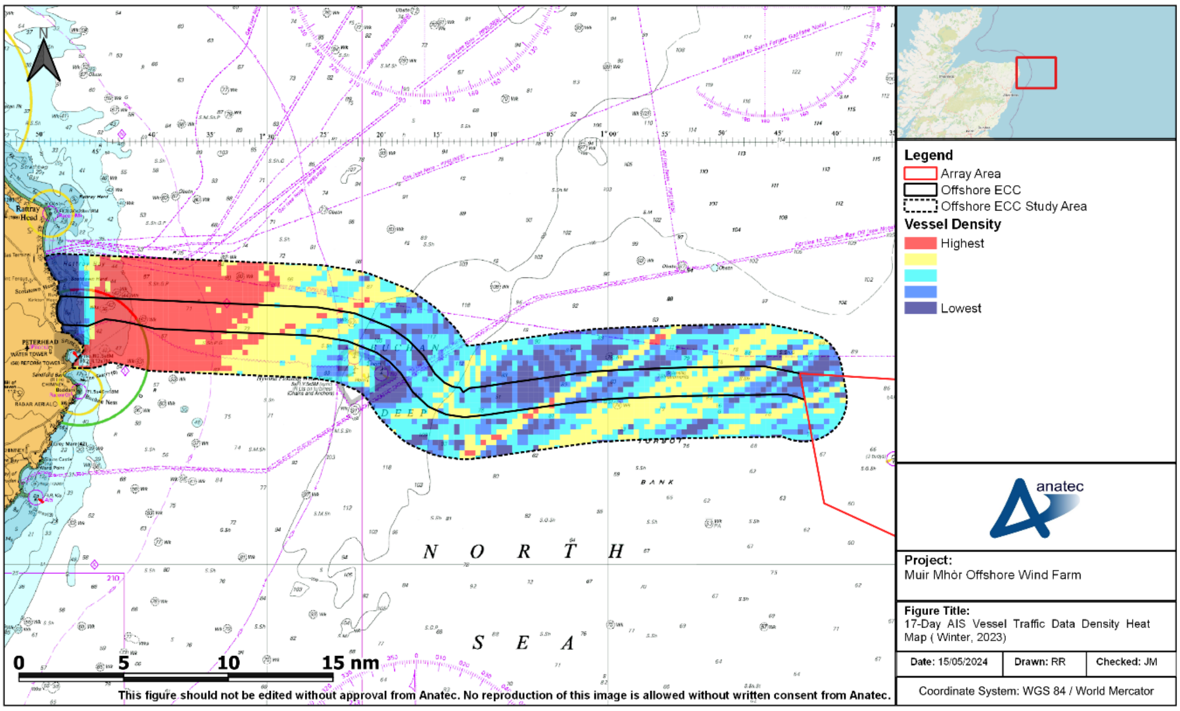


Figure 10-20 17-Day AIS Vessel Traffic Data Density Heat Map (Offshore ECC, Winter 2023)

201. A plot of the vessel tracks recorded during the 15-day summer data period within the offshore ECC study area, colour-coded by vessel type and excluding temporary traffic, is presented in Figure 10-3. Following this, Figure 10-4 presents the same data converted to a density heat map. The same vessel density ranges have been used for the summer data as were used in the winter data to allow a direct comparison, noting these are not the same ranges used for the Array Area in Section 10.1.

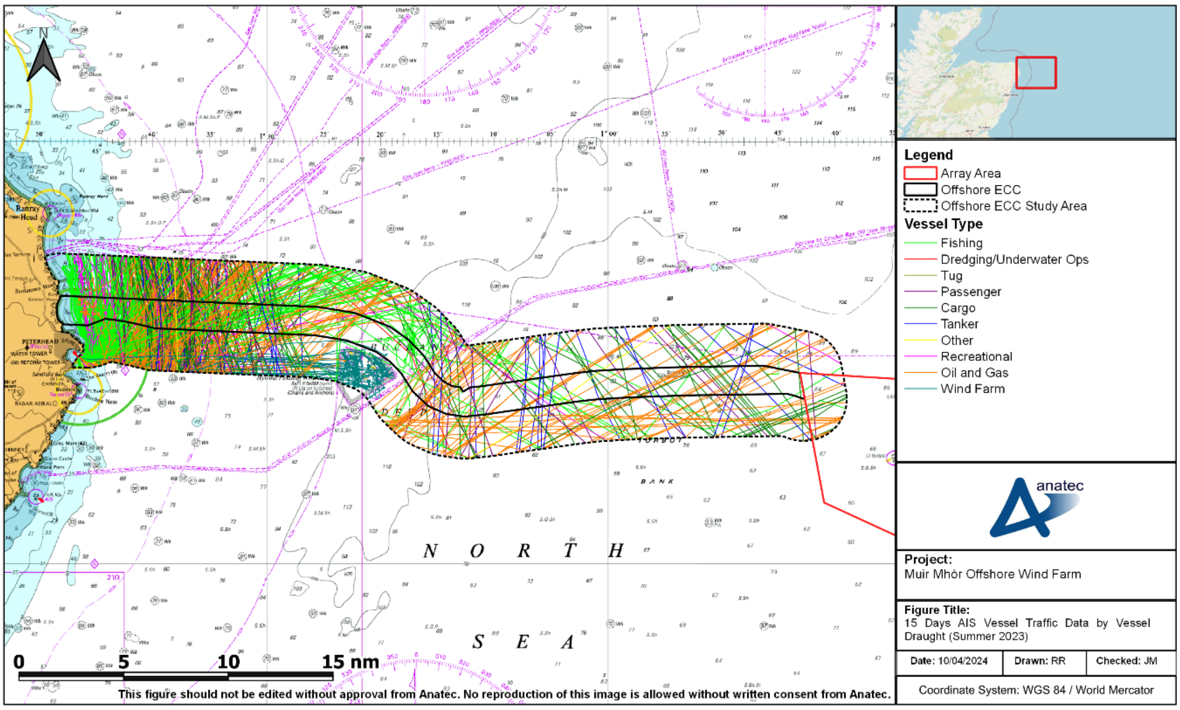


Figure 10-21 15-Day AIS Vessel Traffic Data by Vessel Type (Offshore ECC, Summer 2023)

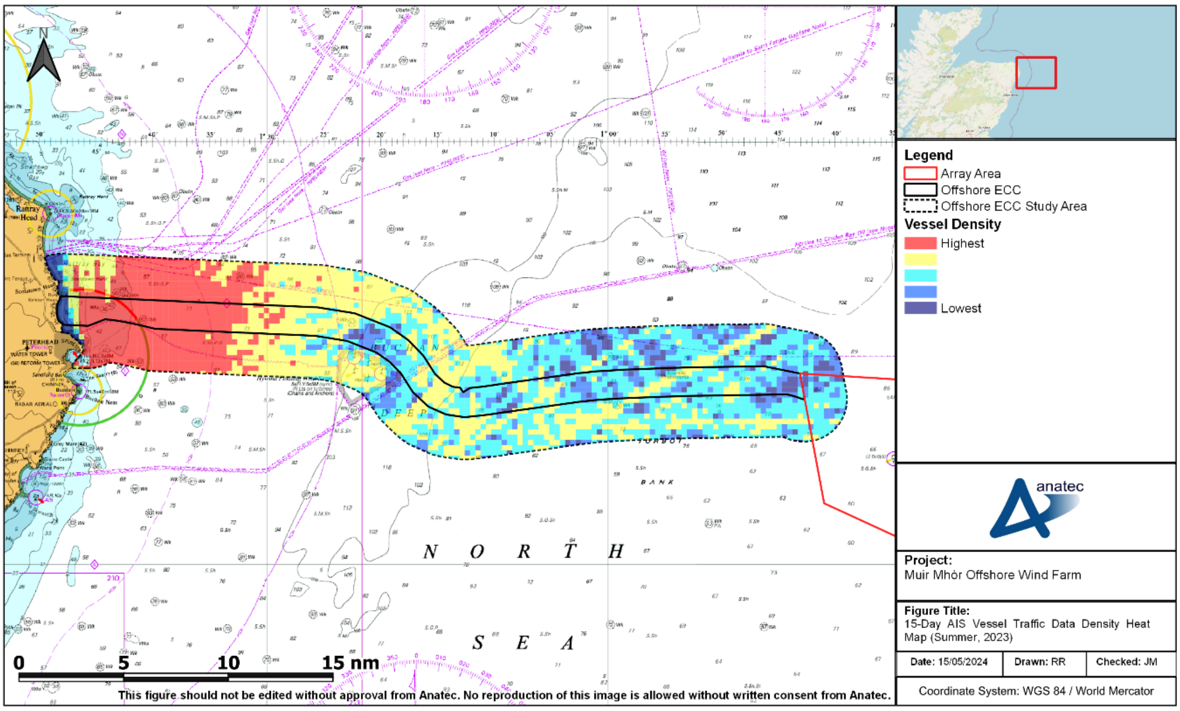


Figure 10-22 15-Day AIS Vessel Traffic Data Density Heat Map (Offshore ECC, Summer 2023)

10.2.1 Vessel Counts

202. Over the 17 days analysed in winter, there was an average of 48 unique vessels per day recorded within the offshore ECC study area. An average of 39 unique vessels per day was recorded crossing the offshore ECC, or 81% of all vessel traffic recorded during the winter data period.

203. Figure 10-23 illustrates the daily number of unique vessels recorded within the offshore ECC study area as well as crossing the offshore ECC during the winter data period.

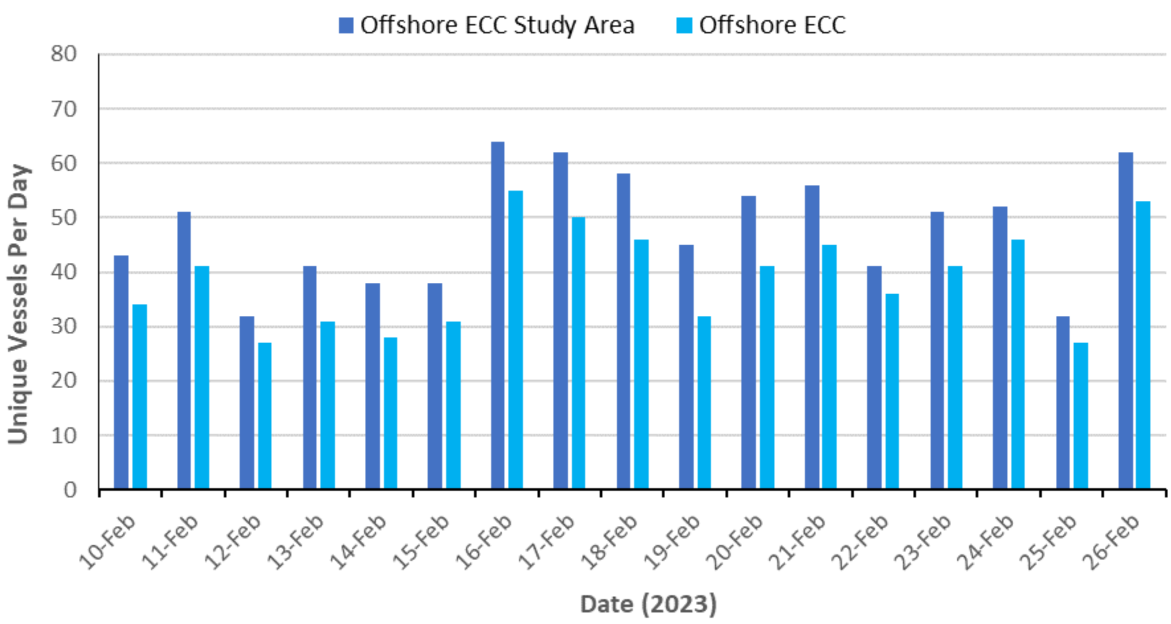


Figure 10-23 Daily Unique Vessel Counts within Offshore ECC Study Area and Offshore ECC (Winter 2023)

204. The busiest full day recorded within the offshore ECC study area throughout the winter data period was 16 February, when 64 unique vessels were recorded. The busiest full day recorded during the winter data period within the offshore ECC was also 16 February, when 55 unique vessels were recorded.

205. The quietest full day recorded within the offshore ECC study area throughout the winter data period was 12 February and 25 February when 32 unique vessels were recorded. The quietest full day recorded during the winter data period within the offshore ECC was also 12 February and 25 February when 27 unique vessels were recorded.

206. Over the 15 days analysed in summer, there was an average of 62 unique vessels per day recorded within the offshore ECC study area. An average of 45 unique vessels per day was recorded crossing the offshore ECC, or 72% of all vessel traffic recorded during the summer data period.

207. Figure 10-24 illustrates the daily number of unique vessels recorded within the offshore ECC study area as well as crossing the offshore ECC during the summer data period.

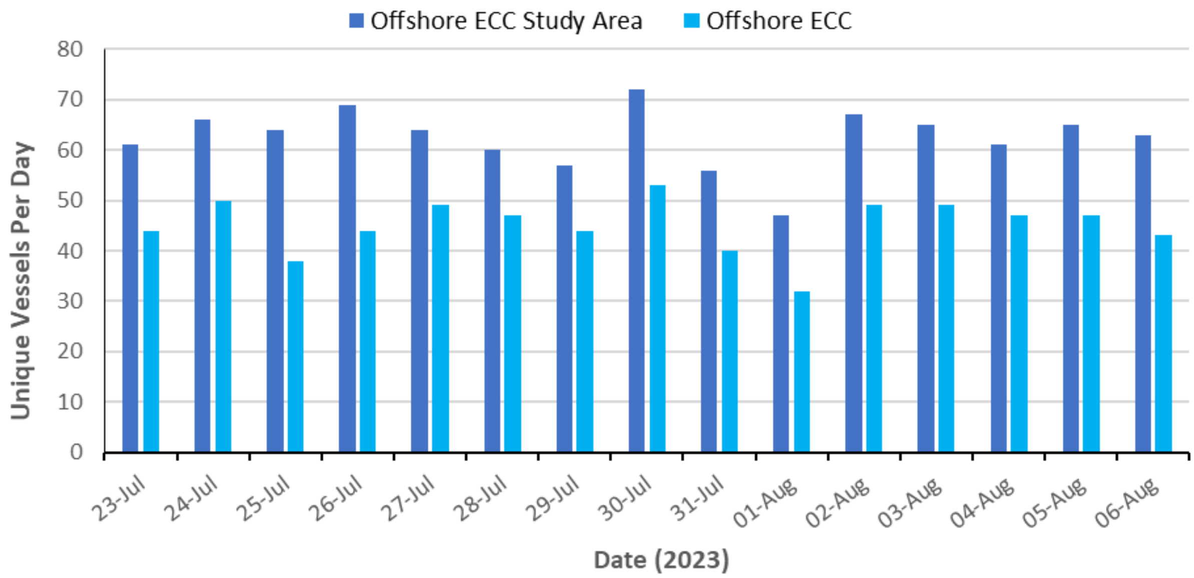


Figure 10-24 Daily Unique Vessel Counts within Offshore ECC Study Area and Offshore ECC (Summer 2023)

208. The busiest full day recorded within the offshore ECC study area throughout the summer data period was 30 July, when 72 unique vessels were recorded. The busiest full day recorded during the summer data period within the offshore ECC was also 30 July, when 53 unique vessels were recorded.

209. The quietest full day recorded within the offshore ECC study area throughout the summer data period was 1 August when 47 unique vessels were recorded. The quietest full day recorded during the summer data period within the offshore ECC was also 1 August, when 32 unique vessel was recorded.

10.2.2 Vessel Type

210. The percentage distribution of the main vessel types recorded passing within the offshore ECC study area as well as crossing the offshore ECC during the winter data period is presented in Figure 10-25. The same distribution for the summer data is presented in Figure 10-26.

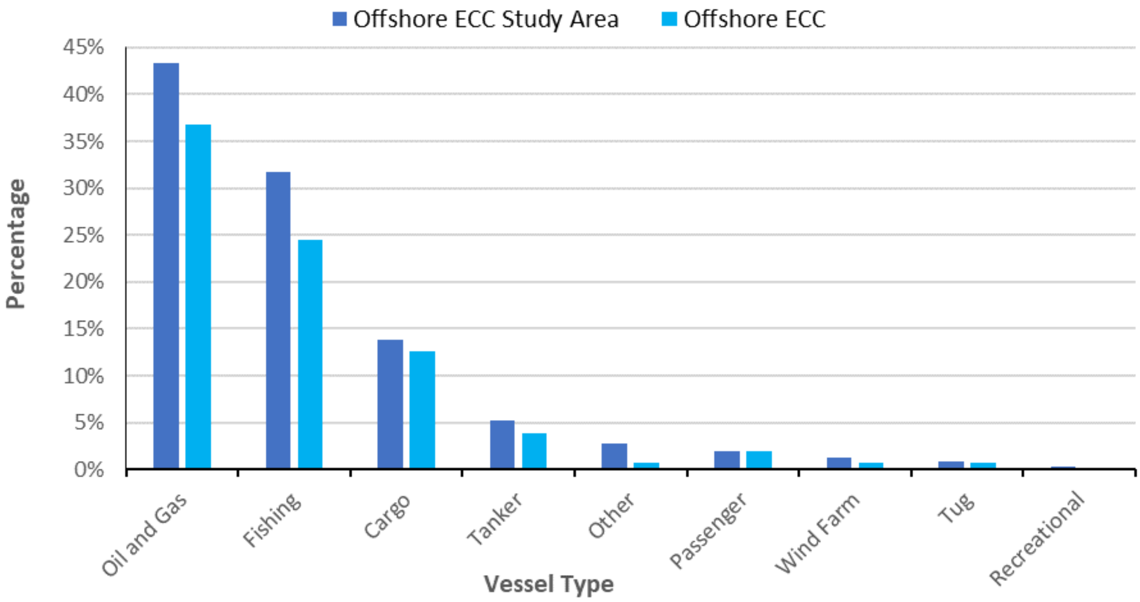


Figure 10-25 Vessel Type Distribution within Offshore ECC Study Area and Offshore ECC (Winter 2023)

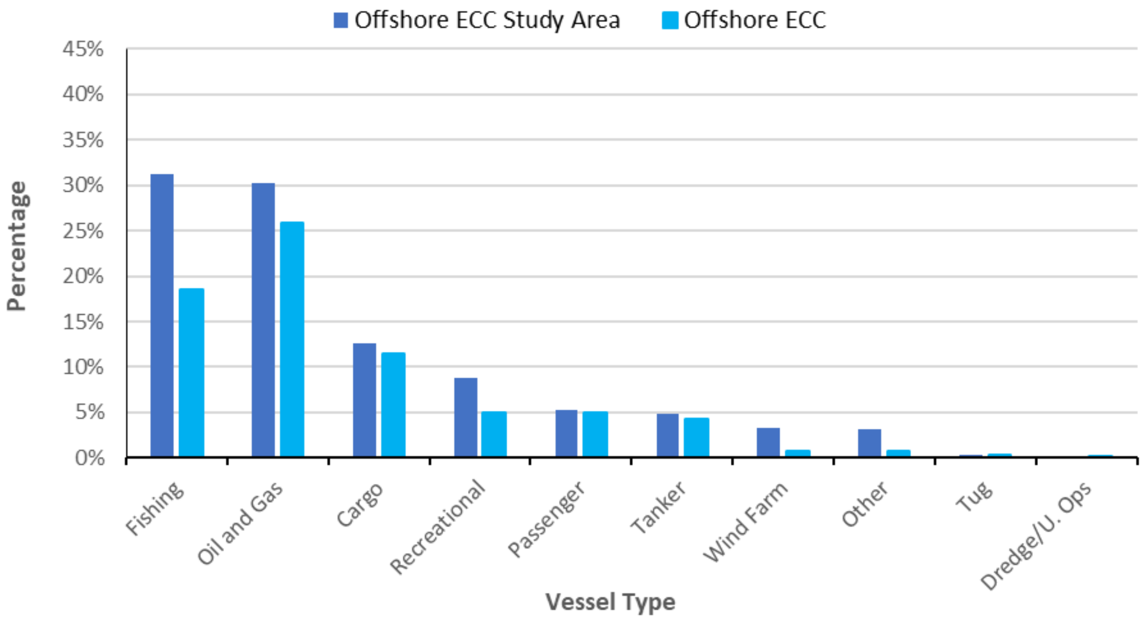


Figure 10-26 Vessel Type Distribution within Offshore ECC Study Area and Offshore ECC (Summer 2023)

211. Throughout the winter data period, the main vessel types within the offshore ECC study area were oil and gas vessels which accounted for 43% of all vessels recorded. Fishing vessels (32%), cargo vessels (14%) and tankers (5%) were also recorded. No other vessel type accounted for more than 5% of all vessels recorded. There was a similar trend in vessel types crossing the offshore ECC with oil and gas vessels (37% of all crossing vessel traffic) fishing vessels (25%), and cargo vessels (13%) being the

most commonly recorded vessel types. It is noted that only two unique recreational vessels were recorded within the offshore ECC study are during the winter data period. These vessels did not cross the offshore ECC and were recorded entering/exiting Peterhead Port to the south.

212. Throughout the summer data period, the main vessel types within the offshore ECC study area were fishing vessels which accounted for 31% of all vessels recorded and oil and gas vessels which accounted for 30%. Cargo vessels (13%), recreational vessels (9%) and passenger vessels (5%) were also recorded. No other vessel type accounted for more than 5% of all vessels recorded. There was a similar trend in vessel types crossing the offshore ECC with oil and gas vessels (26% of all crossing vessel traffic) and fishing vessels (19%) being the most commonly recorded vessel types. Cargo vessels (11%), recreational vessels (9%) and passenger vessels (5%) were also more frequently recorded crossing the offshore ECC. The increase in recreational and passenger vessels during the summer data period in comparison to the winter is expected given the more favourable sailing conditions and the increase of cruise liner presence.

213. The following subsections consider each of the main vessel types individually.

10.2.2.1 Oil and Gas Vessels

214. Oil and gas vessels recorded during the combined winter and summer data periods are presented in Figure 10-27.

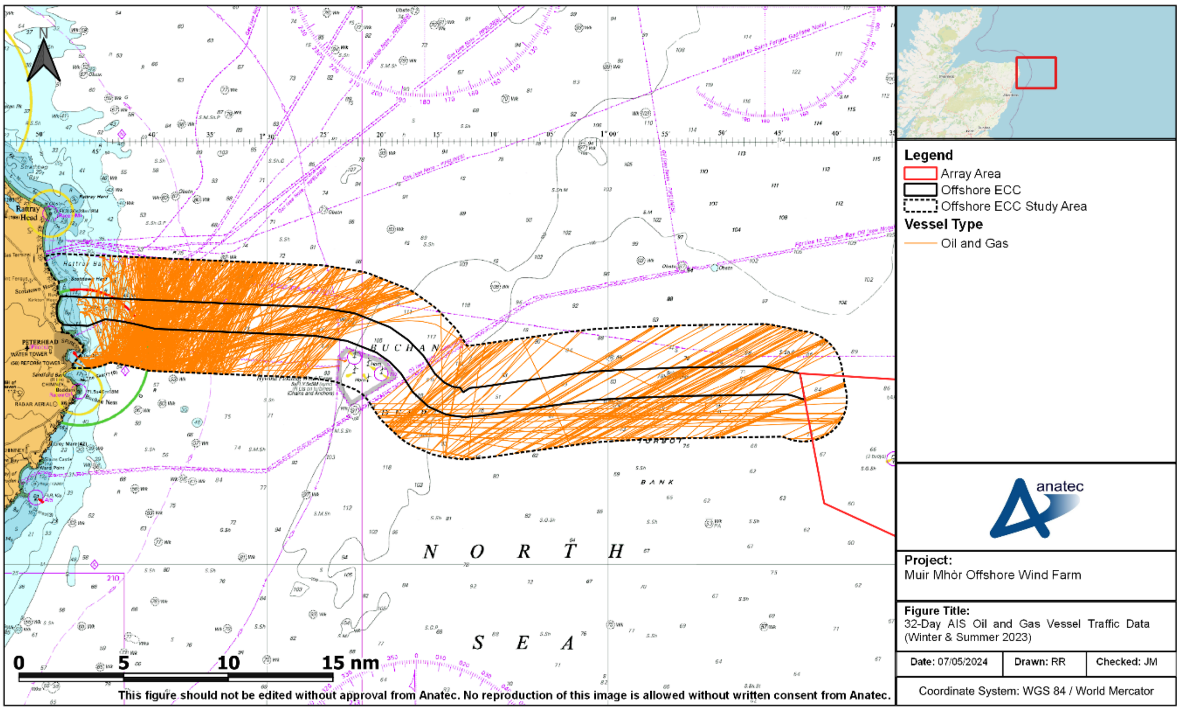


Figure 10-27 32-Day Oil and Gas Vessels (Offshore ECC, Winter and Summer 2023)

215. An average of 21 oil and gas vessels were recorded per day during the winter data period and an average of 20 per day during the summer data period. There was limited seasonality in oil and gas vessels and equal counts were recorded over each data period. An average of 18 unique oil and gas vessels crossed the offshore ECC per day during the winter data period and an average of 12 unique oil and gas vessels crossed the offshore ECC per day during the summer data period.

216. The majority of oil and gas vessels were either routeing north-east and were identified in the Array Area vessel traffic in Section 10.1.2.1, or routeing north-south close to shore. Over 80% of oil and gas vessels were recorded inshore of Hywind with no vessels intersecting the Hywind boundary.

217. Few vessels were recorded within the 50 m contour which is situated approximately 3 nm (5.56 km) offshore. Vessels that were within this area were mainly exhibiting waiting behaviours as opposed to being on transit.

10.2.2.2 Fishing Vessels

218. Fishing vessels recorded during the combined winter and summer data periods are presented in Figure 10-28.

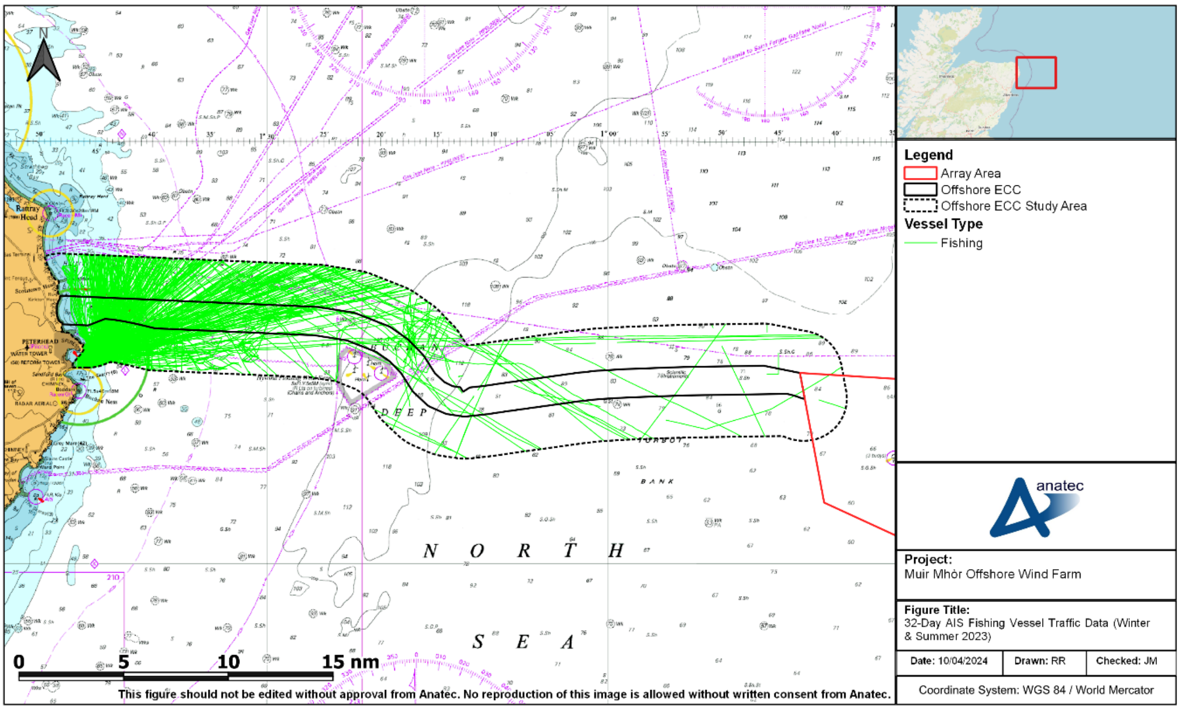


Figure 10-28 32-Day Fishing Vessels (Offshore ECC, Winter and Summer 2023)

219. An average of 15 unique fishing vessels were recorded per day during the winter data period and an average of 20 per day during the summer data period. An average of 12 unique fishing vessels crossed the offshore ECC per day during the winter and summer data periods.

220. Fishing vessels were primarily on transit within the offshore ECC study area with six unique vessels recorded engaged in potting activity around 3 nm to 10 nm (5.56 to 18.5 km) offshore during the winter data period. During the summer data period, five unique potting vessels (four of which were the same vessels recorded during the winter data period) were recorded in inshore waters of up to 3 nm (5.56 km) offshore, within the 50 m contour line. One trawler was also recorded likely engaged in active fishing to the north of Hywind during the summer data period.

221. During the Hazard Workshop, the SWFPA noted there is a gentleman's agreement [the Peterhead Creel Agreement] currently in place for static gear vessels which work from the 1° 40' W line east from October to April, and from the 1° 40' W line west from April to October. This aligns with the fishing activity recorded during the data periods as noted above.

222. It was also raised by the SWFPA that vessels will be landing at Peterhead and then returning to their home port of Fraserburgh (UK) and will contribute to a lot of the transiting vessels routeing close to the coast. Several fishing vessels were also exhibiting waiting behaviour close to Peterhead Port likely waiting for berth availability and landing opportunities within port.

10.2.2.3 Cargo Vessels

223. Cargo vessels recorded during the combined winter and summer data periods are presented in Figure 10-29.

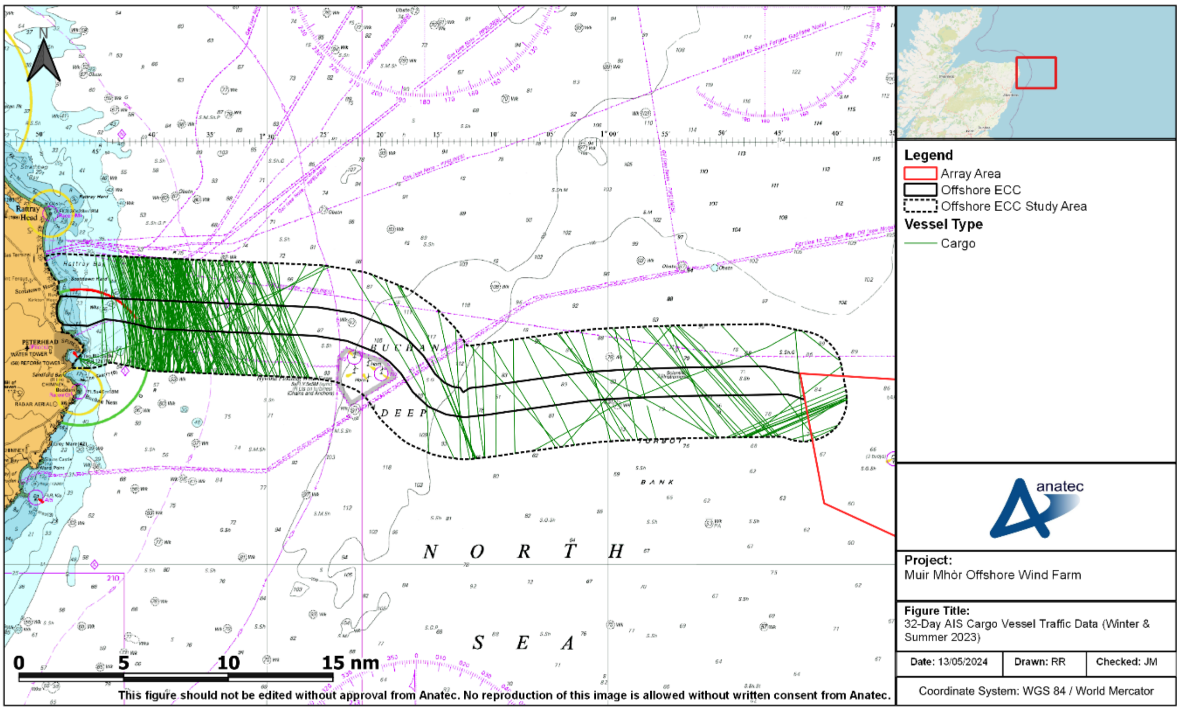


Figure 10-29 32-Day Cargo Vessels (Offshore ECC, Winter and Summer 2023)

224. An average of seven unique cargo vessels were recorded per day during the winter data period and an average of eight per day during the summer data period. An average of six to seven unique fishing vessels crossed the offshore ECC per day during the winter and summer data periods.

225. Cargo vessels were primarily routeing inshore of Hywind north south following the coast and accounted for 81% of all cargo vessels recorded within the offshore ECC study area across the combined data periods. These vessels were mainly routeing north to destinations including the Northern Isles and Iceland and south to Aberdeen and Rotterdam (the Netherlands). This routeing included two Ro-Ro vessels routeing between Aberdeen and the Northern Isles, specifically Lerwick (UK) and Kirkwall (UK).

226. Those cargo vessels further offshore were primarily identified in the Array Area analysis in Section 10.1.2.2, including the Aberdeen – Risavika Ro-Ro route within the offshore ECC study area to the east, passing south of the offshore ECC itself.

227. The main cargo sub-types recorded across the combines data periods include Ro-Ro (25%), general cargo (23%), part containerised (18%), and containers (13%).

10.2.2.4 Recreational Vessels

228. Recreational vessels recorded during the combined winter and summer data periods are presented in Figure 10-30.

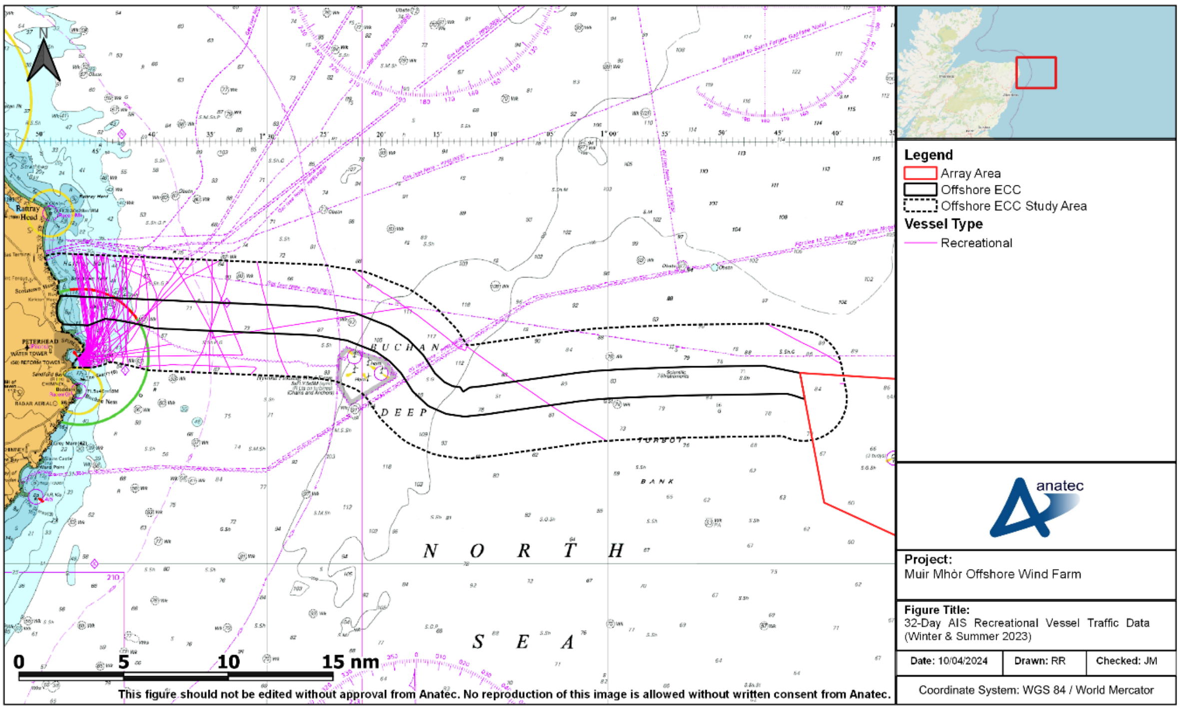


Figure 10-30 32-Day Recreational Vessels (Offshore ECC, Winter and Summer 2023)

229. An average of five to six unique recreational vessels were recorded per day during the summer data period with an average of three per day crossing the offshore ECC. Only two unique recreational vessels were recorded during the winter data period with both transits south of the offshore ECC entering/exiting Peterhead Bay and did not cross the offshore ECC.

230. The majority of recreational vessels were transiting close to the coast and entering/exiting Peterhead Bay. RYA Scotland noted during the Hazard Workshop that Peterhead Bay Marina is a popular stop for transiting recreational vessels and vessels tend to transit closer to ports and shore to avoid commercial vessels further offshore.

10.2.2.5 Pilot Vessels

231. Pilot vessels recorded during the combined winter and summer data periods are presented in Figure 10-31.

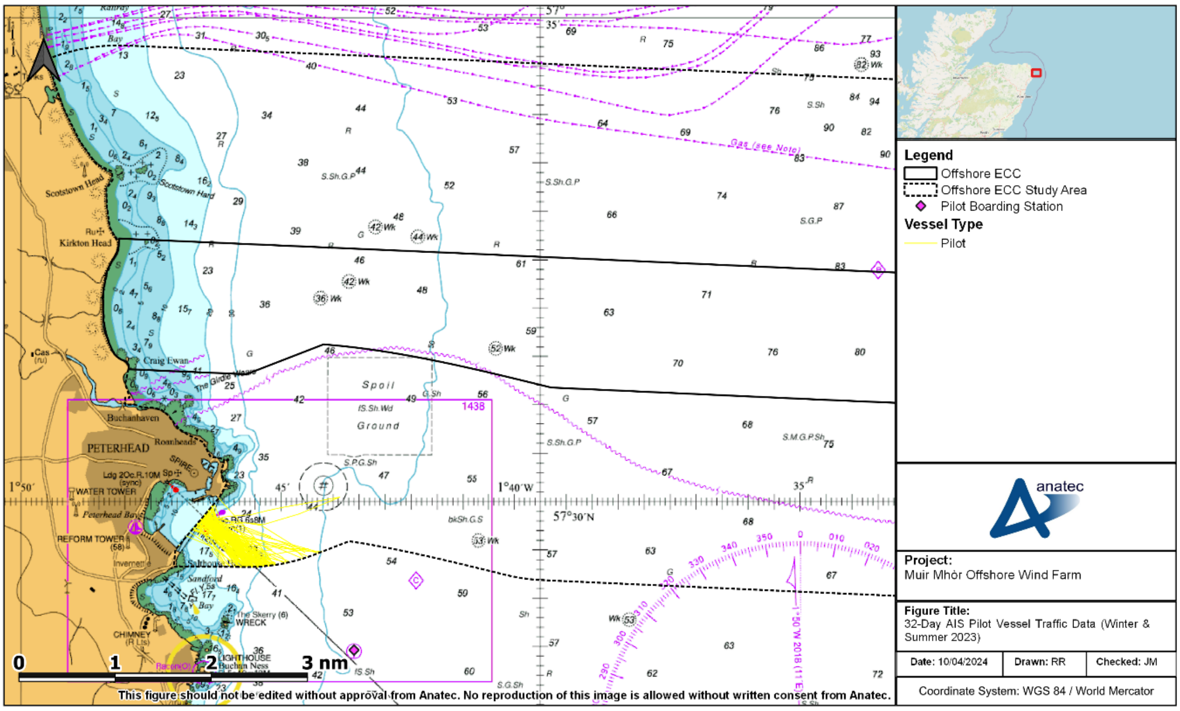


Figure 10-31 32-Day Pilot Vessels (Offshore ECC, Winter and Summer 2023)

232. One unique pilot vessel, associated with Peterhead Port, was recorded on 28 of the 32 days during the combined data period with most days exhibiting multiple transits to/from the pilot boarding station to Peterhead Port. Pilot vessel activity does not intersect the offshore ECC, and pilotage requirements are detailed in Section 7.2.1.

10.2.2.6 Anchored Vessels

233. The same anchor assessment which was applied to the study area for the Array Area in Section 10.2.2.6 has also been applied to the offshore ECC study area across the combined data periods. After applying the criteria, no vessels were deemed to be at anchor within the offshore ECC study area across the combined data periods. This reflects the absence of any charted anchorage areas in proximity to the offshore ECC, including in nearshore areas.

10.2.3 Vessel Size

10.2.3.1 Vessel Length

234. Vessel LOA was available for greater than 99% of AIS vessels recorded throughout the combined winter and summer data periods. Vessels with unspecified LOA were all recreational vessels and have been removed from the analysis where relevant.

235. The combined 32-days vessel traffic data is presented in Figure 10-32, colour-coded by LOA. Following this, a distribution of these vessel LOA is presented in Figure 10-33.

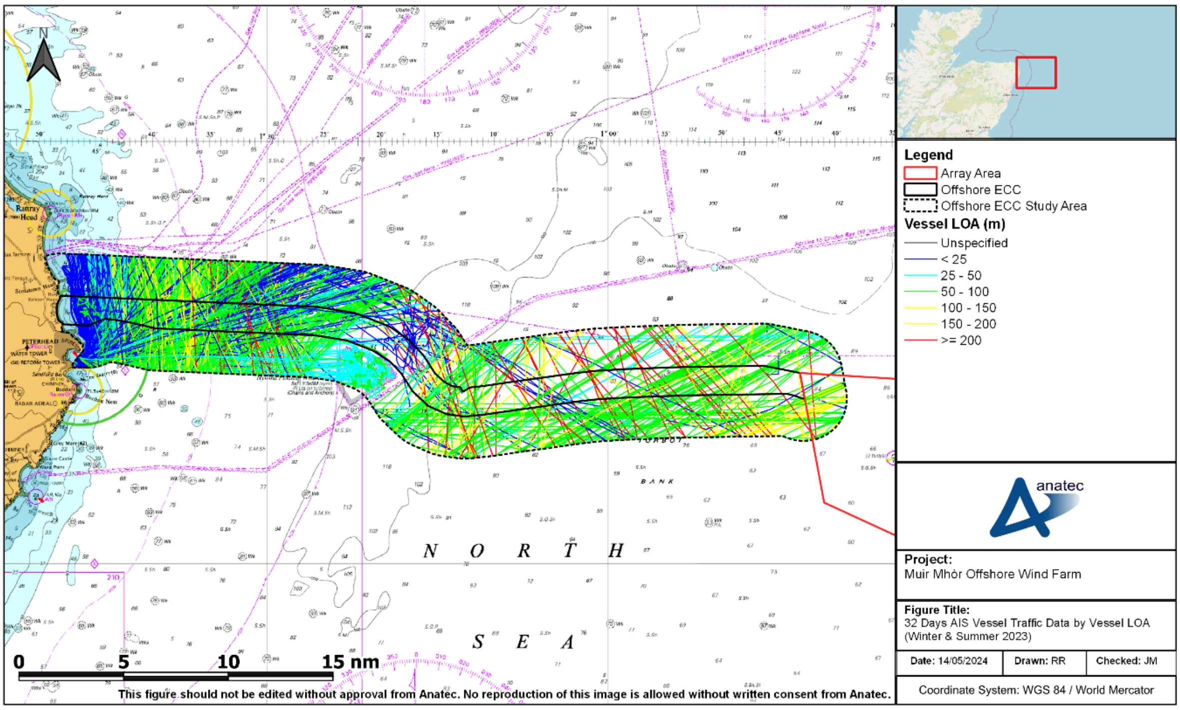


Figure 10-32 32-Day Vessel Traffic Survey Data by Vessel Length (Offshore ECC, Winter and Summer 2023)

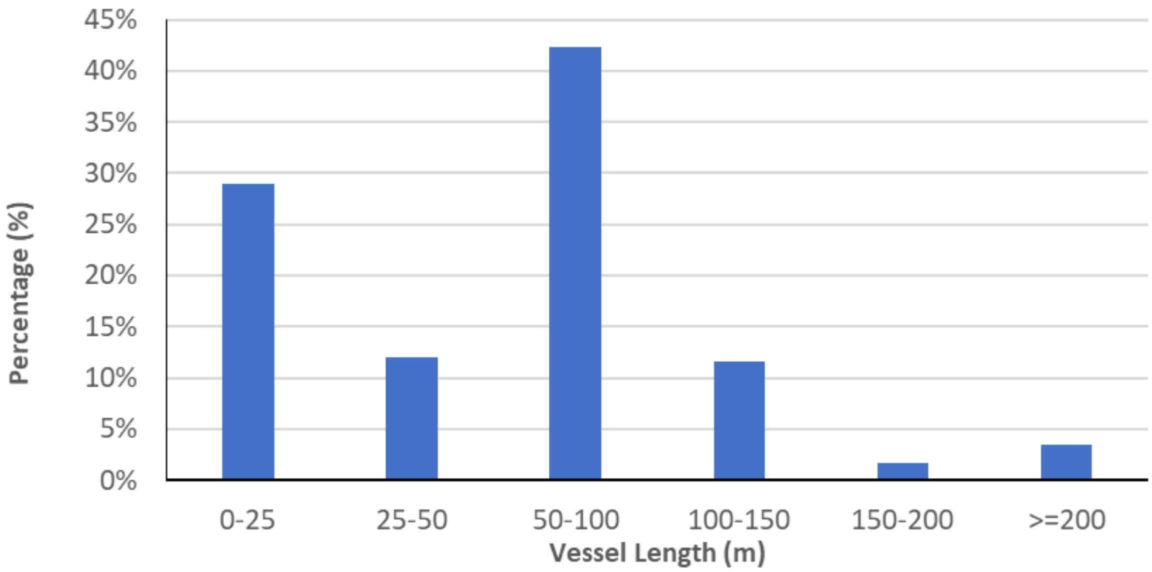


Figure 10-33 Vessel LOA Distribution (Offshore ECC, Winter and Summer 2023)

236. Of vessels with a valid LOA, the average LOA recorded was 70 m. Vessel LOA ranged from a 5 m potter to a 333 m cruise liner; this cruise liner crossed the offshore ECC on two occasions in the east of the offshore ECC study area during the summer data period. The majority of vessels had a LOA which ranged between 50 to 100 m and mainly comprised of oil and gas vessels. Vessels with greater LOA were primarily passenger vessels and large cargo vessels with no vessels greater than 200 m recorded inshore of the 50 m contour water depth. Vessels of smaller LOA were recreational and fishing vessels.

10.2.3.2 Vessel Draught

237. Vessel draught was available for approximately 78% of AIS vessels recorded throughout the combined winter and summer data periods. Vessels with unspecified draughts have been removed from the analysis where relevant.

238. The combined 32-days vessel traffic data is presented in Figure 10-34, colour-coded by vessel draught. Following this, a distribution of these vessel draughts is presented in Figure 10-35.

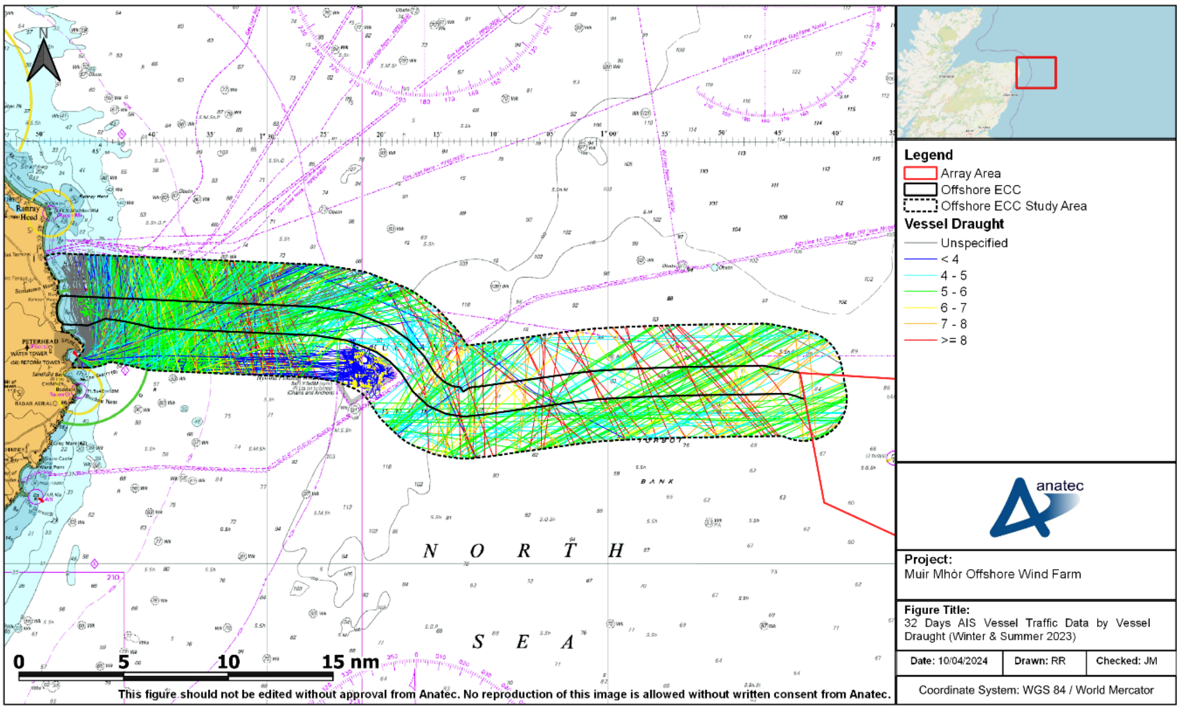


Figure 10-34 32-Day Vessel Traffic Data by Vessel Draught (Offshore ECC, Winter and Summer 2023)

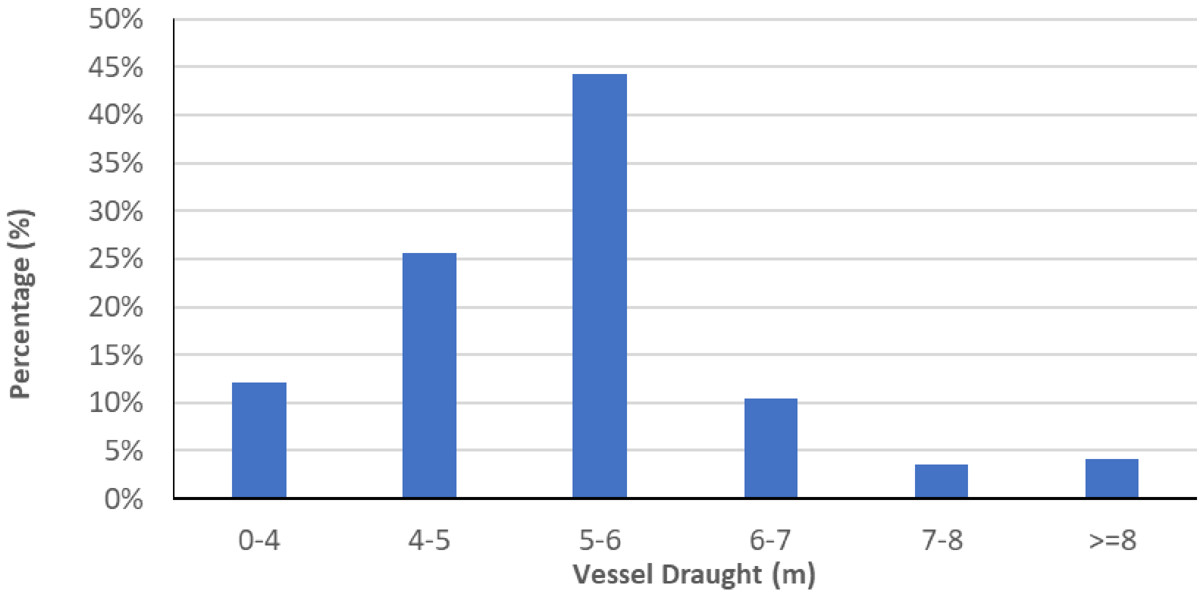


Figure 10-35 Vessel Draught Distribution (Offshore ECC, Winter and Summer 2023)

239. Of vessels with a valid broadcast vessel draught, the average draught recorded was 5.1 m. Vessel draught ranged from 0.2 m for various fishing vessels to a 15 m bulk carrier cargo vessel; this cargo vessel crossed the offshore ECC routeing north south, inshore of Hywind, during both the winter and summer data periods. The majority of vessels had a draught which ranged between 4 to 6 m and mainly comprised of

fishing vessels and oil and gas vessels. Vessels with a draught 8 m and above accounted for 4% and were larger cargo, tanker, and passenger vessels and were not recorded inshore of the 50 m contour water depth. Only 1% of vessels had a draught of 10 m or greater within the offshore ECC study area.

11 Base Case Vessel Routeing

11.1 Definition of a Main Commercial Route

240. 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 can also be interrogated to show vessels (by name and/or operator) that frequently transit those routes. The route width is then calculated using the 90th percentile rule from the median line of the potential shipping route as shown in Figure 11-1.

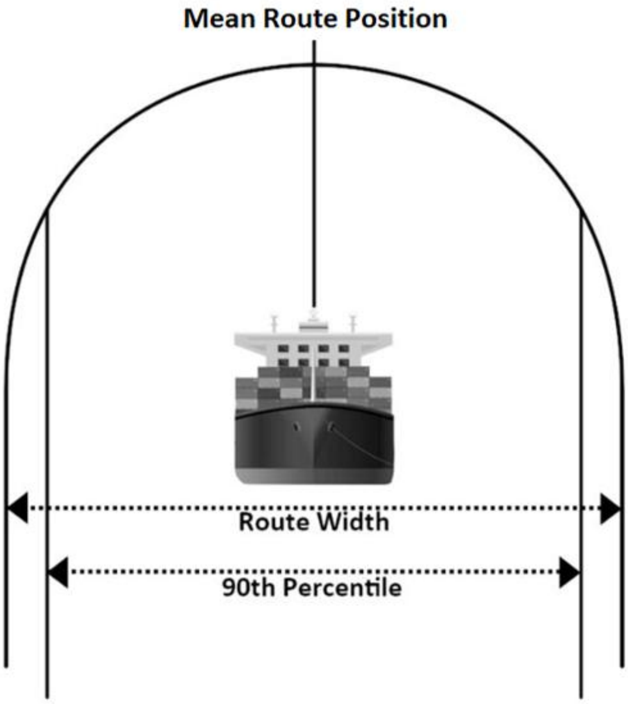


Figure 11-1 Illustration of a Main Route Calculation

11.2 Pre Wind Farm Main Commercial Routes

241. A total of 18 main commercial routes were identified within the study area from the vessel traffic survey data (which was validated by the long-term vessel traffic data) i.e., the pre wind farm scenario. These main commercial routes and corresponding 90th percentiles within the study area are shown relative to the Array Area in Figure 11-2. Following this, a description of each route is provided in Table 11-1, including the average number of vessels per week, start and end locations, main vessel types, and details of any commercial ferry routeing where applicable.

242. Of the 18 main routes identified, 11 of these routes were exclusively oil and gas routes. Six routes were commercial vessels only (cargo, tanker, passenger) and one

route was a combination of Ro-Ro and oil and gas vessels; this was the only commercial ferry route identified and was first introduced in Section 10.1.2.2.

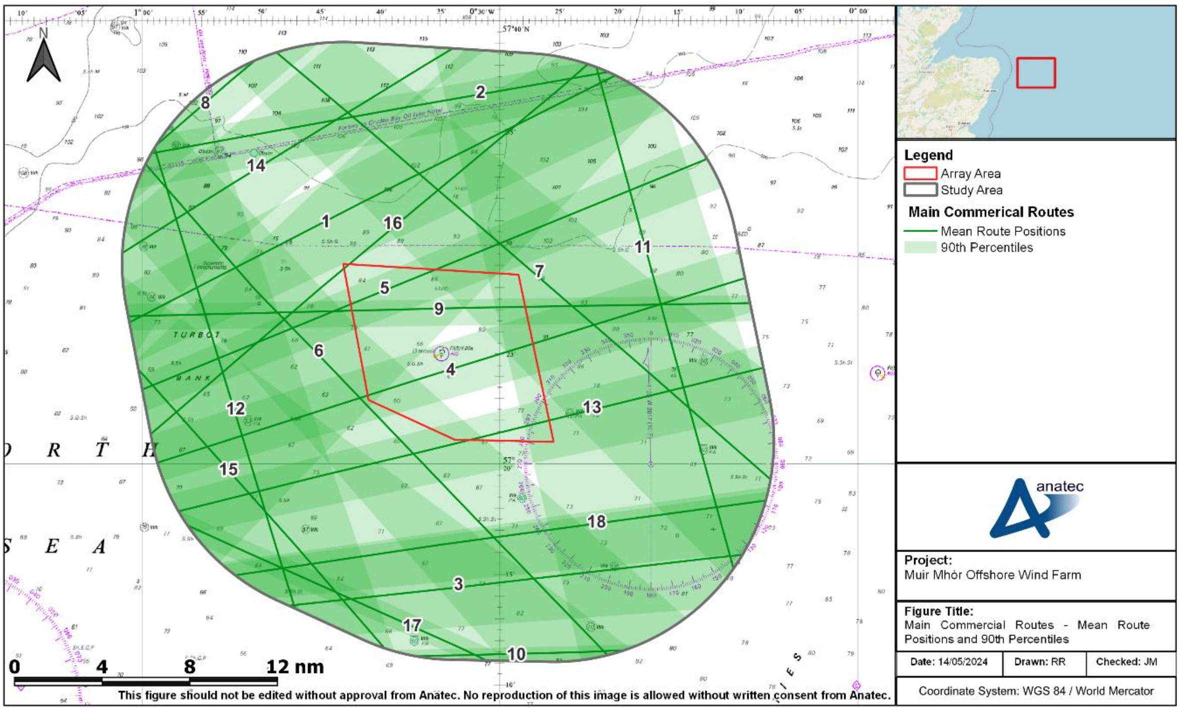


Figure 11-2 Main Commercial Routes – Mean Route Positions and 90th Percentiles

Table 11-1 Main Commercial Route Details

Route Number	Vessels per Week	Route Details
1	8	**Aberdeen – Alba/Britannia/Andrew Fields.** Oil and gas vessels (100%).
2	7	**Peterhead – Forties Field.** Oil and gas vessels (100%).
3	7	**Aberdeen/Montrose Ports – Mungo/Seagull/Montrose Fields.** Oil and gas vessels (100%).
4	5	**Aberdeen – Forties/Nelson/Everest Fields.** Oil and gas vessels (100%).
5	4	**Aberdeen – Risavika/Aberdeen – Armada Field.** Sea Cargo operated Ro-Ro route (45%) and dedicated oil and gas route (55%).
6	4	**Germany/Netherlands – USA/Canada/Mexico.** Cargo vessels (75%) with infrequent tankers (16%) and seasonal cruise liners (9%).
7	4	**Germany – USA/Canada/Mexico.** Cargo vessels (83%) with infrequent tankers (13%) and seasonal cruise liners (4%). Used by the Germany – Glensanda (UK) regular cargo route.
8	2 to 3	**Aberdeen – Tiffany Field.** Oil and gas vessels (100%).
9	2	**Peterhead – Kittiwake Field.** Oil and gas vessels (100%).
10	2	**Aberdeen – Culzean Field/ETAP.** Oil and gas vessels (100%).

Route Number	Vessels per Week	Route Details
11	2	**Northern Isles – Rotterdam.** Mainly tankers (61%) and cargo vessels (35%)
12	1 to 2	**Iceland – Humber ports/Rotterdam.** Cargo vessels (58%) and tankers (42%).
13	1 to 2	**Aberdeen – Kittiwake Field.** Oil and gas vessels (100%).
14	1 to 2	**Aberdeen – Norway.** Oil and gas vessels (100%).
15	1 to 2	**Moray Firth – Rotterdam.** Cargo vessels (63%), tankers (24%) and seasonal cruise liners (13%).
16	1 to 2	**Montrose – Norway.** Oil and gas vessels (100%).
17	Less than 1	**Peterhead – Curlew Field.** Oil and gas vessels (100%).
18	Less than 1	**Aberdeen – Baltic Ports.** Cargo vessels (84%) and tankers (16%).

12 Adverse Weather Routeing

243. Some vessels and vessel operators may operate alternative routes during periods of adverse weather. This section focuses on vessel movements in adverse weather. This takes into consideration the implications of a scenario when 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 Proposed Development or activities associated with the Proposed Development.

244. 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.

12.1 Identification of Periods of Adverse Weather

245. The vessel traffic survey data and long-term vessel traffic 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 from 15 to 17 February 2023 causing the survey vessel to return to port for over 24 hours across 16 and 17 February 2023. Rough waters were also recorded on 20 and 24 February 2023 but the vessel remained on site. These were the only recorded instances of adverse weather during the survey periods.

246. Historical weather information provided by the Met Office (Met Office, 2024) has been used to identify periods of adverse weather during the 12-month period of January 2022 – December 2022 (covering the long-term vessel traffic data) and during the 14-day survey periods in February 2023 and July/August 2023 (covering the vessel traffic survey data). By investigating such identified periods, cases where routes may have been altered or cancelled can then be identified. The key weather events identified, and the overlap with each dataset, are detailed in Table 12-1.

Table 12-1 Key weather events relevant to the Proposed Development (Met Office, 2024)

Weather Event	Date	Data Set Overlap	Details
Storm Malik	29 January 2022	Long-term vessel traffic data	Damaging and deadly north-westerly winds to northern Scotland and north-east England. Widespread wind gusts of over 60 kt and was one of the ten most significant winter

Weather Event	Date	Data Set Overlap	Details
			storms to affect the UK since the storm naming system was introduced for the 2015/2016 season. Wind gusts of up to 74 kt were recorded on the east coast of Scotland.
Storm Corrie	30 to 31 January 2022	Long-term vessel traffic data	Further damaging winds with gusts reaching 80 kt on the east coast of Scotland.
Storm Dudley	16 to 17 February 2022	Long-term vessel traffic data	Strong winds and snow leaving many areas in Cumbria and eastern England and Wales without power. Wind gusts of up to 48 kt were recorded on the east coast of Scotland.
Storm Eunice	18 February 2022	Long-term vessel traffic data	The most severe, deadly, and damaging storm to affect England and Wales since February 2014. Record wind gusts for England of 106 kt were recorded on Isle of Wight. Wind gusts of up to 41 kt on the east coast of Scotland. Severe travel disruption on land and to shipping across the UK.
Storm Franklin	20 to 21 February 2022	Long-term vessel traffic data	Strong winds and rain following on from previous storms with severe flood warnings in place. Wind gusts of up to 46 kt on the east coast of Scotland.
Storm Otto	17 February 2023	Winter vessel traffic survey	The storm caused transport disruption, with trains, buses and ferry services delayed or cancelled, and fallen trees blocked many routes in Aberdeenshire, with damage to property recorded. Wind gusts of up to 72 kt recorded on the east coast of Scotland.
Storm Antoni	5 August 2023	Summer vessel traffic survey	Strong winds and heavy rain to parts of England, Wales and Northern Ireland. No weather impacts were recorded in Scotland.

12.2 Adverse Weather Effects of Vessel Traffic

247. The vessel traffic survey data and the long-term vessel traffic data was assessed for any vessel movements which could be associated with periods of adverse weather. This analysis along with consultation has been used to identify potential commercial routeing activity related to adverse weather conditions in proximity to the Proposed Development, with the periods outlined in Table 12-1 and commercial ferries (which can be seen to make similar transits on a very regular basis) studied most closely. Additionally, as part of the Regular Operator consultation, Regular Operators identified from the long-term vessel traffic data were asked "*Whether the presence of the Project poses any safety concerns to your vessels, including in relation to adverse weather routeing*" (Annex D).

248. Tidewater Marine Ltd provided feedback in relation to adverse weather routeing during the Regular Operator consultation, it was noted:

> *During the winter months Masters of Tidewater Marine Ltd vessels are constantly "zig zagging" to stay safe in rough weather and that south easterly storms tend to give the most problems as the majority of course, either to an*

installation or back to port, are at 90 degrees, which PSVs tend not to like as the cargo tends to fall out of the vessel. There is no shelter until the vessel is back in port, and sometimes with ports such as Peterhead you may be asked to sail if a South Easterly is forecast, as the port is not safe in a South Easterly storm.

249. Tidewater Marine Ltd confirmed during the Regular Operator consultation that the Proposed Development is not considered to impact vessels greatly and vessels are constantly updating course and constructing passage plans before departing. No other Regular Operator responses were provided.

250. During dedicated meetings no other stakeholders raised any concerns around adverse weather routeing with RYA Scotland noting recreational vessels may enter the operational array during periods of adverse weather but recreational vessel traffic within the Array Area and the surrounding area is minimal and confirmed the vessel traffic survey data is representative. RYA Scotland noted that no transits are expected that far offshore during winter periods, and this is the period of time where adverse weather conditions would be more likely.

251. It was identified during the long-term vessel traffic data analysis (Annex E) that several transits from a Ro-Ro operated by Smyril Line, who was identified as a Regular Operator, were recorded further offshore than its intended route and so are present within the study area during winter months; west of the Array Area (Figure E-10 in Annex E). The route operates between Rotterdam and Tórshavn (Faroe Islands) and normally utilises the Pentland Firth and passes south of Orkney between the Stroma and Swona islands (UK). On the transits recorded intersecting the study area, the route deviated from its usual course and passed north of Orkney between the Orkney and Shetland Island groups, in an area of greater open sea room. This behaviour may be due to adverse weather conditions. This route passes at the closest distance of 3.6 nm (6.67 km) to the west of the Array Area and so is not anticipated to be affected by the presence of the Proposed Development.

13 Cumulative Overview

252. Cumulative effects have been considered for activities in combination and cumulatively with the Proposed Development. This section provides an overview of cumulative developments screened into the cumulative risk assessment based on the criteria outlined in Section 3.4.

253. The outputs of the cumulative risk assessment are then provided in Section 21.

13.1 Offshore Wind Farm Developments

254. In addition to the Proposed Development, there are several other proposed OWF projects located on the North Sea. During consultation, various stakeholders expressed an interest in the cumulative build out of OWF projects.

255. Operational wind farms are present in proximity to the Proposed Development but have been screened out due to being part of the baseline assessment. These include Hywind, Aberdeen, and Kincardine.

256. The closest screened in development to the Proposed Development is the CampionWind Offshore Wind Project, located approximately 6.8 nm (12.6 km) directly east of the Array Area. Other relevant screened in developments within 50 nm of the Array Area are detailed in Table 13-1 along with their associated tier based on the criteria outlined in Section 3.4. Following this, these developments are illustrated in Figure 13-1.

Table 13-1 Cumulative Screening Summary for OWF Developments

Project	Status (as of July 2024)	Distance to Array Area (nm)		Distance to Offshore ECC (nm)		Data Confidence	Tier
		nm	km	nm	km		
CampionWind	Pre Planning	6.8	12.6	16.1	29.8	High	1
Aspen	Pre Planning	10.8	20.0	16.1	29.8	High	1
Flora	Pre Planning	13.0	24.1	0.0	0.0	High	1
Salamander	Consent Application Submitted	15.3	28.3	5.00	9.26	High	1
Green Volt	Consented	21.0	38.9	20.7	38.3	High	2
Ossian	Scoped	27.7	51.3	33.7	62.4	High	2
Bellrock	Scoped	28.2	52.2	38.2	70.7	High	2
Morven	Scoped	31.4	58.2	32.8	60.7	High	2
MarramWind	Scoped	31.9	59.1	31.5	58.3	High	2
Cedar	Pre Planning	35.4	65.6	46.9	86.9	High	2
Bowdun	Pre Planning	28.3	52.4	24.0	44.4	High	3

Project	Status (as of July 2024)	Distance to Array Area (nm)		Distance to Offshore ECC (nm)		Data Confidence	Tier
		nm	km	nm	km		
Buchan	Scoped	48.6	90.0	42.8	79.3	High	3

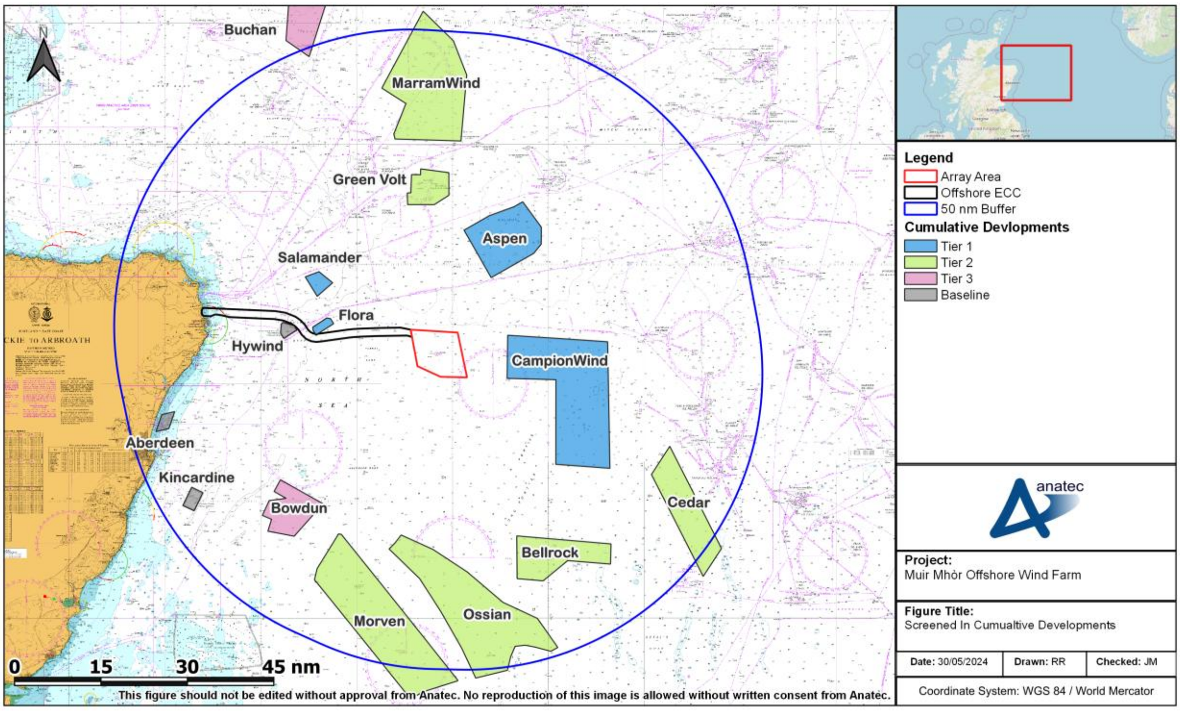


Figure 13-1 Cumulative OWF Developments

13.2 Subsea Cable Developments

257. Two subsea cable developments have been identified as crossing the offshore ECC and have been screened in to the cumulative assessment both developments are of low data confidence and have been detailed in Table 13-2. These cables are the electrical power cable from the Buchan Oil Field and the NorthConnect interconnector linking Scotland to Norway. The interconnector is anticipated to make landfall in Long Haven Bay, south of Peterhead and in Simadalen, Norway and will cross the offshore ECC offshore of Peterhead. The development is currently in the pre planning stage and so has been screened into the cumulative assessment, however, the current status of the development is unknown at the time of writing as the Norwegian Government rejected the licensing application in March 2023 (Europower, 2023).

258. The Eastern Green Link 2 interconnector was noted during the Hazard Workshop and is expected to be installed prior to construction of the Proposed Development. However, it is not expected to cross the offshore ECC and therefore there is no clear pathway through which a potentially significant hazard may arise.

Table 13-2 Cumulative Screening Summary for Subsea Cable Developments

Project	Status	Distance to Offshore ECC (nm)	Data Confidence	Tier
NorthConnect	Pre Planning	0	Low	3
Buchan Oil Field	Pre Planning	0	Low	3

13.3 Other Cumulative Developments

259. It is noted that no subsea pipelines, oil and gas infrastructure, marine aggregate dredging areas, port developments, or wave/tidal developments have been screened in to the cumulative assessment. This is due either to any identified projects already being operational or already active (and thus part of the baseline assessment) or no clear pathway through which a potentially significant hazard may arise.

14 Future Case Vessel Traffic

260. The vessel traffic baseline established in Section 10 is used as input into the risk assessment (Sections 18 to 20). 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 Proposed Development (the post wind farm scenario).

261. The following subsections outline the future case scenarios which have been used to inform the risk assessment, and which has also been applied to the collision and allision risk modelling in Section 16.

14.1 Increases in Commercial Vessel Activity

262. Given future commercial traffic trends are dependent on various factors, and are hence difficult to predict, the NRA has assumed potential increases of 10% and 20% within the commercial traffic allision and collision modelling. The consideration of a range of conservative values is considered as covering potential increases over the course of the Proposed Development's operational lifespan. These values were proposed during the Hazard Workshop and no concerns were raised.

263. These values also consider that oil and gas vessels may decrease over time due to the decommissioning of oil and gas structures in the North Sea but as noted by the UK Chamber of Shipping (Section 4.4) oil and gas vessels may be repurposed across the offshore wind industry and can balance out the reduction in oil and gas movements.

14.2 Increases in Commercial Fishing Activity

264. Indicative 10% and 20% increases in commercial fishing vessel transits have been considered in the modelling undertaken within the NRA. These values are used due to there again being limited reliable information on future activity levels upon which any firm assumption can be made. It is noted that additional information on commercial fishing trends is contained within **Volume 2, Chapter 13 (Commercial Fisheries)**.

14.3 Increases in Recreational Activity

265. There are no known developments which will increase the activity of recreational vessels within the area. Therefore, as with commercial fishing activity, given the lack of reliable information relating to future trends, 10% and 20% increases are considered conservative, and have therefore been applied.

14.4 Increase Associated with Proposed Development Activities

266. The anticipated number of vessels associated with the Proposed Development during the construction and O&M phases are presented in Section 6.6. Base ports have not yet been determined for any phase of the Proposed Development and therefore it is not possible to provide any detailed overview of the likely pattern of project vessel movements.

14.5 Commercial Traffic Routeing (Proposed Development in Isolation)

14.5.1 Methodology

267. It is not possible to consider all potential alternative routeing options for commercial traffic and therefore alternatives have been based upon worst-case assumptions to ensure exposure to wind farm structures is maximised.

268. Assumptions for re-routeing include:

- All alternative routes maintain a minimum mean distance of 1 nm (1.85 km) from offshore installations and existing OWF 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 account known routeing preferences including consideration of banks/shallows and AtoNs.

269. Annex 1 of MGN 654 defines a methodology for assessing passing distance from OWF boundaries, noting that it also states that the methodology is "*not a prescriptive tool but needs intelligent application"* (MCA, 2021).

270. 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 1 nm (1.85 km) of established OWFs (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 1 nm (1.85 km) off established developments.

271. The NRA also aims to establish the WCS based on navigational safety parameters. On this basis the most conservative realistic scenario for vessel routeing is considered to be mean route positions passing 1 nm (1.85 km) 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.

14.5.2 Main Commercial Route Deviations

272. The methodology detailed in Section 14.5.1 has been applied to potential deviations that may arise to the base case routes identified and discussed in Section 11.2.

273. An illustration of the anticipated WCS shift in the mean route positions of the main commercial routes within the study area following the development of the Proposed Development is presented in Figure 14-1.

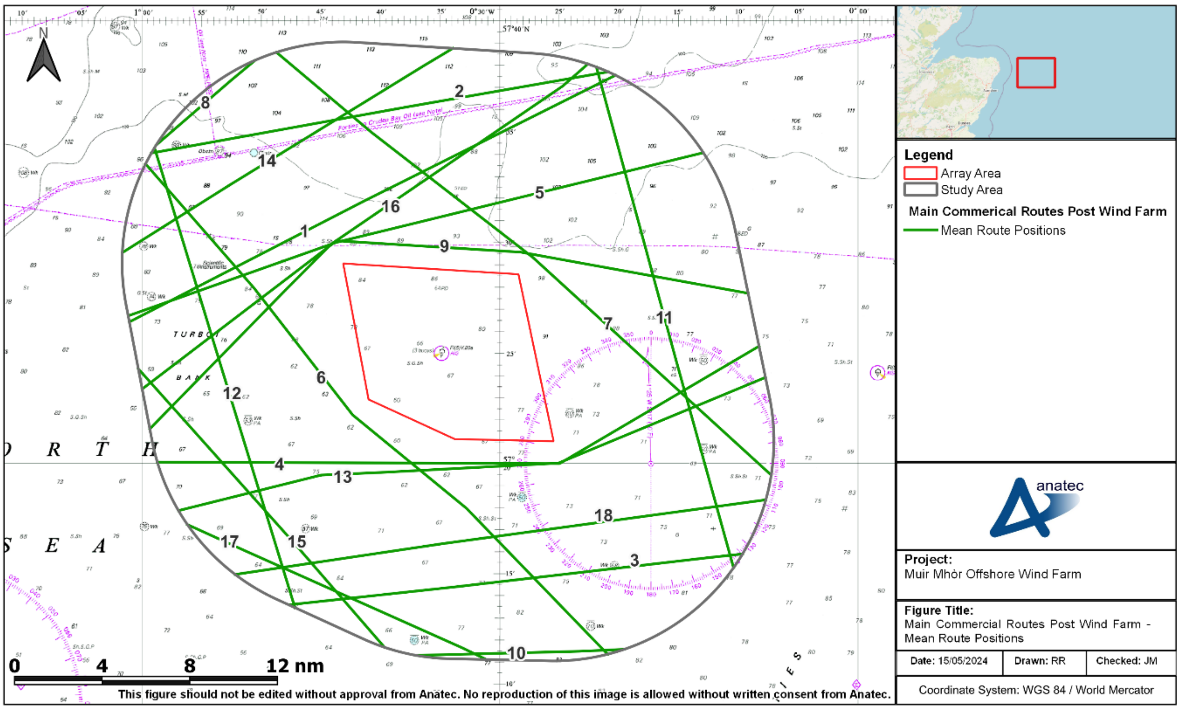


Figure 14-1 Main Commercial Routes Post Wind Farm – Mean Route Positions

274. Deviations of main commercial routes from the pre wind farm scenario would be required for seven out the 18 main commercial routes identified, with deviations ranging from less than a 0.1% distance increase for Routes 6, 7, and 16 to a 1.5% distance increase for Route 4.

275. Deviated routes are detailed further in Table 14-1.

Table 14-1 Summary of Post Wind Farm Deviated Main Commercial Routes

Route Number	Increase in Route Length (nm)	Percentage Change in Total Route Length (%)	Nature of Deviation
4	1.5	1.5	Passing south of the Array Area.
5	0.6	0.2	Passing north of the Array Area.
6	0.1	Less than 0.1	Passing further south-west of the Array Area.
7	Less than 0.1	Less than 0.1	Passing further north-east of the Array Area.

Route Number	Increase in Route Length (nm)	Percentage Change in Total Route Length (%)	Nature of Deviation
9	0.8	1.0	Passing north of the Array Area.
13	0.4	0.4	Passing south of the Array Area.
16	0.1	Less than 0.1	Passing north-west of the Array Area.

14.6 Commercial Traffic Routeing (Cumulative)

276. An illustration of the anticipated worst-case shift in the mean positions of the main commercial routes within a 50 nm (92.6 km) buffer following the development of the Proposed Development and Tier 1 and Tier 2 cumulative projects (Section 13.1) is presented in Figure 14-2. Again, these deviations are based on Anatec's assessment of the WCS and follow the same methodology outlined for deviations due to the Proposed Development in isolation (Section 14.5.1).

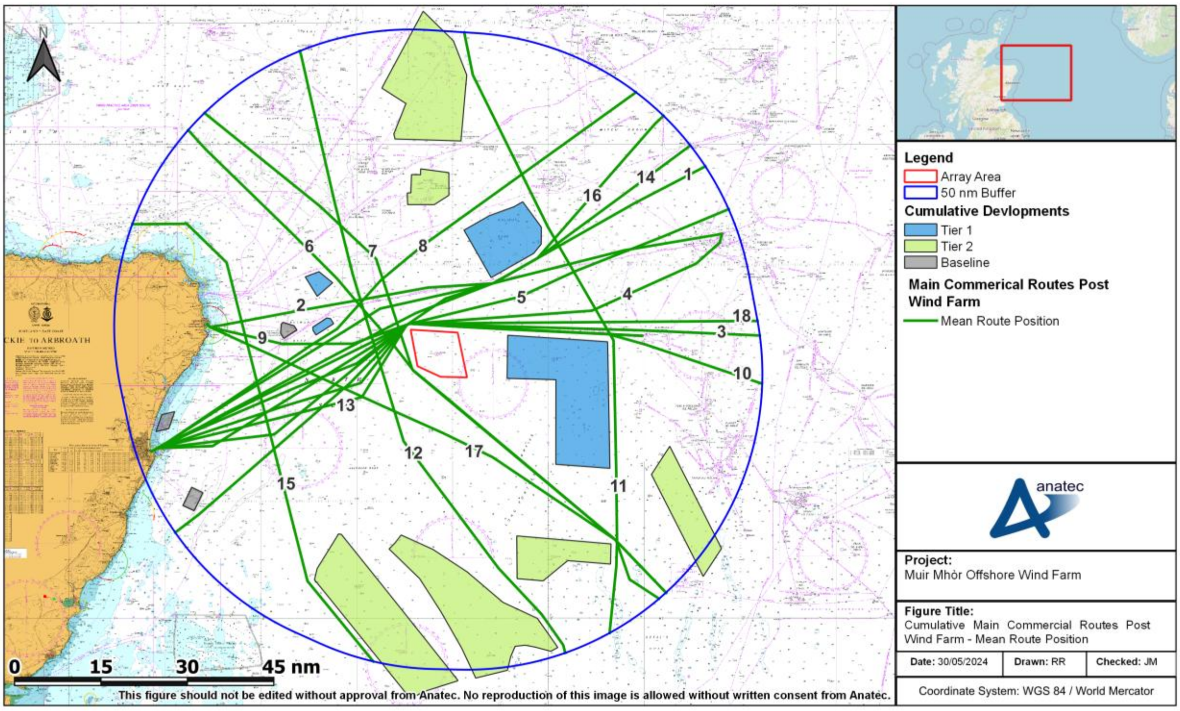


Figure 14-2 Cumulative Main Commercial Routes Post Wind Farm – Mean Route Position

277. At a cumulative level, deviations would be required for all 18 main commercial routes identified in the pre wind farm scenario.

278. Of these 18 deviations, only one route, Route 5 (Aberdeen – Risavika/Armada Field), would not be further affected by cumulative developments and the route remains the same as in the post wind farm in isolation scenario, i.e., the presence of the Tier 1 and Tier 2 cumulative projects does not further increase the deviation.

279. As noted in Section 14.5.2, seven main commercial routes were deviated due to the presence of the Proposed Development in isolation with the presence of Tier 1 and Tier 2 developments. A further three routes (Route 3, 10, and 18) are also impacted by the Proposed Development in the cumulative scenario. Therefore, a total of 10 main commercial routes identified from the pre wind farm scenario would be impacted by the presence of the Proposed Development either in isolation or at a cumulative level.

280. The remaining eight routes deviated at a cumulative level (Routes 1, 2, 8, 11, 12, 14, 15, and 17) are not impacted by the presence of the Proposed Development in any scenario. These routes would require a level of deviation, as illustrated in Figure 14-2, if the cumulative developments were to be developed even if the Proposed Development was not, and so the Proposed Development has no direct impact on these routes.

281. Table 14-2 provides a summary of the screened in developments that each main route identified has the potential to interact with assuming pre wind farm routeing patterns.

Table 14-2 Cumulative Routeing Interaction Summary

Route Number	Route Deviated in Isolation	Muir Mhòr	Tier 1 Developments				Tier 2 Developments					
			Campion Wind	Aspen	Flora	Salamander	Green Volt	Ossian	Bellrock	Morven	Marram Wind	Cedar
1	×	×	×	✓	×	×	×	×	×	×	×	×
2	×	×	×	✓	×	×	×	×	×	×	×	×
3	×	✓	✓	×	×	×	×	×	×	×	×	×
4	✓	✓	✓	×	×	×	×	×	×	×	×	×
5	✓	✓	×	×	×	×	×	×	×	×	×	×
6	✓	✓	×	×	×	×	×	×	✓	×	×	×
7	✓	✓	✓	×	×	×	×	×	×	×	×	✓
8	×	×	×	×	✓	×	×	×	×	×	×	×
9	✓	✓	✓	×	×	×	×	×	×	×	×	×
10	×	✓	✓	×	×	×	×	×	×	×	×	×
11	×	×	✓	✓	×	×	×	×	✓	×	✓	×
12	×	×	×	×	×	×	×	✓	×	×	×	×
13	✓	✓	✓	×	×	×	×	×	×	×	×	×
14	×	×	×	✓	×	×	×	×	×	×	×	×
15	×	×	×	×	×	×	×	✓	×	✓	×	×
16	✓	✓	×	✓	×	×	×	×	×	×	×	×
17	×	×	×	×	×	×	×	×	×	×	×	✓
18	×	✓	✓	×	×	×	×	×	×	×	×	×

15 Navigation, Communication, and Position Fixing Equipment

282. 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 Proposed Development.

15.1 Very High Frequency Communications (including Digital Selective Calling (DSC))

283. In 2004, trials were undertaken at the North Hoyle OWF, located off the coast of North Wales. As part of these trials, tests were undertaken to evaluate the operational use of typical small vessel VHF transceivers (including DSC) when operated close to WTGs.

284. The WTGs 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 WTGs, then it is reasonable to assume that larger vessels with higher powered and more efficient systems would also be unaffected.

285. 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).

286. Furthermore, as part of SAR trials carried out at the North Hoyle OWF in 2005, radio checks were undertaken between the Sea King helicopter and both Holyhead and Liverpool coastguards. The aircraft was positioned to 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).

287. In addition to the North Hoyle trials, a desk-based study was undertaken for the Horns Rev 3 OWF 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).

288. 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 Proposed Development is anticipated to have no significant impact upon VHF communications.

15.2 Very High Frequency Direction Finding

289. During the North Hoyle OWF trials in 2004, the VHF Direction Finding (DF) equipment carried in the trial boats did not function correctly when very close to WTGs (within approximately 50 m). This is deemed to be a relatively small-scale impact due to the

limited use of VHF direction finding equipment and will not impact operational or SAR activities (MCA and QinetiQ, 2004).

290. 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 1 nm (1.85 km), the homer system operated as expected with no apparent degradation.

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

15.3 Automatic Identification System

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

293. 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 Proposed Development.

15.4 Navigational Telex System

294. 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.

295. 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.

296. 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.

297. 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 Proposed Development.

15.5 Global Positioning Service

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

299. 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).

300. Therefore, there are not expected to be any significant impacts associated with the use of GPS systems within or in proximity to the Proposed Development, noting that there have been no reported issues relating to GPS within or in proximity to any operational OWFs to date.

15.6 Electromagnetic Interference

301. 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 can be used to calculate heading, used with a sextant to calculate latitude, and with a marine chronometer to calculate longitude.

302. 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.

303. 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 Proposed Development will have a significant impact on vessel navigation. However, some smaller craft (fishing or leisure) may rely on it as their sole means of navigation.

15.6.1 Subsea Cables

304. The subsea cables for the Proposed Development will be Alternating Current (AC) with studies indicating 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). Therefore, electromagnetic interference due to cables associated with the Proposed Development are not considered any further.

15.6.2 Wind Turbine Generators

305. MGN 654 (MCA, 2021) notes that small vessels with simple magnetic steering and hand bearing compasses should be wary of using these close to WTGs 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.

15.6.3 Experience at Operation Offshore Wind Farms

306. 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 OWFs.

15.7 Marine Radar

307. This section summarises the results of trials and studies undertaken in relation to Radar effects from OWFs in the UK. It is important to note that since the time of the trials and studies discussed, WTG technology has advanced significantly, most notably in terms of the size of WTGs available to be installed and utilised. The use of these larger WTGs allows for a greater spacing between WTGs 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.

15.7.1 Trials

308. 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 WTGs on the use and effectiveness of marine Radar.

309. In 2004, trials undertaken at the North Hoyle OWF (MCA and QinetiQ, 2004) identified areas of concern regarding the potential impact on marine- and shore-based Radar systems due to the large vertical extents of the WTGs (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).

310. 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 1.5 nm [2.78 km]) 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 15-1.

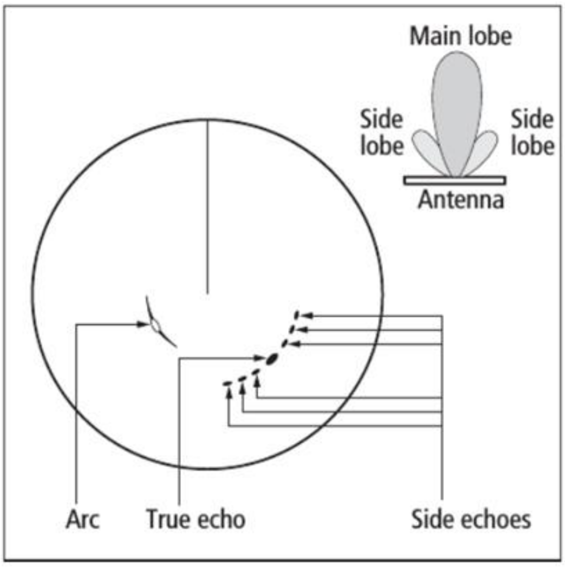


Figure 15-1 Illustration of Side Lobes on Radar Screen

311. 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 15-2.

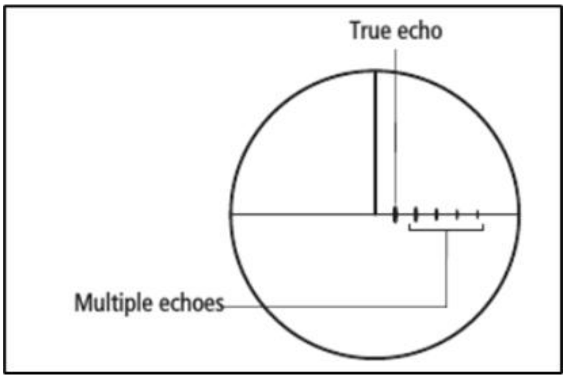


Figure 15-2 Illustration of Multiple Reflected Echoes on Radar Screen

312. 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 OWFs. However, as experience of effects associated with use of marine Radar in proximity to OWFs grew, the MCA refined their guidance, offering more flexibility within the most recent Shipping Route Template contained within MGN 654 (MCA, 2021).

313. A second set of trials conducted at Kentish Flats OWF in 2006 on behalf of the British Wind Energy Association (BWEA) – now called RenewableUK (BWEA, 2007) – also found that Radar antennas which are sited unfavourably with respect to components of the vessel's structure can 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.

314. Theoretical modelling of the effects of the development of the proposed Atlantic Array OWF, 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 WTGs than that considered within the early trials. 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 WTGs and safe navigation;
- Even in the worst-case with Radar operator settings artificially set to be poor, there is significant clear space around each WTG 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;
- 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 WTGs 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 WTGs 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 and recreational craft). It is noted that this situation would arise with or without WTGs 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.

315. In summary, experience in UK waters has shown that mariners have become increasingly aware of any Radar effects as more OWFs 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 can be effectively mitigated by "*careful adjustment of Radar controls*".

316. 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, 2008a). The interference buffers presented in Table 15-1 are based on MGN 654 (MCA, 2021), MGN 371 (MCA, 2008a), MGN 543 (MCA, 2016) and MGN 372 (MCA, 2008b).

Table 15-1 Distance at which Impacts of Marine Radar Occur

Distance at which effect occurs (nm)	Identified effects
0.5	▪ Intolerable impacts can be experienced. ▪ X-Band Radar interference is intolerable under 0.25 nm (0.46 km). ▪ Vessels may generate multiple echoes on shore-based Radars under 0.45 nm (0.83 km).
1.5	▪ Under MGN 654, impacts on Radar are considered to be tolerable with mitigation between 0.5 and 3.5 nm (0.92 and 6.48 km). ▪ S-band Radar interference starts at 1.5 nm. ▪ Echoes develop at approximately 1.5 nm (2.78 km), 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 WTGs. ▪ The WTGs produce strong Radar echoes giving early warning of their presence. ▪ Target size of the WTG echo increases close to the WTG with a consequent degradation on both X and S-Band Radars.

317. As noted in Table 15-1, the onset range from the WTGs of false returns is approximately 1.5 nm (2.78 km), with progressive deterioration in the Radar display as the range closes. If interfering echoes develop, the requirements of the 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 VTS or AIS (MCA, 2016).

15.7.2 Experience from Operational Developments

318. The evidence from mariners operating in proximity to existing OWFs is that they quickly learn to adapt to any effects. Figure 15-3 presents the example of the Galloper and Greater Gabbard OWFs, which are located in proximity to IMO routeing measures. Despite this proximity to heavily trafficked TSS lanes, there have been no reported incidents or issues raised by mariners who operate within the vicinity. The interference buffers presented in Figure 15-3 are as per Table 15-1.

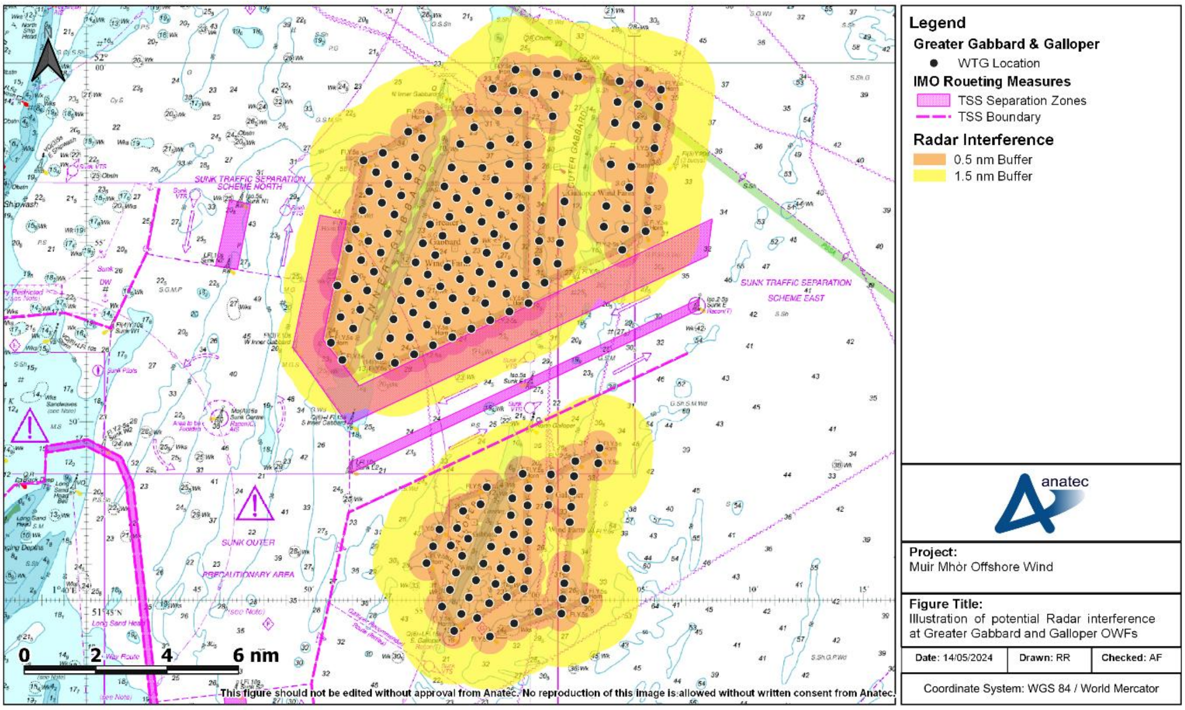


Figure 15-3 Illustration of Potential Radar Interference at Greater Gabbard and Galloper OWFs

319. As indicated by Figure 15-3, vessels utilising the TSS lanes will experience some Radar interference based on the available guidance. Both developments are operational, and each of the lanes is used by a minimum of five 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.

320. AIS information can also be used to verify the targets of larger vessels (generally vessels over 15 m LOA – the minimum threshold for fishing vessel AIS carriage requirements). Approximately 2.6% of the vessel traffic recorded within the Shipping and Navigation Study Area was under 15 m LOA, although throughout the vessel traffic surveys approximately 93% of vessel tracks during the summer survey period were recorded on AIS, indicating a high level of AIS take-up among vessels for which AIS carriage is not mandatory. However, due to the distance offshore, smaller vessels which would not normally carry AIS are less likely to transit as far from the coast.

321. 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 OWF.

322. Figure 15-4 presents an illustration of potential Radar interference due to the Proposed Development relative to the post wind farm routeing illustrated in Section 13. The Radar effects have been applied to the indicative array layout introduced in Section 6.2.1.

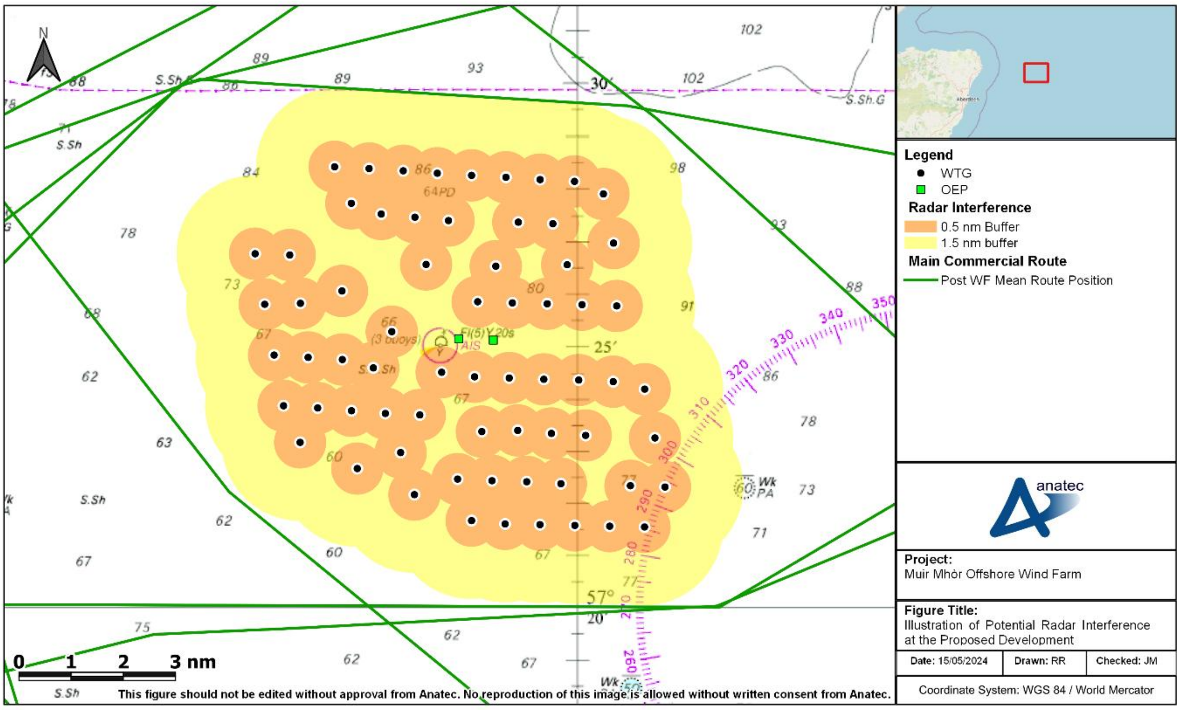


Figure 15-4 Illustration of Potential Radar Interference at the Proposed Development

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

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

15.8 Sound Navigation and Ranging System

325. No evidence has been found to date with regard to existing OWFs 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 Proposed Development.

15.9 Noise

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

15.10 Summary of Potential Effects on Use

327. Based on the detailed technical assessment of the effects due to the presence of the Proposed Development on navigation, communication and position fixing equipment in the previous subsections, Table 15-2 summarises the assessment of frequency and consequence and the resulting risk for each component of this hazard.

Table 15-2 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 direction finding	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

328. On the basis of these findings, associated risks are screened out of the risk assessment undertaken in Sections 18 to 20.

16 Collision and Allision Risk Modelling

329. To inform the risk assessment, a quantitative assessment of some of the major hazards associated with the Proposed Development has been undertaken. The following subsections outline the inputs and methodology used for the collision and allision risk modelling.

16.1 Hazards Under Consideration

330. Hazards considered in the quantitative assessment are as follows:

- Increased vessel to vessel collision risk;
- Increased powered vessel to structure allision risk;
- Increased drifting vessel to structure allision risk; and
- Increased fishing vessel to structure allision risk.

331. The pre wind farm assessment has been informed by the vessel traffic survey data (Section 10) in combination with the outputs of consultation (Section 4) and other baseline data sources (such as Anatec's ShipRoutes database). Conservative assumptions have been made with regard to route deviations and future shipping growth over the lifetime of the Proposed Development.

332. The methodology for determining the post wind farm routeing is outlined in Section 14.5.1 with the subsequent route deviations used throughout this section for post wind farm modelling.

16.2 Scenarios Under Consideration

333. For each element of the quantitative assessment both a pre and post wind farm scenario with base and future case vessel traffic levels have been considered. As a result, four distinct scenarios have been modelled:

- Pre wind farm with base case traffic levels;
- Pre wind farm with future case traffic levels defined by a:
  - 10% increase in traffic; and
  - 20% increase in traffic.
- Post wind farm with base case traffic levels; and
- Post wind farm with future case traffic levels defined by a:
  - 10% increase in traffic; and
  - 20% increase in traffic.

334. The results of the base case scenarios are detailed in full in the following subsections with the equivalent results for the future case scenarios provided in Section 16.5.

16.3 Pre Wind Farm Modelling

16.3.1 Vessel to Vessel Encounters

335. An assessment of current vessel to vessel encounters has been undertaken by replaying at high speed the vessel traffic data collected as part of the vessel traffic surveys (Section 5.2). The model defines an encounter as two vessels passing within 1 nm (1.85 km) of each other within the same minute. This helps to illustrate where existing shipping congestion is highest and therefore where offshore developments, such as an OWF, could potentially increase congestion and therefore also increase the risk of encounters and collision. No account of whether encounters are head on or stern on are given; only close proximity is accounted for.

336. The identified encounters were manually checked to determine whether there were any clear cases of non-genuine encounters (e.g., towing operations). Any such instances have been removed and the final encounters are illustrated in Figure 16-1, colour-coded by vessel type.

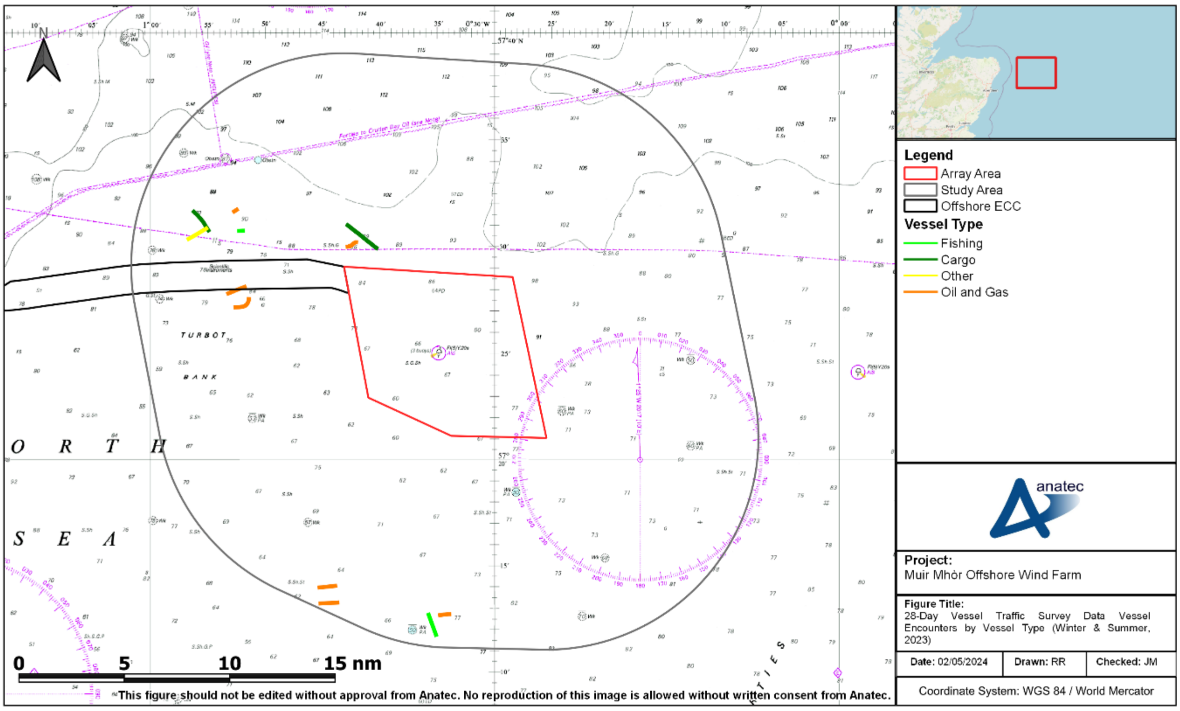


Figure 16-1 28-Day Vessel Traffic Survey Data Vessel Encounters by Vessel Type (Winter and Summer, 2023)

337. A total of six encounters were recorded during the combined survey periods resulting in an average of one encounter every four to five days within the study area. All encounters occurred in the winter survey period and no encounters occurred within the Array Area. Seven of the 12 vessels involved in encounters were oil and gas vessels.

16.3.2 Vessel to Vessel Collisions

338. Using the pre wind farm vessel routeing as input, Anatec's COLLRISK model has been run to estimate the existing vessel to vessel collision risk in proximity to the Proposed Development.

339. A heat map based upon the geographical distribution of collision risk within a 0.5 × 0.5 nm (0.95 × 0.95 km) grid for the base case is presented in Figure 16-2.

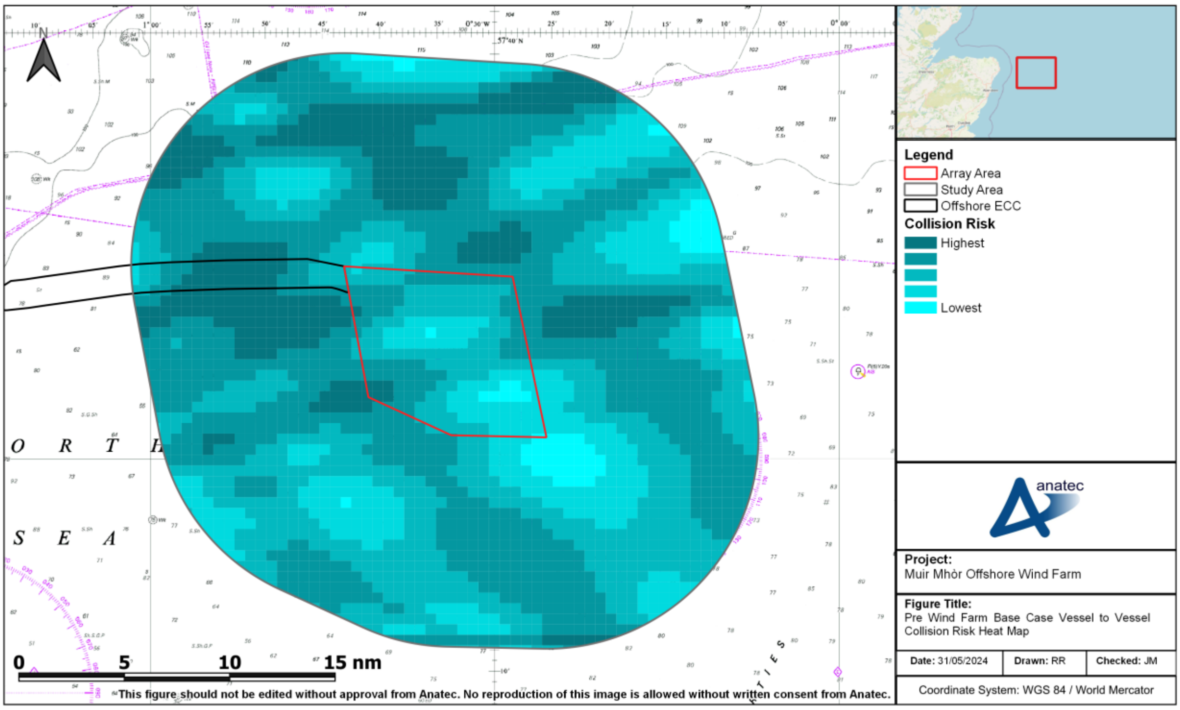


Figure 16-2 Pre Wind Farm Base Case Vessel to Vessel Collision Risk Heat Map

340. Assuming base case vessel traffic levels, the annual collision frequency pre wind farm was estimated to be 2.3210^{-4}, corresponding to a return period of approximately one in 4,310 years. This return period is below average compared with other UK OWF developments and is reflective of the low levels of large commercial routed traffic in the study area.

341. It is noted that the model is calibrated based upon major incident data at sea which allows for benchmarking but does not cover all incidents. Other incident data, which includes minor incidents, is presented in Section 9.

16.4 Post Wind Farm Modelling

16.4.1 Simulated Automatic Identification System

342. Anatec's AIS Simulator software was used to gain an insight into the potential re-routes commercial traffic following the installation of the wind farm structures

within the Array Area. The AIS Simulator uses the mean positions of identified main commercial routes within the study area and the anticipated shift post wind farm, together with the standard deviations and average number of vessels on each main commercial route to simulate tracks.

343. A plot of 28 days of simulated AIS (to match the total duration of the vessel traffic surveys) within the study area based on the deviated main commercial routes is presented in Figure 16-3.

344. It is noted that the simulated AIS represents an WCS based on a mean 1 nm (1.85 km) passing distance from the Array Area for routes.

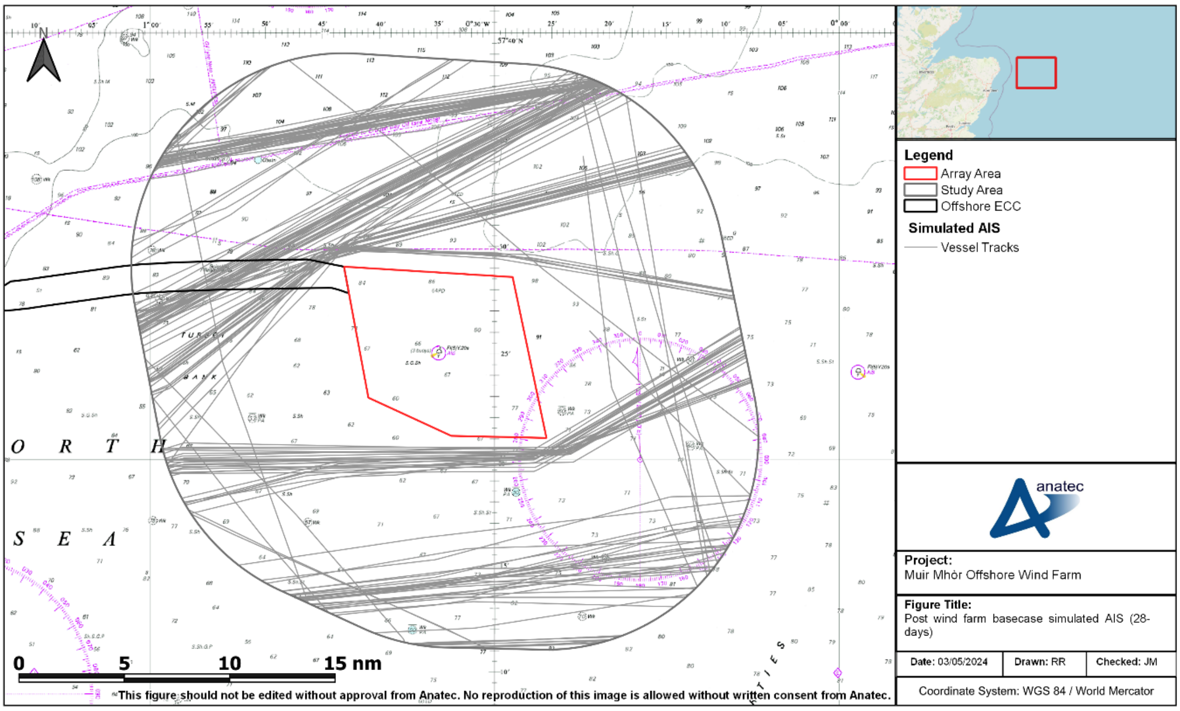


Figure 16-3 Post Wind Farm Base Case Simulated AIS (28-days)

16.4.2 Vessel to Vessel Collisions

345. Using the post wind farm routeing as input, Anatec's COLLRISK model has been run to estimate the anticipated vessel to vessel collision risk in proximity to the Proposed Development.

346. A heat map based upon the geographical distribution of collision risk within a 0.5 × 0.5 nm (0.95 × 0.95 km) grid for the base case is presented in Figure 16-4.

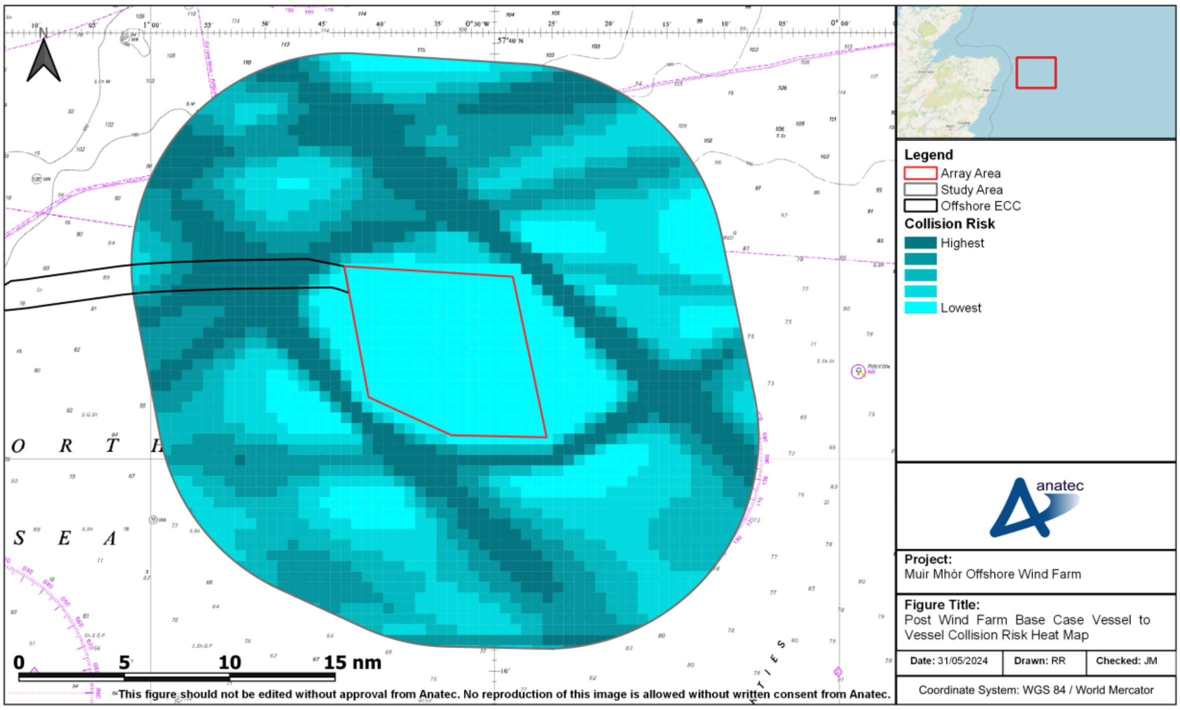


Figure 16-4 Post Wind Farm Base Case Vessel to Vessel Collision Risk Heat Map

347. Assuming base case vessel traffic levels, the annual collision frequency pre wind farm was estimated to be 2.98×10^{-4}, corresponding to a return period of approximately one in 3,359 years. This represents a 28% increase in collision frequency compared to the pre wind farm base case result. However, this frequency is still lower than average for other UK OWFs.

348. The change in vessel to vessel collision risk between the base case pre wind farm and post wind farm scenarios is presented in a heat map in Figure 16-5.

349. The greatest change in collision risk is associated with each of the corners of the Array Area where the busiest routes are deviated. As the deviations are minor (six out of seven deviations less than 0.8 nm) the change in collision risk is local to the areas through which these routes pass.

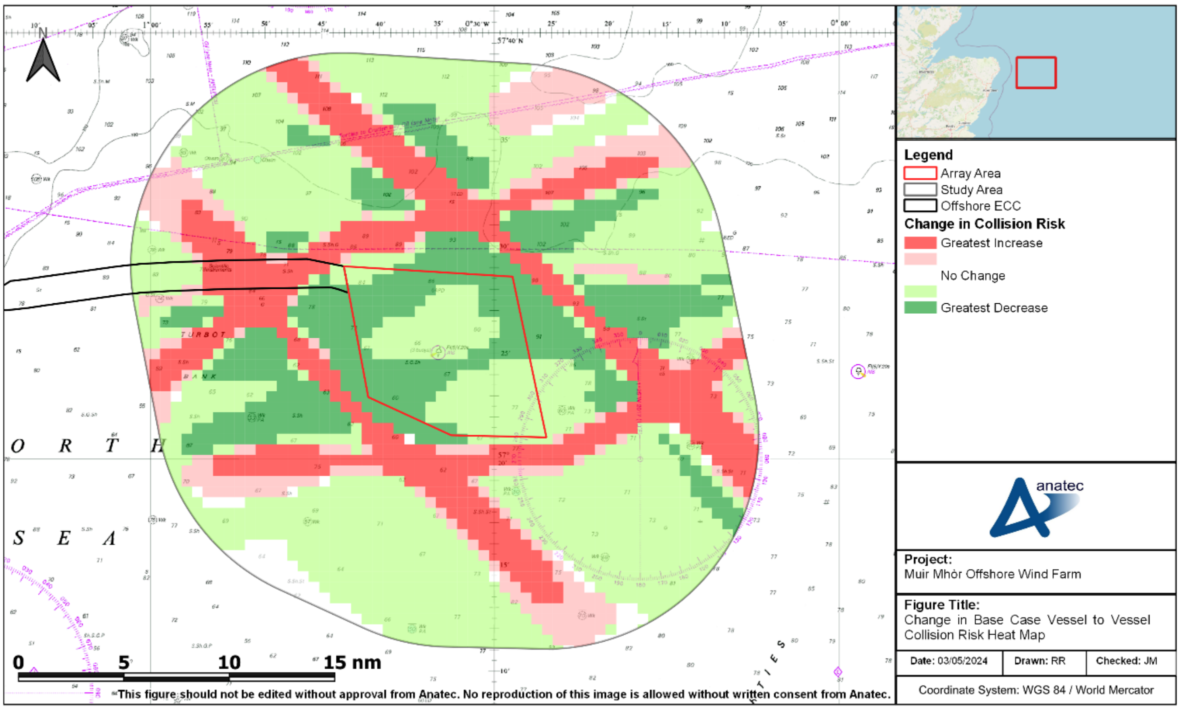


Figure 16-5 Change in Base Case Vessel to Vessel Collision Risk Heat Map

16.4.3 Powered Vessel to Structure Allision Risk

350. Based upon the vessel routeing identified in the study area, the anticipated re-routeing as a result of the presence of the Proposed Development, and assumptions that relevant commitments are in place (Section 23), the frequency of an errant vessel under power deviating from its route to the extent that it came into proximity with a wind farm structure associated with the Proposed Development is considered to be low.

351. From consultation with the shipping industry, it is also assumed that commercial vessels would be highly unlikely to navigate between wind farm structures due to the restricted sea room, and so will instead be directed by the aids to navigation located in the region and those present at the Proposed Development. During the construction and decommissioning phases this will primarily consist of the buoyed construction/ decommissioning area, whilst during the O&M phase this will primarily consist of the lighting and marking of the wind farm structures themselves.

352. Using the post wind farm routeing as input, together with the worst-case indicative array layout and local meteorological ocean data, Anatec's COLLRISK model was run to estimate the likelihood of a commercial vessel alliding with one of the wind farm structures within the Array Area whilst under power. In order to maintain an WCS, the model did not consider one structure shielding another.

353. A plot of the annual powered allision frequency per structure for the base case is presented in Figure 16-6, with the chart background removed to increase the visibility of those structures with lower allision frequencies.

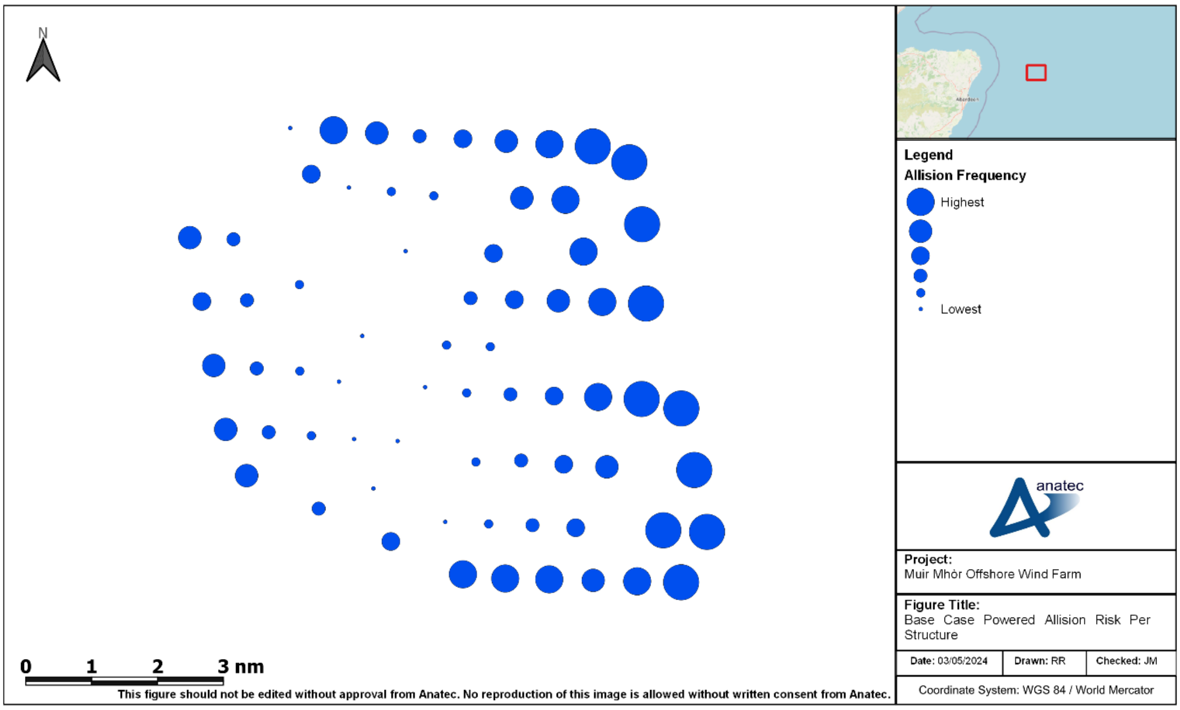


Figure 16-6 Base Case Powered Allision Risk Per Structure

354. Assuming base case vessel traffic levels, the annual powered allision frequency was estimated to be 2.29×10^{-4}, corresponding to a return period of approximately one in 4,376 years. This return period is lower than the average recorded for powered allision risk in other UK OWF developments.

355. The greatest powered vessel to structure allision risk was associated with structures at the eastern extent of the Array Area. The greatest individual powered allision risk was associated the WTG on the north-eastern corner (approximately 1.79×10^{-5} or one in 55,866 years). This is where one of the busiest main commercial routes is deviated east around this north-east corner.

16.4.4 Drifting Vessel to Structure Allision Risk

356. Using the post wind farm routeing as input, together with the worst-case indicative layout and local meteorological ocean data, Anatec's COLLRISK model was run to estimate the likelihood of a commercial vessel alliding with one of the wind farm structures within the Array Area. The model is based on the premise that propulsion on a vessel must fail before drifting will occur. The model takes account of the type and size of the vessel, the number of engines and the average time required to repair but does not consider navigational errors caused by human actions.

357. The exposure times for a drifting scenario are based upon the vessel hours spent in proximity to the Array Area (up to 10 nm from the Array Area). These have been estimated based on the vessel traffic levels, speeds, and revised routeing patterns. The exposure is divided by vessel type and size to ensure that these specific factors, which based upon analysis of historical incident data have been shown to influence incident rates, are taken into account for the modelling.

358. Using this information, the overall rate of mechanical failure in proximity to the Array Area was estimated. The probability of a vessel drifting towards a wind farm structure and the drift speed are dependent on the prevailing wind, wave, and tidal conditions at the time of the incident. Therefore, three drift scenarios were modelled, each using the meteorological ocean data provided in Section 8:

- Wind;
- Peak spring flood tide; and
- Peak spring ebb tide.

359. The probability of vessel recovery from drift is estimated based upon the speed of the drift and hence the time available before arriving at a wind farm structure. Vessels which do not recover within this time are assumed to allide. Conservatively, no account is made for another vessel (including a project vessel) rendering assistance.

360. After modelling the three drifting scenarios, it was established that the wind dominated scenario produced the worst-case results. A plot of the annual powered allision frequency per structure for the base case is presented in Figure 16-7.

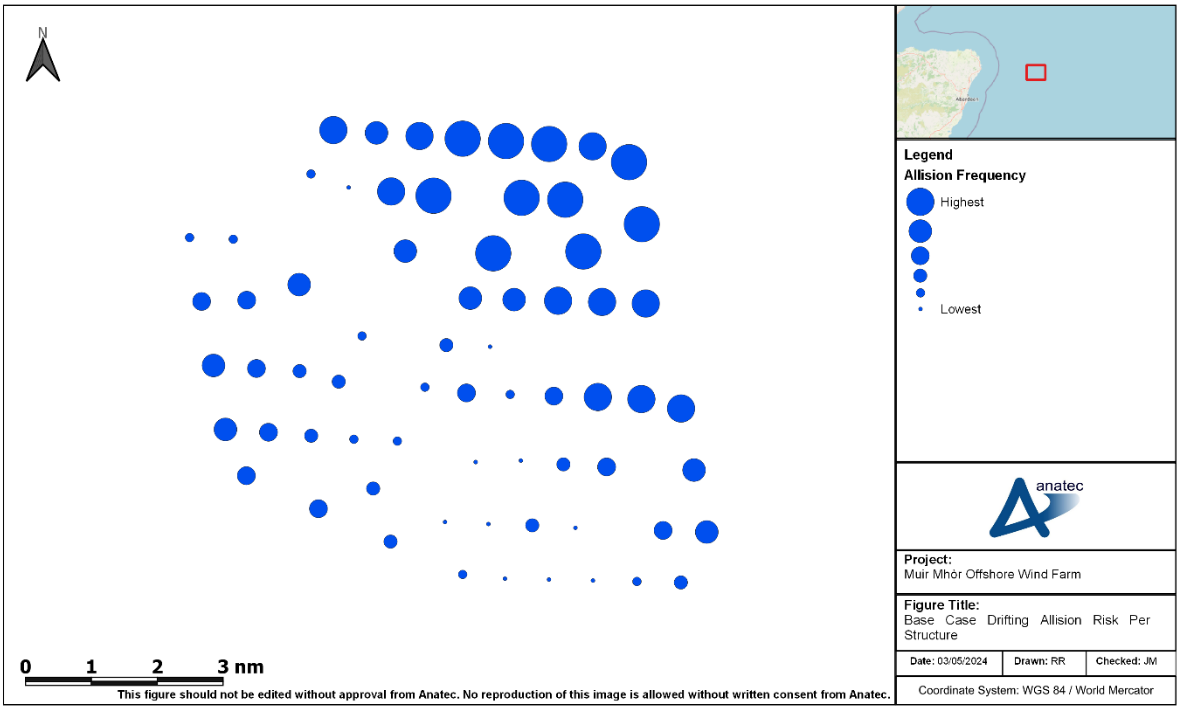


Figure 16-7 Base Case Drifting Allision Risk Per Structure

361. Assuming base case vessel traffic levels, the annual drifting allision frequency was estimated to be 2.98×10^{-5}, corresponding to a return period of approximately one in 33,517 years. This return period is lower than the average recorded for drifting allision risk in other UK OWF developments.

362. The greatest drifting vessel to structure allision risk was associated with structures at the north-eastern extent of the Array Area, the same as noted in the powered allusion risk (Section 16.4.3). The greatest individual drifting allision risk was again associated with the WTG on the north-east corner (approximately 3.55×10^{-5} or one in 28,140 years).

363. It is noted that historically there have been no reported drifting allision incidents with wind farm structures in the UK. Whilst drifting vessels do occur every year in UK waters, in most cases the vessel has been recovered prior to any allision incident occurring (such as by anchoring, restarting engines, or being taken in tow).

16.4.5 Fishing Vessel to Structure Allision Risk

364. Using the vessel traffic survey data as input, Anatec's COLLRISK model was run to estimate the likelihood of a fishing vessel alliding with one of the wind farm structures within the Array Area.

365. A fishing vessel allision is classified separately from other allisions since, unlike in the case of the commercial traffic characterised using the main commercial routes, fishing vessels may be either in transit or actively fishing within the study area.

Moreover, fishing vessels could be observed internally within the Array Area in addition to externally. Anatec's COLLRISK model uses vessel numbers, sizes (length and beam), array layout and structure dimensions. The likelihood of a major allision incident has been calibrated against historical maritime incident data and historical AIS vessel traffic data within operational OWF arrays.

366. The model conservatively assumes no change in baseline fishing activity i.e., no account is made of vessels passing over or in close proximity to structure locations choosing to increase passing distance post wind farm. This is considered an extremely conservative assumption.

367. A plot of the annual fishing vessel allision frequency per structure for the base case is presented in Figure 16-8.

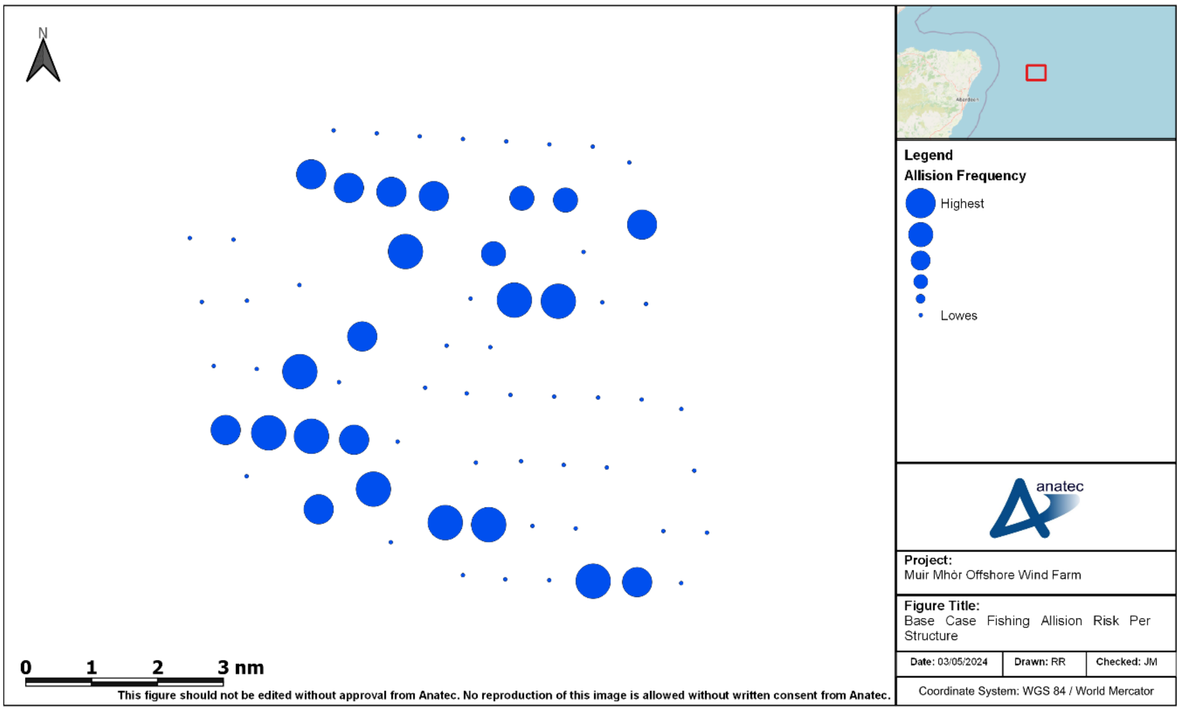


Figure 16-8 Base Case Fishing Allision Risk Per Structure

368. Assuming base case vessel traffic levels, the annual fishing vessel to structure allision frequency was estimated to be 2.93×10^{-2}, corresponding to a return period of approximately one in 34 years.

369. The greatest fishing vessel to structure allision risk was associated with various internal WTGs where active fishing transits were observed during the survey periods. The greatest individual allision risk was associated with a WTG internally within the south-west portion of the indicative array layout (approximately 3.45×10^{-3} or one in 290 years).

16.5 Risk Results Summary

370. The previous sections modelled two scenarios, namely the pre and post wind farm scenarios with base case traffic levels. In order to incorporate the potential for future traffic growth pre and post wind farm scenarios each with future case traffic levels have also been modelled (10% and 20% increases). Table 16-1 summarises the results of all six scenarios.

Table 16-1 Risk Results Summary

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base case	2.32×10^{-4} (1 in 4,318 years)	2.98×10^{-4} (1 in 3,359 years)	6.57×10^{-5} (1 in 15,222 years)
	Future case (10%)	2.79×10^{-4} (1 in 3,581 years)	3.59×10^{-4} (1 in 2,788 years)	7.94×10^{-5} (1 in 12,600 years)
	Future case (20%)	3.27×10^{-4} (1 in 3,054 years)	4.20×10^{-4} (1 in 2,379 years)	9.28×10^{-5} (1 in 10,777 years)
Powered vessel to structure allision	Base case	N/A	2.29×10^{-4} (1 in 4,376 years)	2.29×10^{-4} (1 in 4,376 years)
	Future case (10%)	N/A	2.51×10^{-4} (1 in 3,990 years)	2.51×10^{-4} (1 in 3,990 years)
	Future case (20%)	N/A	2.66×10^{-4} (1 in 3,755 years)	2.66×10^{-4} (1 in 3,755 years)
Drifting vessel to structure allision	Base case	N/A	2.98×10^{-5} (1 in 33,517 years)	2.98×10^{-5} (1 in 33,517 years)
	Future case (10%)	N/A	3.29×10^{-5} (1 in 30,356 years)	3.29×10^{-5} (1 in 30,356 years)
	Future case (20%)	N/A	3.56×10^{-5} (1 in 28,107 years)	3.56×10^{-5} (1 in 28,107 years)
Fishing vessel to structure allision	Base case	N/A	2.87×10^{-2} (1 in 34 years)	2.87×10^{-2} (1 in 34 years)
	Future case (10%)	N/A	3.16×10^{-2} (1 in 31 years)	3.16×10^{-2} (1 in 31 years)
	Future case (20%)	N/A	3.44×10^{-2} (1 in 28 years)	3.44×10^{-2} (1 in 28 years)
Total	**Base case**	**2.32×10^{-4} (1 in 4,318 years)**	**2.93×10^{-2} (1 in 34 years)**	**2.90×10^{-2} (1 in 34 years)**
	Future case (10%)	**2.79×10^{-4} (1 in 3,581 years)**	**3.22×10^{-2} (1 in 31 years)**	**3.19×10^{-2} (1 in 31 years)**
	Future case (20%)	**3.27×10^{-4} (1 in 3,054 years)**	**3.52×10^{-2} (1 in 28 years)**	**3.48×10^{-2} (1 in 29 years)**

16.6 Mooring Lines and Dynamic Inter-Array Cables

371. This section considers the mooring lines and inter-array cables associated with the floating infrastructure relative to baseline traffic volumes and draughts to determine potential risk associated with under keel interaction. The outputs have been fed into the qualitative risk assessment of under keel interaction undertaken in Section 19.7.

372. Based on operational experience of existing OWFs and consultation undertaken for the Proposed Development, it is likely that commercial vessels will deviate to avoid the Array Area. On this basis, considering the vessel types recorded within the Array Area (Section 10.1.2), the key vessel type that must be considered is fishing. It is noted that recreational vessels were not recorded regularly within the Array Area in the vessel traffic survey data and RYA Scotland confirmed that vessel transits as far offshore as the Array Area are less unlikely with any mariners doing so highly experienced. It was noted that on a rare occurrence, a recreational vessel may enter the Array Area to avoid larger commercial vessels or in adverse weather. This would be an exceptionally rare case and given the number of recreational vessels offshore in proximity to the Array Area, they are not a key focus.

373. The focus of this assessment on fishing vessels is considered appropriate on the basis that they will also typically have larger draughts than recreational vessels and based on the available information and consultation are more prevalent than other vessel types in the area. The SWFPA also confirmed that large pelagic fishing vessels will transit through the Array Area.

16.6.1 Vessel Draught

374. The distribution of fishing vessel draughts recorded within the Array Area during the 28 days of vessel traffic survey data, recorded on AIS only, are presented in Figure 16-9. Of all fishing vessels recorded on AIS, 32% did not broadcast a valid draught and so are not incorporated into distribution. However, these vessels not broadcasting a valid draught are likely smaller vessels with shallower draughts and so the analysis is considered to be conservative.

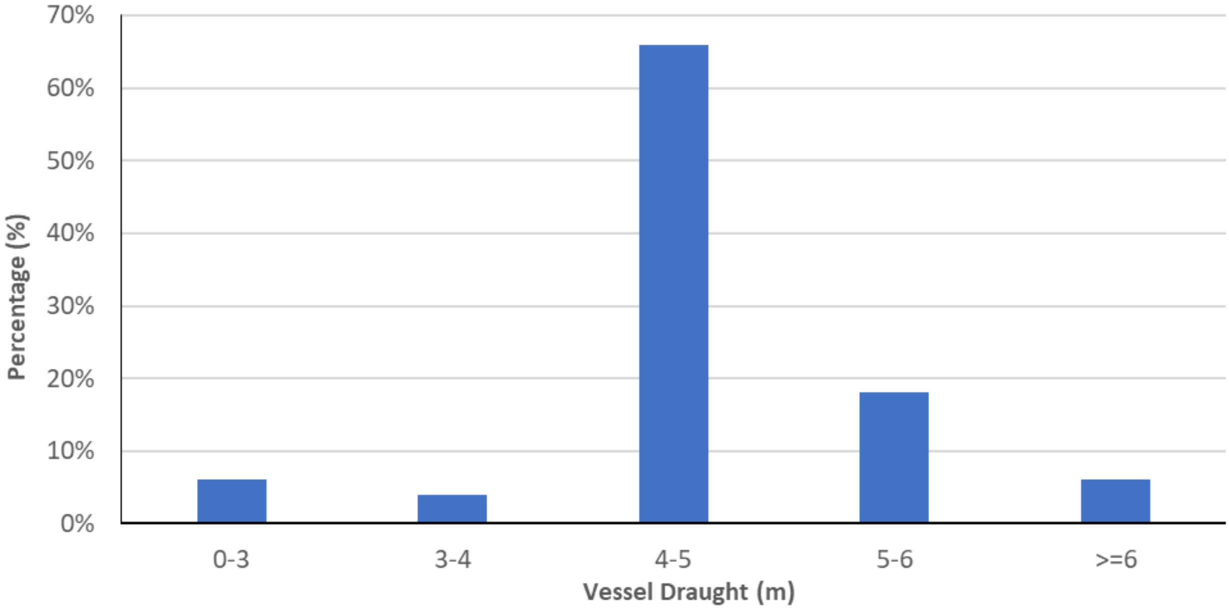


Figure 16-9 28-Day AIS Fishing Vessel Draught Distribution (Winter and Summer, 2023)

375. The maximum draught recorded was 7.2 m, with the average being approximately 4.4 m. As shown, the significant majority of fishing vessels within the Study Area had draughts of between 4 and 5 m (66%).

16.6.2 Mooring Line Interaction

376. Based on the substructure types and mooring line arrangements under consideration as illustrated in Figure 6-3 (Section 6), the use of barge floaters and taut mooring lines is considered a worst-case for under keel interaction. If barge substructures are used, the mooring lines will connect at deck level, estimated at 25 m above the waterline before breaking surface water at approximately 419 m from the barge substructure.

377. On this basis, the approximate descent of the mooring lines in the vicinity of the barge floater is shown in Figure 16-10. The average and maximum fishing vessel draughts recorded in the Array Area are shown for reference (Section 16.6.1) as well as commercial vessels for comparison. It is noted that the values detailed above have been assumed for the purposes of this interaction assessment and that it will be necessary to assess final under keel clearance available post installation.

378. The assessment has been undertaken up to 1,457 m from the floater, noting that this is the maximum distance of the mooring line terminus from the edge of the barge floater, providing an overall distance of 1,500 m from the floater centre.

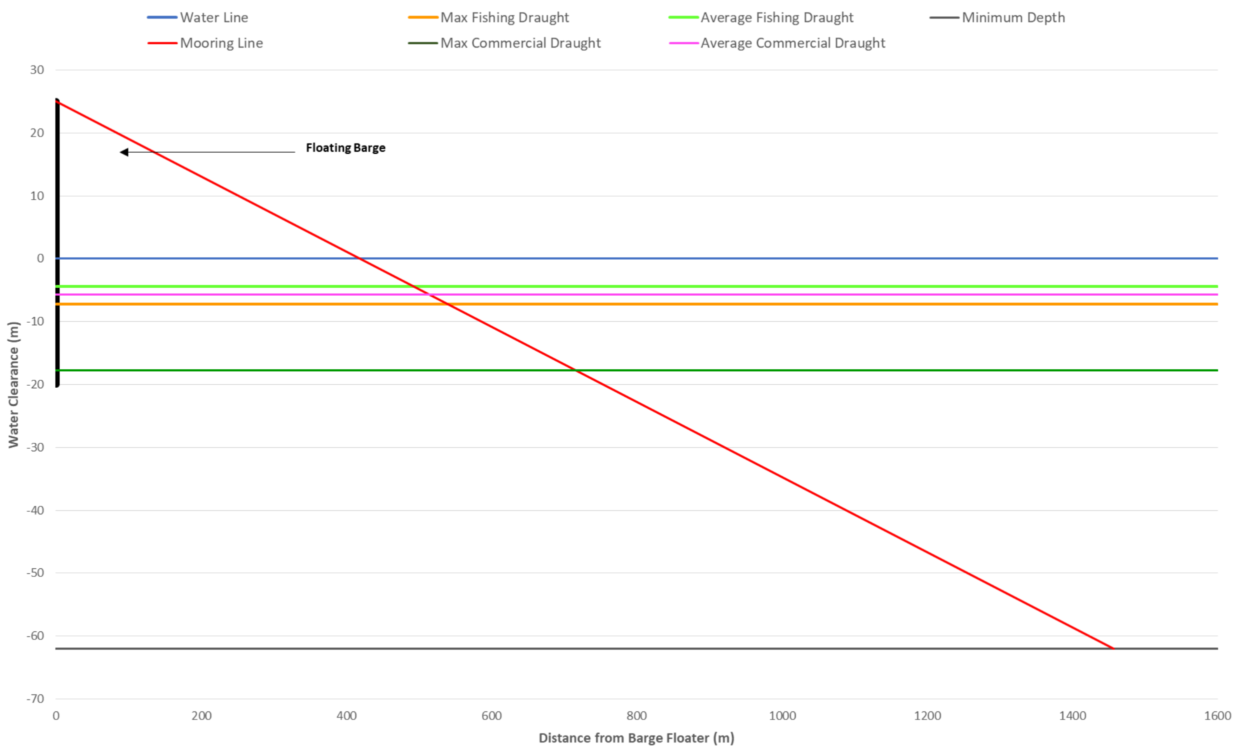


Figure 16-10 Mooring Line Relative to Maximum Vessel Draught

379. As shown, a fishing vessel with the maximum draught recorded (7.2 m) should avoid an under keel interaction beyond approximately 539 m from a barge floater. A fishing vessel of average draught (4.4 m) would achieve this beyond 492 m from a barge floater.

380. For completeness, a commercial vessel with the largest draught recorded (17.7 m) should avoid an under keel interaction beyond approximately 715 m from a barge floater. A commercial vessel of average draught (5.7 m) would achieve this beyond 514 m from a barge floater. However, it is again acknowledged that commercial vessels are not expected to navigate internally within the Array Area.

381. Although these distances are substantial (and extend beyond the maximum rotor diameter of the WTGs), the mooring line does not break the surface of the water until approximately 419 m from the edge of the barge floater, i.e., there is a visual aid for the majority of the area within which a fishing vessel would be subject to an under keel interaction risk.

16.6.3 Inter-Array Cables

382. Unlike, mooring lines, there is no worst-case substructure type which would increase any risk for inter-array cables (since the horizontal distance of the inter-array cables is measured from the edge of the floater rather than the centre point). As a worst-case, a hog bend may be incorporated into the implementation of the inter-array

cables. If so the minimum depth of the inter-array cable below the sea surface will be 3.1 m located at a maximum distance of 70 m from the floater. From this point, a taut mooring line is assumed as a worst-case.

383. The approximate descents of the inter-array cables from the hog bend is shown in Figure 16-11. The average and maximum fishing vessel draughts recorded in the Array Area are shown for reference (Section 16.6.1) with commercial vessels again as comparison. It is again noted that the values detailed above have been assumed for the purposes of this interaction assessment and that it will be necessary to assess final under keel clearance available post installation.

384. This assessment has been undertaken from the 70 m distance from the edge of the floating substructure due to the potential of a hog bend occurring within the inter-array cables. As this is the minimum depth, the risk has been calculated from this point.

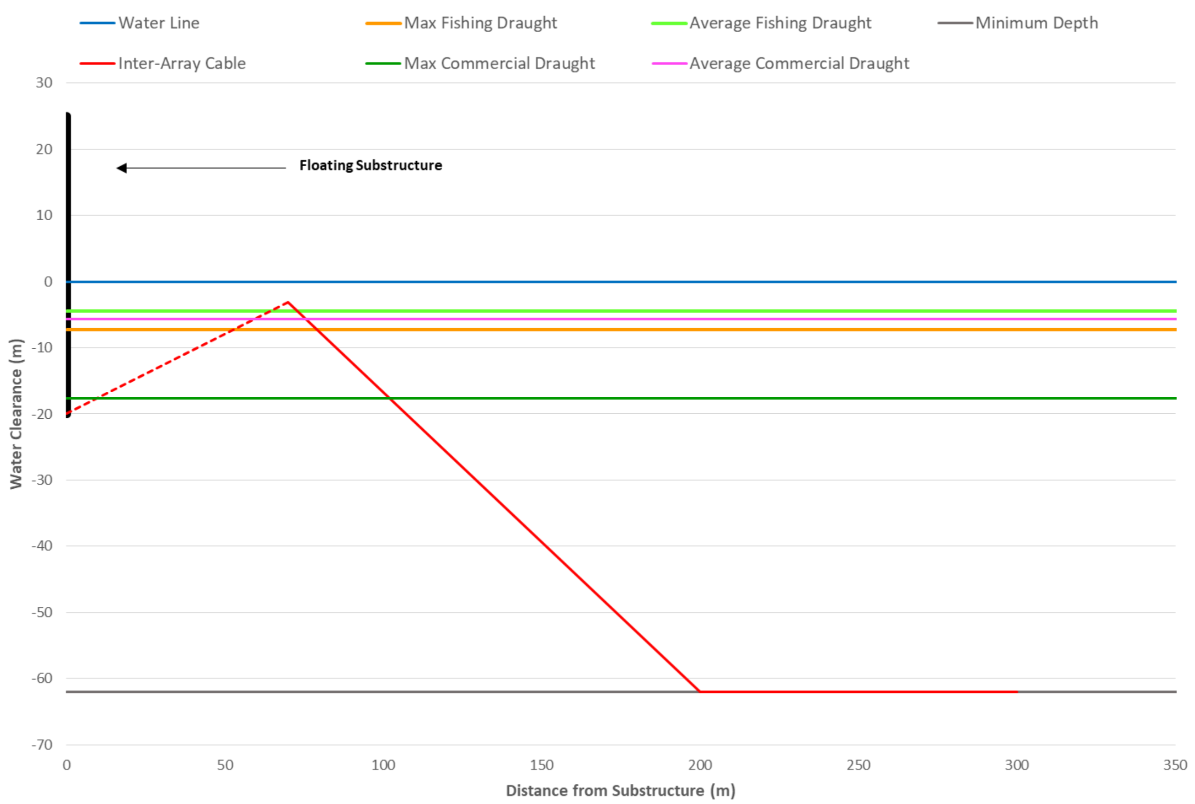


Figure 16-11 Inter-Array Cable Relative to Maximum Vessel Draught

385. As shown, a fishing vessel with the maximum draught recorded (7.2 m) should avoid an under keel interaction with an inter-array cable beyond approximately 9 m from the hog bend (79 m from the edge of the floating substructure). A fishing vessel of average draught (4.4 m) would achieve this beyond 3 m from the hog bend (73 m from the edge of the floating substructure).

386. For completeness, a commercial vessel with the largest draught recorded (17.7 m) should avoid an under keel interaction beyond approximately 32 m from the hog bend (102 m from the edge of the floating substructure). A commercial vessel of average draught (5.7 m) would achieve this beyond 6 m from the hog bend (76 m from the edge of the floating substructure).

387. These distances are less substantial than that associated with the mooring lines. The distances are well within the range of a 500 m safety zone (noting this would only be deployed during major maintenance activities) and the maximum rotor diameter of the WTGs.

16.6.4 Approach to Risk Assessment

388. The potential for interaction with the mooring lines and inter-array cables has been assessed within the O&M phase risk assessment in Section 19, noting the risk is managed via construction and decommissioning mitigations during those phases. The potential that the mooring system will fail leading to a loss of station incident is assessed in through all phases of the Proposed Development in Sections 18 to 20.

389. As part of this, consideration has been given in the risk assessment to an ORE Catapult report which investigated potential hazards relating to the use of floating technology including not only mooring lines and dynamic inter-array cables but also wet storage management and towage operations (ORE Catapult, 2023).

17 Introduction to Risk Assessment

390. Sections 18 to 20 provides a qualitative and quantitative risk assessment (using FSA) for the hazards identified due to the Proposed Development in isolation, based on baseline data, expert opinion, outputs of the Hazard Workshop, stakeholder concerns and lessons learnt from existing offshore developments. The hazards assessed are as follows:

- Vessel displacement;
- Increased third-party vessel collision risk;
- Third-party with project vessel collision risk;
- Reduced access to local ports and harbours;
- Loss of station;
- Creation of vessel to structure allision risk;
- Reduction of under keel clearance as a result of cable protection, dynamic cables, and mooring lines;
- Anchor interaction with mooring lines or subsea cables; and
- Reduction of emergency response capability including SAR.

391. The Shipping and Navigation users considered are as follows:

- Commercial vessels;
- Recreational vessels;
- Commercial fishing vessels in transit;
- Emergency responders; and
- Local ports and services including pilot vessels.

392. For each hazard, embedded mitigation measures (commitments) which have been identified as relevant to reducing risk are listed, with full descriptions provided in Section 23. This is followed by statements defining the frequency of occurrence, severity of consequence, and subsequent significance of risk based on the methodology defined in Section 3.

393. The cumulative risk assessment is detailed in Section 21 and provides a qualitative and quantitative risk assessment (using FSA) for the hazards identified due to the Proposed Development cumulatively with those other developments identified from the cumulative screening (Section 13). The same inputs outlined for the in isolation risk assessment are applicable.

394. The hazards assessed are as per the in isolation risk assessment noted above, with the exception of loss of station and anchor interaction with mooring lines or subsea cables. These hazards have been scoped out of the cumulative risk assessment due to the local nature of the hazard which results in a limited pathway by which the hazard could become cumulative in nature.

395. The risk control log (Section 22) summarises the risk assessment and a concluding risk statement is provided (Section 25.4).

18 Construction Phase Risk Assessment

18.1 Vessel Displacement

396. *Construction activities associated with the installation of structures and cables may displace existing routes/activity.*

18.1.1 Qualification of Risk

397. The volume of vessel traffic passing within or in proximity to the Array Area has been established using vessel traffic data collected during dedicated surveys (28 days over winter and summer 2023) and from coastal receivers (12 months, 2022) as well as Anatec's ShipRoutes database. These datasets were interrogated to identify main routes using the principles set out in MGN 654 (MCA, 2021) (Section 11).

398. Although there will be no restrictions on entry into the buoyed construction area, other than through active safety zones, based on experience at previously under construction OWFs and consultation, it is anticipated that the majority of commercial vessels will choose not to navigate internally within the buoyed construction area and therefore some main route deviations will be required.

399. The full methodology for main route deviations is provided in Section 14.5.1, with deviations established in line with MGN 654 (MCA, 2021). A deviation will be required for seven of the 18 main commercial routes identified.

400. The largest deviation is anticipated to be 1.5 nm (2.78 km), associated with Route 4 (east west routeing of oil and gas vessels between Aberdeen and oil and gas fields including Forties, Nelson, and Everest). This increase equates to a 1.5% increase in route length for the portion of the route deviating south around the Array Area. Only one of the other deviated routes features a distance increase equal to or greater than 0.5%; Route 9 at 1.0% with an anticipated deviated of 0.8 nm (1.48 km) (east west routeing of oil and gas vessels between Peterhead and Kittiwake field). Of the other four deviated routes, increases are extremely minimal. For all deviated routes the volumes of traffic are relatively low, with the busiest being Route 4 with an average of five vessels per week. With future case traffic levels these volumes would remain relatively low.

401. Tidewater Marine Ltd noted during the Regular Operator outreach that vessel deviation due to the Proposed Development will not impact their vessels greatly as their oil and gas vessels are constantly adjusting passage plans to meet new requirements and are used to adapting to new offshore installations.

402. Vessel displacement was not raised as a key concern during the Hazard Workshop. It is also recognised that there was only one regular route involving commercial ferries in the area (Route 5) which would be particularly sensitive to any disruption to schedules. This route would be anticipated to deviate 0.6 nm (1.11 km) north-east at an increase of 0.21% total route distance. No concerns were noted relating to the

need to deviate as it was understood the deviation would be slight and given the route volume there would be minimal affects.

403. Given the location of the offshore ECC, it is considered likely that cable installation will lead to displacement with many commercial vessels routeing north south crossing the offshore ECC, however, no concerns were raised over displacement due to cable installation in regard to commercial vessels. Installation activities will be short-term and temporary in nature and cover only a small extent. Therefore, deviations will be manageable, particularly with the promulgation of information allowing mariners to passage plan accordingly.

404. Based on experience at previously under construction OWFs, it is anticipated that fishing vessels and recreational vessels will also choose not to routinely navigate internally within the buoyed construction area. There is limited transit activity featuring fishing vessels in proximity to the Array Area with vessels already transiting south-west of the Array Area (noting that displacement of active commercial fishing activity is assessed separately in **Volume 2, Chapter 13 (Commercial Fisheries)**).

405. For recreational vessels there is even less activity in proximity to the Array Area with vessels only present in very small volumes during the summer periods on a variety of bearings. It was raised by the RYA Scotland that any displacement of recreational vessels should also consider the increase of tiredness due to increased voyages. However, displacement will be limited and there is sufficient sea room around the Array Area to accommodate any affected recreational vessels and any recreational vessels transiting this far offshore would be expected to undertake due diligence of their intended route (i.e., adequate passage planning) as noted by the NLB during the Hazard Workshop.

406. For installation activities associated with the offshore ECC, fishing vessels in transit to Peterhead Port may be affected if approaching from the north where the cable activities would be occurring. This is of importance as Peterhead Port is the largest fishing port in Europe and it is vital that vessels are able to maintain landing schedules. Vessels departing Peterhead Port were either on transit to fishing grounds or back to home ports such as Fraserburgh as noted by the SWFPA during the Hazard Workshop. There was seasonal static fishing recorded in the offshore ECC which was raised during the Hazard Workshop by the SWFPA noting any displacement would also result in the displacement of gear and this will be assessed separately in **Volume 2, Chapter 13 (Commercial Fisheries)**, but may cause further displacement to other vessel types when gear has to be moved to an alternative location.

407. For recreational vessels, there are frequent crossings of the offshore ECC in the summer, and therefore some potential for displacement around installation activities. However, there is sufficient sea room available for this (east and west) and so disruption will be limited as agreed by the RYA Scotland at the Hazard Workshop who confirmed cable installation will not pose any problems for recreational vessels

as COLREGs will apply and recreational vessels will work around ongoing project works.

18.1.2 Consequences

408. The main consequence of vessel displacement associated with the Array Area and offshore ECC will be increased journey times and or distance but does not impact on schedules or compliance with COLREGs. The extent of these consequences is expected to be limited, noting that the promulgation of information relating to the Proposed Development and marking on relevant nautical charts will allow suitable passage planning and the presence of the buoyed construction area and guard vessels will assist with guiding vessels around the Array Area. No notable effects on navigational safety are anticipated.

409. As a worst-case, there could be increased journey times and/or distances which impacts on schedules or an inability to comply with COLREGs could occur.

18.1.3 Embedded Mitigation Measures

410. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development and adherence to a VMNSP (C-16);
- Application for safety zones (C-17);
- Marking on Admiralty charts (C-25);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19);
- Compliance with MGN 654 (C-21); and
- Lighting and marking (C-24, C-32, C-42).

18.1.4 Significance of Risk

411. The frequency of occurrence in relation to displacement of vessel traffic for the Array Area during the construction phase is considered **frequent**. The severity of consequence in relation to displacement of vessel traffic is considered **minor**. Overall, it is predicted that the significance of risk due to vessel displacement is **tolerable with mitigation**.

412. The frequency of occurrence in relation to displacement of vessel traffic for the offshore ECC during the construction phase is considered **reasonably probable**. The severity of consequence in relation to displacement of vessel traffic is considered **negligible**. Overall, it is predicted that the significance of risk due to vessel displacement is **broadly acceptable**.

18.2 Increased Third-Party Vessel Collision Risk

413. *Construction activities associated with the installation of structures and cables may increase encounters and collision risk with other third-party vessels.*

18.2.1 Qualification of Risk

414. It is anticipated that seven of the main 18 commercial routes identified will deviate as a result of the construction of the Proposed Development. This may lead to increased vessel densities in the surrounding areas, which in turn could lead to an increase in vessel to vessel encounters and therefore an increased risk of collision. The risk of collision was not raised as a key topic during consultation including at the Hazard Workshop.

415. Based on the pre OWF modelling, the baseline encounter levels and collision risk levels within the study area are low, with an estimated vessel to vessel collision frequency of one every 4,310 years. The low level of collision risk is due to the volume of traffic in the area relative to the available sea space.

416. The collision frequency was estimated at one in 3,359 years, representing a 28% increase on the pre OWF scenario which is a low change than estimated for various other offshore wind developments. Although this is a moderate increase, the likelihood of a collision incident remains low, and this is also reflected when considering future case traffic levels.

417. There is a potential for hotspots to occur where traffic routeing east west from ports on the east coast to offshore locations crosses over traffic routeing north-west south-east between northern ports and mainland Europe. This would be a greater risk at each of the four main corner locations of the Array Area, particularly on the western boundary where the greater volume routes intersect. However, these routes are still relatively low in volume and so level of risk is low and there is also ample sea room available around the Array Area.

418. For the offshore ECC, any displacement of commercial vessels due to installation activities is not anticipated to affect available sea room such that the risk of a collision between third-party vessels is materially increased.

419. For fishing vessels and recreational vessels, there remains sufficient open sea room around the Array Area and offshore ECC installation activities to ensure that collision risk (including with a commercial vessel) is minimal. Additionally, the promulgation of information relating to construction activities, deployment of the buoyed construction area, and charting of infrastructure will allow vessel Masters (across all vessel types) to passage plan in advance, minimising any displacement and subsequent collision risk. Additionally, information for fishing vessels will be promulgated through ongoing liaison with fishing fleets, and fisheries associations via an appointed Fisheries Liaison Officer (FLO) and Fishing Industry Representative.

18.2.2 Consequences

420. The main consequence of increased third-party collision risk associated with the Array Area and offshore ECC will be increased encounters. In the event that a third-party to third-party vessel encounter does occur, it is likely to be localised and occur

for only a short duration, with collision avoidance action implemented by the vessels involved, in line with COLREGs, thus ensuring that the situation does not develop into a collision incident. This is supported by experience at previously under construction OWFs where no collision incidents involving two third-party vessels have been reported. Mitigation measures will also minimise the likelihood of encounters including promulgation of information relating to the Proposed Development, marking on relevant nautical charts to allow suitable passage planning and the presence of the buoyed construction area and guard vessels which will assist with guiding vessels around the Array Area.

421. Historical collision incident data (Section 9.5) also indicates that the most likely consequences will be low should a collision occur, with minor contact between the vessels resulting in minor damage and no injuries to persons, with both vessels able to resume their respective passages and undertake a full inspection at the next port.

422. As an unlikely worst-case scenario, a high impact collision event could occur. This could lead to one or more of the vessels foundering resulting in a Potential Loss of Life (PLL) and pollution. In such circumstances, project vessels may attend the incident under International Convention for the Safety of Life at Sea (SOLAS) obligations and in liaison with the MCA, the Environmental Management Plan (EMP) (**Volume 4, Appendix 2 (Outline Environmental Management Plan)**) would be implemented.

18.2.3 Embedded Mitigation Measures

423. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to an EMP (C-08);
- Development of and adherence to an VMNSP (C-16);
- Application for safety zones (C-17);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19);
- Compliance with MGN 654 (C-21);
- Lighting and marking (C-24, C-36, C-42); and
- Marking on Admiralty charts (C-25).

18.2.4 Significance of Risk

424. The frequency of occurrence in relation to increased third-party vessel collision risk for the Array Area during the construction phase is considered **remote**. The severity of consequence in relation to increased third-party collision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to increased third-party collision risk is **tolerable with mitigation**.

425. The frequency of occurrence in relation to increased third-party vessel collision risk for the offshore ECC during the construction phase is considered **extremely unlikely**.

The severity of consequence in relation to increased third-party collision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to increased third-party collision risk is **broadly acceptable**.

18.3 Third-Party with Proposed Development Vessel Collision Risk

426. *Proposed Development vessels associated with construction activities may increase encounters and collision risk for other vessels already operating in the area.*

18.3.1 Qualification of Risk

427. Up to 49 project vessels may be on site simultaneously during the construction phase making up to 1,543 return trips. This will include Restricted in Ability to Manoeuvre (RAM) vessels. It is assumed that construction vessels will be on-site throughout the duration of the construction phase.

428. Based on historical incident data, there has been one instance of a third-party vessel colliding with a project vessel in the UK (Section 9.5). During this incident, which occurred in 2011, moderate vessel damage was reported with no harm to persons. Since then, awareness of offshore wind developments and the application of the mitigation measures outlined below has improved or been refined considerably in the interim, with no further collision incidents reported since.

429. Proposed Development vessels will be managed by marine coordination through a VMNSP, **Volume 4, Appendix 5 (Outline Vessel Management and Navigation Safety Plan)**. This will be particularly important for project vessels transiting to and from the Array Area, noting that the base port(s) for construction are not yet known. It is also noted that project vessels will carry AIS and comply with Flag State regulations including the COLREGs and SOLAS.

430. Where project vessels are undertaking construction activities associated with surface structures, safety zones are anticipated. An application for safety zones of 500 m will be sought during the construction phase around structures where construction activity is ongoing (e.g., where a construction vessel is present). These will serve to protect project vessels engaged in construction activities. Minimum advisory passing distances, as defined by risk assessment, may also be applied where safety zones do not apply (e.g., around cable installation vessels).

431. 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 require all vessels operating in reduced visibility to reduce speed to allow more time for reacting to encounters, thus minimising the collision risk.

432. The promulgation of information will ensure mariner awareness of construction activities is maximised, including charting of infrastructure, ongoing liaison with fisheries via an appointed FLO and Fishing Industry Representative, and advanced

warning of safety zones and any minimum advisory safe passing distances, with the latter particularly relevant for offshore ECC installation activities since safety zones are not permitted. Additionally, a buoyed construction area will be deployed around the Array Area in consultation with NLB. This will further maximise mariner awareness when in proximity to ongoing construction works in the Array Area, both in day and night conditions including in poor visibility.

18.3.2 Consequences

433. The main consequences of third-party with project vessel collision risk associated with the Array Area and offshore ECC are expected to be similar to that outlined for the case of collision risk between two third-party vessels (Section 18.2.2). If an encounter occurs between a third-party vessel and a project vessel, it is likely to be 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.

434. As a worst-case, increased encounters and impacts on compliance with COLREGs, resulting in a collision event with the potential of foundering, vessel damage, PLL, and/or pollution could occur. In such circumstances, other project vessels may attend the incident under SOLAS obligations and in liaison with the MCA and the EMP would be implemented (**Volume 4, Appendix 2 (Outline Environmental Management Plan)**).

18.3.3 Embedded Mitigation Measures

435. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to an EMP (C-08);
- Development of and adherence to a VMNSP (C-10, C-16);
- Application for safety zones (C-17);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19); and
- Project vessel compliance with international marine regulations (C-22).

18.3.4 Significance of Risk

436. The frequency of occurrence in relation to third-party with project vessel collision risk for the Array Area during the construction phase is considered **extremely unlikely**. The severity of consequence in relation to third-party with project vessel collision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to third-party with project vessel collision risk is **broadly acceptable**.

437. The frequency of occurrence in relation to third-party with project vessel collision risk for the offshore ECC during the construction phase is considered **remote**. The severity of consequence in relation to third-party with project vessel collision risk is

considered **moderate**. Overall, it is predicted that the significance of risk due to third-party with project vessel collision risk is **tolerable with mitigation**.

18.4 Reduced Access to Local Ports, Harbours, and Marinas

438. *Construction activities associated with the installation of structures and cables may reduce access to local ports and harbours.*

18.4.1 Qualification of Risk

439. Up to 49 construction vessels may be utilised across the construction phase and will include vessels which are RAM. Project vessels will be managed by marine coordination through a VMNSP, **Volume 4, Appendix 5 (Outline Vessel Management and Navigation Safety Plan)**.

440. The closest port or harbour to the Proposed Development is Peterhead Port, located approximately 34 nm (62.9 km) to the west of the Array Area. Given the relative distance to ports in the area and the anticipated deviations for the main commercial routes, it is not anticipated that there will be any substantial effect due to Array Area construction activities on vessel approaches to and from any local ports beyond the deviations already outlined for impacts on vessel displacement (Section 18.1), especially since the ports associated with the construction of the Proposed Development are also not yet known.

441. For offshore ECC construction activities, there is a greater risk given the proximity to the entrance to Peterhead Port, which is located approximately 1 nm (1.85 km) south of the offshore ECC. Where cable installation is ongoing vessel displacement is possible; this is particularly of importance to fishing vessels which as highlighted in the vessel displacement hazard (Section 18.1), are likely entering Peterhead Port to land and rely on berth availability and landing schedules. Installation activities for the offshore ECC will be short-term and temporary in nature and cover only a small extent at any given time.

442. RYA Scotland also noted during consultation that Peterhead Marina is a key stopping point for recreational vessels transiting the coast. A key element of the coordination will be in relation to pilotage activities, but it is noted that the pilot boarding station for Peterhead Port is located well clear of the offshore ECC and during the vessel traffic surveys, and long-term vessel traffic data, no pilot vessels intersected the offshore ECC. Additionally, the Peterhead Port Authority raised no concerns in the Hazard Workshop. Nevertheless, information will be promulgated prior to any construction activities to allow mariners to passage plan accordingly.

18.4.2 Consequences

443. The main consequence will be minor disruption to port access and related services via increased journey time and/or distance but with no impact on schedules, berth times, or compliance with COLREGs.

444. As an unlikely worst-case, increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs could occur, relating to navigable water depths, tidal windows and pilotage services.

18.4.3 Embedded Mitigation Measures

445. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to an EMP (C-08);
- Development of and adherence to a VMNSP (C-10);
- Promulgation of information (C-19); and
- Project vessel compliance with international marine regulations (C-22).

18.4.4 Significance of Risk

446. The frequency of occurrence in relation to reduced access to local ports, harbours, and marinas for the Array Area during the construction phase is considered **remote**. The severity of consequence in relation to reduced access to local ports, harbours, and marinas is considered **minor**. Overall, it is predicted that the significance of risk due to reduced access to local ports, harbours, and marinas is **broadly acceptable**.

447. The frequency of occurrence in relation to reduced access to local ports, harbours, and marinas for the offshore ECC during the construction phase is considered **frequent**. The severity of consequence in relation to reduced access to local ports, harbours, and marinas is considered **minor**. Overall, it is predicted that the significance of risk due to reduced access to local ports, harbours, and marinas is **tolerable with mitigation**.

18.5 Loss of Station

448. *In the event that the mooring system holding a floating substructure fails, or there is failure or damage to tow during WTG towage during construction, the floating substructure may suffer loss of station and become a floating hazard to passing vessels.*

449. As this hazard is only relevant to the floating WTGs associated within the Array Area; this hazard will only assess the Array Area and not the offshore ECC.

18.5.1 Qualification of Risk

450. Loss of station was raised as a discussion point during the Hazard Workshop and the UK Chamber of Shipping noting that loss of station is just as crucial to be assessed at the construction phase with the importance of loss of tow being the key concern. Towage of the WTG to site will be subject to a dedicated risk assessment at the time of the towage operations when full specifications relating to the operations is available. This dedicated risk assessment should cover all elements of the towing operation including in port approaches.

451. For loss of station due to a mooring line failure during the construction phase while located within the Array Area, the Array Area will be monitored by vessels on-site at all times ensuring all infrastructure remains in-situ. If a mooring line failure was to arise, the project vessels would be able to respond in a timely manner ensuring a loss of station event does not occur and appropriate arrangements are taken which may include towing the floater off-site.

452. On this basis, a loss of station is considered likely to represent a low frequency event, noting that for a total loss of station, all moorings would be required to fail (each WTG will have a minimum of three).

18.5.2 Consequences

453. The main consequence will be failure of a single mooring line leading to a temporary increase in the maximum excursion of the floating structure but without full loss of station.

454. As a worst-case, a towage operation could fail resulting in a floater being adrift in a high risk area with collision and/or allision risk arising.

18.5.3 Embedded Mitigation Measures

455. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to an EMP (C-08);
- Fisheries liaison (C-12, C-13);
- Development of and adherence to an VMNSP (C-016);
- Guard vessel(s) via risk assessment (C-17);
- Promulgation of information (C-19);
- Lighting and marking (C-24, C-32, C-42);
- Compliance with regulatory floating guidance (C-26); and
- Minimum blade tip clearance (C-33).

18.5.4 Significance of Risk

456. The frequency of occurrence in relation to loss of station during the construction phase is considered **extremely unlikely**. The severity of consequence in relation to loss of station is considered **moderate**. Overall, it is predicted that the significance of risk due to loss of station is **broadly acceptable**.

19 Operation and Maintenance Phase Risk Assessment

19.1 Vessel Displacement

457. *The presence of structures may displace existing routes/activity.*

19.1.1 Qualification of Risk

458. Based on experience at existing operational OWFs, it is anticipated that commercial vessels will choose not to navigate internally within the Array Area and therefore the main route deviations established for the equivalent construction phase hazard for vessel displacement in line with MGN 654 (MCA, 2021) are again applicable during the O&M phase of the Proposed Development (Section 18.1).

459. Subsequently, the nature of this hazard for commercial vessels is expected to be broadly similar to that considered for the equivalent construction phase hazard for vessel displacement (Section 18.1). The buoyed construction area will no longer serve to assist with guiding vessels around the Array Area, but the operational lighting and marking of the array will serve this purpose.

460. Vessels using the deviated routes are typically smaller commercial oil and gas vessels whose Masters will be experienced with navigating in close proximity to offshore installations. Therefore, there is potential that depending upon the final array layout, these vessels may occasionally choose to navigate internally through the Array Area noting that there will be no restrictions on entry, other than active O&M safety zones. It is noted that under keel interaction risk associated with mooring lines and dynamic cables is assessed in Section 19.7.

461. For fishing vessels and recreational vessels, internal navigation within the Array Area is considered feasible during the O&M phase, noting that the minimum spacing of 1,000 m is sufficient to accommodate transits by smaller vessels. Additionally, there will be no restrictions on entry into the Array Area for any vessel other than through any active 500 m major maintenance safety zones. The SWFPA noted during the Hazard Workshop that large pelagic fishing vessels (50 to 60 m) may transit within the operational array with small vessel internal transits dependant on weather conditions and time of day; this will be down to skipper preference.

462. The RYA also noted that it should be expected that some recreational vessel transits occur within the Array Area during operation, and possibly in adverse weather conditions. Vessels may also enter if avoiding larger commercial vessels. Based on baseline characteristics of recreational vessels, noting the RYA confirmed the vessel traffic survey data to be representative, recreational vessel volumes are very low, and any internal transits or deviations made by recreational vessels would be infrequent. Again, as noted during the construction phase, any recreational vessels transiting this far offshore would be expected to undertake due diligence of the intended route as noted by the NLB during the Hazard Workshop.

463. The frequency of maintenance activities associated with the offshore ECC is expected to be limited, and so potential disruption associated with the offshore ECC will again be limited and any deviations will be minimal and easily manageable with notice of any maintenance being promulgated.

19.1.2 Consequences

464. The main consequences of vessel displacement during the O&M phase are also considered to be equivalent to the construction phase, in particular potential for increased journey times and distances (Section 18.1.2). No notable effects on navigational safety are anticipated.

19.1.3 Embedded Mitigation Measures

465. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development and adherence to an VMNSP (C-16);
- Application for safety zones (C-17);
- Marking on Admiralty charts (C-25);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19);
- Compliance with MGN 654 (C-21); and
- Lighting and marking (C-24, C-32, C-42).

19.1.4 Significance of Risk

466. The frequency of occurrence in relation to displacement of vessel traffic for the Array Area during the O&M phase is considered **frequent**. The severity of consequence in relation to displacement of vessel traffic is considered **minor**. Overall, it is predicted that the significance of risk due to vessel displacement is **tolerable with mitigation**.

467. The frequency of occurrence in relation to displacement of vessel traffic for the offshore ECC during the O&M phase is considered **reasonably probable** The severity of consequence in relation to displacement of vessel traffic is considered **negligible**. Overall, it is predicted that the significance of risk due to vessel displacement is **broadly acceptable**.

19.2 Increased Third-Party Vessel Collision Risk

468. *The presence of structures may increase encounters and collision risk with other third-party vessels.*

19.2.1 Qualification of Risk

469. Based on experience at existing operational OWFs, it is anticipated that commercial vessels will choose not to navigate internally within the Array Area and therefore the main route deviations established for the equivalent construction phase hazard for

vessel displacement in line with MGN 654 (MCA, 2021) are again applicable (Section 18.2).

470. Subsequently, the nature of this hazard (increased third-party vessel to vessel collision) for commercial vessels is expected to be broadly similar to that considered for the equivalent construction phase hazard including mitigation measures (Section 18.2.3). Although the buoyed construction area will no longer serve to assist with guiding vessels around the Array Area, the operational lighting and marking of the array will serve this purpose.

471. An additional factor during the O&M phase is the potential for the view of other vessels to be blocked or hindered due to the presence of structures, particularly for small craft which may choose to navigate internally within the Array Area. However, the minimum spacing between WTGs (1,000 m) is sufficient to ensure that any notable effects – which would likely arise only along a row of WTGs – occur only where the vessels involved are far apart, i.e., at opposite ends of the row of WTGs. As the distance between the vessels closes, any blocking effect would quickly reduce. In adverse weather conditions obtaining a visual of a crossing vessel may be more challenging, but it is anticipated that in such circumstances the COLREGs would be applied in terms of using reduced speeds in limited visibility.

472. Based on the post OWF modelling, the baseline encounter levels and collision risk levels within the study area are low, with an estimated vessel to vessel collision frequency of one every 3,359 years. The low level of collision risk is due to the volume of traffic in the area relative to the available sea space. With post wind farm vessel traffic volumes increased by 20% in the area, collision risk only rises to a frequency of one every 2,379 years, which is still considered low.

473. As noted in the vessel displacement hazard for the O&M phase (Section 19.1), smaller commercial oil and gas vessels may transit within the operational array and may reduce the hotspots identified during the construction phase (Section 18.2) on the corners of the Array Area.

474. This is the same for smaller craft, fishing vessels and recreational vessels, where internal transits within the operational array may be expected as noted throughout the vessel displacement hazard (Section 19.1). There remains sufficient open sea room around the Array Area and offshore ECC during O&M activities to ensure that collision risk (including with a commercial vessel) is minimal.

475. Additionally, the promulgation of information relating to O&M activities and charting of infrastructure will allow vessel Masters (across all vessel types) to passage plan in advance, minimising any displacement and subsequent collision risk. Additionally, information for fishing vessels will be promulgated through ongoing liaison with fishing fleets, and fisheries associations via an appointed FLO and Fishing Industry Representative.

476. Any displacement due to O&M activities within the offshore ECC is not anticipated to affect available sea room such that the risk of a collision between third-party vessels is materially increased.

19.2.2 Consequences

477. Again, the main consequence of increased third-party collision risk associated with the Array Area and offshore ECC is expected to be broadly similar to the equivalent construction phase hazard, i.e., increased encounters (Section 18.2.2).

19.2.3 Embedded Mitigation Measures

478. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to an EMP (C-08);
- Development of and adherence to an VMNSP (C-16);
- Application for safety zones (C-17);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19);
- Compliance with MGN 654 (C-21);
- Lighting and marking (C-24, C-32, C-42); and
- Marking on Admiralty charts (C-25).

19.2.4 Significance of Risk

479. The frequency of occurrence in relation to increased third-party vessel collision risk for the Array Area during the O&M phase is considered **remote**. The severity of consequence in relation to increased third-party vessel collision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to increased third-party vessel collision risk is **tolerable with mitigation**.

480. The frequency of occurrence in relation to increased third-party vessel collision risk for the offshore ECC during the O&M is considered **negligible**. The severity of consequence in relation to increased third-party vessel collision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to increased third-party vessel collision risk is **broadly acceptable**.

19.3 Third-Party with Project Vessel Collision Risk

481. *Project vessels associated with O&M activities may increase encounters and collision risk for other vessels already operating in the area.*

19.3.1 Qualification of Risk

482. Up to 259 return trips per year by a peak of 11 O&M vessels may be made throughout the O&M phase, including RAM vessels. It is assumed that O&M vessels will be on-site throughout the O&M phase. It is noted that the movement of project vessels

during the O&M represents a large decrease in movements in comparison to the construction phase.

483. As with the equivalent construction phase hazard, encounter and collision risk involving a project vessel will be well mitigated, including through marine coordination, carriage of AIS, compliance with Flag State regulations by project vessels, and promulgation of information to fishing fleets via an appointed FLO. An application for safety zones of 500 m radius will be sought during the O&M phase for any ongoing major maintenance within the Array Area.

484. As stated during the equivalent construction based hazard, based on historical incident data, there has been one instance of a third-party vessel colliding with a project vessel in the UK (Section 9.5), with no further collision incidents reported since.

485. Again, 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 require all vessels operating in reduced visibility to reduce speed to allow more time for reacting to encounters, thus minimising the collision risk.

19.3.2 Consequences

486. The main consequences between a third-party vessel and a project vessel are expected to be broadly similar to the equivalent construction phase hazard for third-party to project vessel collision risk (Section 18.3.2).

19.3.3 Embedded Mitigation Measures

487. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to an EMP (C-08);
- Development of and adherence to a VMNSP (C-10, C-16);
- Application for safety zones (C-17);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19); and
- Project vessel compliance with international marine regulations (C-22).

19.3.4 Significance of Risk

488. The frequency of occurrence in relation to third-party with project vessel collision risk for the Array Area during the O&M phase is considered **extremely unlikely**. The severity of consequence in relation to third-party with project vessel collision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to third-party with project vessel collision risk is **broadly acceptable**.

489. The frequency of occurrence in relation to third-party with project vessel collision risk for the offshore ECC during the O&M phase is considered **extremely unlikely**. The severity of consequence in relation to third-party with project vessel collision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to third-party with project vessel collision risk is **broadly acceptable**.

19.4 Reduced Access to Local Ports, Harbours, and Marinas

490. *O&M activities associated with the installation of structures and cables may reduce access to local ports and harbours.*

19.4.1 Qualification of Risk

491. Up to 259 return trips per year by a peak of 11 O&M vessels may be made throughout the O&M phase, including RAM vessels. It is assumed that O&M vessels will be on-site throughout the O&M phase. It is noted that the movement of project vessels during the O&M represents a large decrease in movements in comparison to the construction phase. As per the construction phase, project vessels will be managed by marine coordination through a VMNSP, **Volume 4, Appendix 5 (Outline Vessel Management and Navigation Safety Plan)**.

492. Given the extent of the Array Area will be similar to during the construction phase, this element of the hazard is considered broadly similar.

493. For the offshore ECC, as noted in the construction phase hazard, there is a greater risk given the proximity to Peterhead Port and importance of access for fishing vessels. However, the frequency of O&M activities is expected to be limited, and so potential disruption will be further limited with information promulgated in advance to allow mariners to passage plan accordingly if required.

19.4.2 Consequences

494. The main consequences will be broadly similar to the equivalent construction phase hazard for reduced access to local ports, harbours, and marinas (Section 18.4.2).

19.4.3 Embedded Mitigation Measures

495. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to an EMP (C-08);
- Development of and adherence to a VMNSP (c-10);
- Promulgation of information (C-19); and
- Project vessel compliance with international marine regulations (C-22).

19.4.4 Significance of Risk

496. The frequency of occurrence in relation to reduced access to local ports, harbours, and marinas for the Array Area during the O&M phase is considered **extremely unlikely**. The severity of consequence in relation to reduced access to local ports, harbours, and marinas is considered **minor**. Overall, it is predicted that the significance of risk due to reduced access to local ports, harbours, and marinas is **broadly acceptable**.

497. The frequency of occurrence in relation to reduced access to local ports, harbours, and marinas for the offshore ECC during the O&M phase is considered **reasonably probable**. The severity of consequence in relation to reduced access to local ports, harbours, and marinas is considered **minor**. Overall, it is predicted that the significance of risk due to reduced access to local ports, harbours, and marinas is **tolerable with mitigation**.

19.5 Loss of Station

498. *In the event that the mooring system holding a floating substructure fails, or there is failure or damage to tow during WTG towage for maintenance, the floating substructure may suffer loss of station and become a floating hazard to passing vessels.*

499. As per the construction phase hazard, this hazard is only relevant to the floating WTGs associated within the Array Area; this hazard will only assess the Array Area and not the offshore ECC.

19.5.1 Qualification of Risk

500. During the O&M phase, towage of WTGs to and from site for maintenance will be subject to a dedicated risk assessment at the time of the towage operation when full specifications relating to the operations is available. It is anticipated that a maximum of five return trips per year will be carried out for WTG towage to port. This dedicated risk assessment should cover all elements of the towage operation including in port approaches and internally within the array (noting the latter was specifically raised during consultation by the UK Chamber of Shipping).

501. The MCA require under their Regulatory Expectations on Moorings for Floating Wind and Marine Devices (MCA & HSE, 2017) that developers arrange TPV of the mooring systems by an independent and competent person/body. The Regulatory Expectations state that TPV is a "*continuous activity*" and that should there be any modifications to a system or if new information becomes available with regard to its reliability, additional TPV would be required.

502. The Regulatory Expectations also require the provision of continuous monitoring either by GPS or other suitable means. Each WTG should also have an alarm system in place, whereby an alert will be provided to the Marine Coordination Centre in the

event that any floating substructure leaves a pre-defined ringfenced alarm zone. This means in the unlikely event that a floating substructure suffers total loss of station and drifts outside of its alarm zone, the Developer would be made aware and would be able to track its position and make the necessary emergency arrangements, which will depend upon the design of the substructure and any predefined emergency response protocols. These protocols will also include recovery of a deliberately sunken floating foundation should this be deemed a necessary option in the event of a floating substructure going off station.

503. On the basis of compliance with the Regulatory Expectations, a loss of station is considered likely to represent a low frequency event, noting that for a total loss of station, all moorings would be required to fail (each WTG will have a minimum of three).

19.5.2 Consequences

504. The main consequences will be broadly similar to the equivalent construction phase hazard for loss of station (Section 18.5.2), noting that towage operations will occur less frequently. There is also potential for the lighting and marking of the array to be compromised should a loss of station lead to the loss of a key AtoN as highlighted by NLB during consultation. The implementation of the AtoN Management Plan (**Volume 4, Appendix 6 (Outline AtoN Management Plan)**) will ensure that this issue is addressed appropriately, which may include deployment of a guard vessel.

19.5.3 Embedded Mitigation Measures

505. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to an EMP (C-08);
- Fisheries liaison (C-12, C-13);
- Development of and adherence to an VMNSP (C-16);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19);
- Lighting and marking (C-24, C-32, C-42);
- Compliance with regulatory floating guidance (C-26); and
- Minimum blade tip clearance (C-33).

19.5.4 Significance of Risk

506. The frequency of occurrence in relation to loss of station for the Array Area during the O&M phase is considered **remote**. The severity of consequence in relation to loss of station is considered **moderate**. Overall, it is predicted that the significance of risk due to loss of station is **tolerable with mitigation**.

19.6 Creation of Vessel to Structure Allision Risk

507. *The presence of structures within the Array Area will lead to the creation of powered, drifting and internal allision risk for vessels.*

508. This hazard is only relevant to the floating WTGs associated within the Array Area, this hazard will only assess the Array Area and not the offshore ECC. Additionally, this hazard is scoped out of the risk assessment for the construction and decommissioning phases given the embedded mitigation measures which will be in place including the buoyed construction/decommissioning area. With this mitigation, the risk in these phases is considered negligible.

19.6.1 Qualification of Risk

509. The spatial extent of the hazard is small given that a vessel must be in close proximity to a surface structure for an allision incident to occur. Each allision element is considered in turn with the frequency of occurrence, severity of consequence, and resulting significance of risk across the various elements summarised at the end of the assessment. The forms of allision considered include:

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

19.6.1.1 Powered Allision Risk

510. Based on the quantitative assessment undertaken for the indicative array layout (Section 16.4.3), the base case annual powered vessel to structure allision frequency was estimated to be 2.29×10^{-4}, corresponding to a return period of approximately one in 4,376 years. This is a low return period compared to that estimated for other UK OWF developments and is reflective of the distance offshore and the relatively low volume of vessel traffic intersecting or passing in close proximity to the Array Area. The low return period is also reflected when considering future case traffic levels.

511. Based on historical incident data, there have been two reported instances of a third-party vessel alliding with an operational OWF structure in the UK (in the Irish Sea and Southern North Sea). Both of these incidents involved a fishing vessel, with an RNLI lifeboat attending on both occasions and a helicopter deployed in one case.

512. Vessels are expected to comply with national and international flag state regulations (including the COLREGs and SOLAS) and will be able to passage plan a route which minimises risk given the promulgation of information relating to the Proposed Development, including the charting of infrastructure on relevant nautical charts. On approach, the operational marine lighting and marking on the structures (which will be agreed with the MCA and NLB) will also assist in maximising awareness.

Furthermore, the final layout will be agreed post consent in consultation with MCA and NLB to ensure it is safe from a surface navigation perspective.

513. Should a powered allision occur, the consequences will depend on multiple factors including the energy of the contact, structural integrity of the vessel involved, and sea state at the time of the contact. Fishing vessels and recreational vessels are considered most vulnerable to the impact given the potential for a non-steel construction. With consideration of lessons learned the most likely consequences are minor damage with the vessel able to resume passage and undertake a full inspection at the next port of call. As an unlikely worst-case, the vessel could founder resulting in a PLL and pollution. If pollution were to occur, then the EMP would be implemented (**Volume 4, Appendix 2 (Outline Environmental Management Plan)**).

19.6.1.2 Drifting Allision Risk

514. Based on the quantitative assessment undertaken for the indicative array layout (Section 16.4.4), the base case annual drifting vessel to structure allision frequency was estimated to be 2.98×10^{-5}, corresponding to a return period of approximately one in 33,517 years. This is a low return period compared to that estimated for other UK OWF developments and again reflects the relatively low volume of vessel traffic intersecting or passing in close proximity to the Array Area. The low return period is also reflected when considering future case traffic levels.

515. Based on historical incident data, there have been no instances of a third-party vessel alliding with an operational OWF structure whilst Not Under Command (NUC) (Section 9.5). The MAIB incident data reviewed in proximity to the Proposed Development indicates that machinery failure is not a common incident type and so there is not consider a great potential for a vessel to be adrift in the area.

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

517. In circumstances where a vessel drifts towards a structure in the Array Area, there are actions which the vessel may take to prevent the drift incident developing into an allision situation. For powered vessels, the ideal and likely solution would be to regain power prior to reaching the Array Area (i.e., by rectifying any fault). Failing this, the vessel's emergency response procedures would be implemented which 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 risks (such as anchor snagging on a subsea cable or mooring line), or the use of thrusters (depending on availability and power supply).

518. Noting the considerable water depth within and in proximity to the Array Area, deployment of the anchor may not be possible, particularly for small craft. In such

circumstances, any project vessels on-site may be able to render assistance in liaison with the MCA and in line with SOLAS obligations (IMO, 1974), particularly in the summer months when O&M activities are likely to be more frequent. This response would be managed via the coastguard and marine coordination and depends on the type and capability of vessels on site. This would be particularly relevant for sailing vessels relying on metocean conditions for propulsion, noting if the vessel becomes adrift in proximity to a structure there may be limited time to render assistance.

519. Should a drifting allision occur, the consequences will be similar to those noted for the case of a powered allision including the unlikely worst-case of foundering, PLL, and pollution. However, a drifting vessel is likely to be moving at a reduced speed compared to a powered vessel, thus reducing the energy of the impact, including in the case of a recreational vessel under sail.

19.6.1.3 Internal Allision Risk

520. As noted previously, based on experience at existing operational OWFs, it is anticipated that commercial vessels will be unlikely to navigate internally within the Array Area. Fishing and recreational vessels may be more likely to transit through although are less likely to do so at a floating site such as the Proposed Development compared to fixed sites due to the presence of mooring infrastructure associated with floating WTGs. Nevertheless, during consultation RYA Scotland did note that some recreational vessels may navigate internally, particularly to avoid larger commercial vessels.

521. The base case annual fishing vessel to structure allision frequency for the indicative array layout (Section 16.4.5) is estimated to be 2.93×10^{-2}, corresponding to a return period of approximately one in 34 years. This return period is reflective of fishing vessel traffic within the Array Area, and the conservative assumptions made within the modelling process. In particular, it has been assumed that the baseline fishing activity in terms of proximity to WTGs will not change. This is a very conservative assumption, particularly for a floating site, noting internal transits by larger pelagic fishing vessels may occur based on consultation feedback from the SWFPA.

522. The estimated return period also does not take account of the nature of any allision incident. The worst consequences reported for vessels involved in an allision incident involving a UK OWF development has been flooding, with no life-threatening injuries to persons reported (the model is calibrated against known incidents).

523. The minimum spacing between structures of 1,000 m is considered sufficient for safe internal navigation, i.e., for vessels to keep clear of the OWF structures within the Array Area. It is noted that this spacing is much greater than that associated with many other operational OWFs in the UK. Moreover, the final layout – agreed with MCA and NLB post consent – will be compliant with the requirements of MGN 654 (MCA, 2021).

524. As with any passage, any vessel navigating within the Array Area is expected to passage plan in accordance with SOLAS Chapter V (IMO, 1974) and promulgation of information by the Proposed Development will ensure that such vessels have good awareness of the presence of surface structures. Operational marine lighting and marking will be in place as required by and agreed with NLB and MCA. Given the size of the Array Area, it is unlikely that a mariner would become disoriented when navigating internally; nevertheless, marking will include unique identification marking of each structure in an easily understandable pattern.

525. Should a recreational vessel under sail enter the proximity of a WTG, there is also potential for effects such as wind shear, masking and turbulence to occur. From previous studies of offshore wind developments, it has been concluded that WTGs do reduce wind velocity downwind of a WTG (MCA, 2008a) but that no negative effects on recreational craft have been reported on the basis of the limited spatial extent of the effect and its similarity to that experienced when passing a large vessel or close to other large structures (such as bridges) or the coastline. In addition, no practical issues have been raised by recreational users to date when operating in proximity to existing offshore wind developments.

526. For recreational vessels with a mast there is an additional allision risk when navigating internally within the array associated with the WTG blades. However, the minimum blade tip clearance of 30 m above MSL is greater than the minimum clearance the RYA recommend (22 m above MHWS) for minimising allision risk (RYA, 2019 (b)) and which is also noted in MGN 654 (MCA, 2021).

19.6.2 Consequences

527. Consequences for each scenario are included under the relevant sections. However, the main consequences associated with the creation of vessel to structure allision risk would be that a vessel passes at an unsafe distance resulting in a need to make a late adjustment to course/speed.

528. As a worst-case, an allision event occurs involving vessel damage, PLL and/or pollution.

19.6.3 Embedded Mitigation Measures

529. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to a Development Specification and Layout Plan (DSLP);
- Development of and adherence to an EMP (C-08);
- Development of and adherence to a VMNSP (C-10);
- Fisheries liaison (C-12, C-13);
- Application for safety zones (C-17);
- Promulgation of information (C-19);

- Compliance with MGN 654 (C-21);
- Project vessel compliance with international marine regulations (C-22);
- Lighting and marking (C-24, C-36, C-42);
- Marking on Admiralty charts (C-25); and
- Minimum blade tip clearance (C-33).

19.6.4 Significance of Risk

530. The frequency of occurrence in relation to the creation of vessel to structure allision risk for the Array Area during the O&M phase is considered **remote**. The severity of consequence in relation to creation of vessel to structure allision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to creation of vessel to structure allision risk is **tolerable with mitigation**.

19.7 Reduction of Under Keel Clearance as a Result of Cable Protection, Dynamic Cables, and Mooring Lines

531. *The presence of mooring lines, buoyant inter-array cables, or protection over subsea cables may reduce charted water depths leading to increased risk of under keel interaction for passing vessels.*

19.7.1 Qualification of Risk

532. The spatial extent of the hazard is small given that a vessel must be in close proximity to a mooring line, inter-array cable or subsea cable with cable protection for a reduction to occur. Each element is considered in turn with the frequency of occurrence, severity of consequence, and resulting significance of risk across the various elements summarised at the end of the assessment.

19.7.1.1 Mooring Lines and Dynamic Inter-Array Cables

533. Vessels navigating in proximity to the floating WTGs may be at risk of interaction with the mooring lines or inter-array cables associated with floating WTGs. The level of risk will depend on the clearance available above the subsea elements of the substructures.

534. There will be a maximum of nine mooring lines per floating WTG used to secure the substructures to the seabed. The highest risk areas in terms of potential under keel clearance interaction will be the areas in the immediate vicinity of the floating substructures where the mooring lines and inter-array cables are closest to the surface. Should barges be selected, the mooring lines will connect above the waterline at a height of up to 25 m.

535. As previously noted, it is likely that commercial vessels will not enter the Array Area Moreover, experience indicates that commercial vessels frequently pass 1 nm (1.85 km) or more off established developments. On this basis, taking into consideration the baseline and anticipated post wind farm vessel routeing, it is

considered highly unlikely that a commercial vessel would pass within the Array Area let alone in sufficiently close proximity to the WTGs for an under keel interaction to arise.

536. An analysis of under keel interaction for vessel draughts local to the area has been undertaken in Section 16.6.2. This analysis found – compared against maximum draughts – that the horizontal distance over which an under keel interaction could occur associated with the mooring lines was 539 m for fishing vessels and 715 m for commercial vessels. For the inter-array cables, the horizontal distance over which an under keel interaction could occur was 79 m for fishing vessels and 102 m for commercial vessels.

537. It is noted that across all commercial vessels only smaller oil and gas vessels are considered possible candidates for internal navigation, and so the distance for commercial vessels is highly conservative.

538. For the mooring lines, these distances represent a substantial radius from the floater within which an under keel interaction could occur (and which is out with the maximum rotor diameter of the WTG), the mooring line would be located above the water line for the majority of this distance and therefore the vessel should be able to visually identify the risk. Additionally, the mooring lines will be marked on appropriately scaled UKHO Admiralty charts and, when navigating internally within the array, vessels would be expected to exercise an increased level of caution and awareness.

539. For the inter-array cables, these distances are less substantial, and in particular are well within the maximum rotor diameter of the WTG. Therefore, a vessel may be deterred from navigating in proximity to the structure, reducing the potential for an under keel interaction.

540. It will be necessary to confirm available under keel clearance from the mooring lines post installation, in particular if taut mooring lines are used. The confirmed available clearance should be discussed with the MCA and NLB post installation to determine if any additional mitigation is required.

541. There is limited experience of deployment of floating offshore wind projects in UK waters; however, to date there have been no reported under keel interactions between passing vessels and the components associated with such projects.

542. Details of the infrastructure will be promulgated to maximise awareness of the Proposed Development and any potential under keel interaction risk, including via the FLO. As noted, the locations of the floating substructures will be clearly shown on appropriate nautical charts, and the Developer will also provide the locations of the anchors and mooring lines to the UKHO for charting purposes.

19.7.2 Subsea Cables with Cable Protection

543. Reduction in under keel clearance is only of relevance to subsea cables associated with the Proposed Development where the cable is not buried, and external cable protection is required.

544. The minimum burial depth for inter-array cables and export cable will be 1.0 m. Actual burial depths will be determined via the cable burial risk assessment process undertaken post consent once geotechnical survey data is available. Where cables are buried no under keel interaction risk is anticipated.

545. Where cable burial is not possible, alternative cable protection methods may be deployed which will be determined within the cable burial risk assessment. The requirements of MGN 654 in relation to cable protection will apply, namely cable protection will not change the charted water depth by more than 5% unless appropriate mitigation is agreed with the MCA. 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 (b)).

546. Given existing water depths within the Array Area (between 62 and 97 m), it is not anticipated that the presence of cable protection associated with inter-array cables or interconnector will reduce charted water depths by more than 5%. For the export cable, the water depth is shallow in the nearshore area, and therefore the likelihood of a reduction in charted water depth by more than 5% is much greater, should cable protection be required. However, spatially this is minimal, and water depths quickly increase and reach the 50 m depth contour approximately 3 nm (3.56 km) offshore. Also, from the vessel traffic data limited activity occurs in the nearshore area of the offshore ECC with vessels mainly comprising fishing and recreational which typically have smaller vessel draughts. No large commercial vessel were recorded inshore of the 50 m depth contour in the offshore ECC. Nevertheless, as noted above, in such circumstances the MCA will be consulted on appropriate mitigation (if required) to ensure the under keel interaction risk is ALARP.

19.7.3 Consequences

547. The most likely consequence in regard to reduction of under keel clearance as a result of cable protection, dynamic cables, and mooring lines is a vessel transits over an area of reduced clearance but does not make contact.

548. Should an underwater allision occur, minor damage incurred is the most likely consequence, and foundering or grounding of the vessel resulting in injury to person and pollution (including spillage of potential hazardous cargo) the unlikely worst-case consequences, with the environmental risks of the latter minimised by the implementation of the EMP (**Volume 4, Appendix 2 (Outline Environmental Management Plan)**).

19.7.4 Embedded Mitigation Measures

549. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to a Cable Plan (CaP) (C-02);
- Compliance with MGN 654 (C-21);
- Compliance with regulatory floating guidance (C-26);
- Notification of damage or decay of cables (C-23);
- Marking on Admiralty charts (C-25); and
- Cable burial risk assessment (C-29).

19.7.5 Significance of Risk

550. The frequency of occurrence in relation to reduction of under keel clearance as a result of cable protection, dynamic cables, and mooring lines for the Proposed Development during the O&M phase is considered **reasonably probable**. The severity of consequence in relation to reduction of under keel clearance as a result of cable protection, dynamic cables, and mooring lines is considered **minor**. Overall, it is predicted that the significance of risk due to reduction of under keel clearance as a result of cable protection, dynamic cables, and mooring lines is **tolerable with mitigation**.

19.8 Anchor Interaction with Mooring Lines or Subsea Cables

551. *The presence of mooring lines and subsea cables may increase the risk of anchor interaction.*

19.8.1 Qualification of Risk

552. The spatial extent of the hazard is small given that a vessel must be in close proximity to a mooring line or subsea cable for an interaction to occur.

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

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

554. Although the second of these scenarios may involve limited decision-making time if drifting towards a hazard, in all three scenarios it is anticipated that the charting of infrastructure including the subsea cables and mooring lines (where scale of chart is appropriate) will inform the decision of a vessel to anchor, as per Regulation 34 of SOLAS (IMO, 1974).

555. No anchored vessels were observed within the study area for the Array Area during the survey periods or long-term vessel traffic data. Risk of interaction with an inter-array cable, interconnector cable, or mooring line on a planned anchoring or dragged anchoring basis is therefore anticipated to be extremely low. In terms of emergency anchoring, any areas of high traffic volume are likely to represent the areas of highest risk, particularly where there are hazards nearby (e.g., structures, rocks, shallows). However; given the open sea room in proximity to the Array Area and water depths the likelihood of this scenario arising is very low.

556. Again, no anchored vessels were observed within the offshore ECC study area during the data periods. The burial of the export cables and use of external cable protection as informed by the cable burial risk assessment with a minimum burial depth of 1.0 m, will minimise the likelihood of an interaction occurring. The cable burial risk assessment will also account for traffic volume and sizes.

557. Additionally, as per Regulation 34 of SOLAS (IMO, 1974), it is anticipated that mariners will take account of the presence of the export cables via nautical charts prior to dropping the anchor. With this good practice and mitigation, it is considered unlikely that an anchor interaction will occur.

19.8.2 Consequences

558. The most likely consequence resulting from an anchor interaction with mooring lines or subsea cables, based on historical anchor interaction incidents, would be a vessel anchors on or drags anchor over a subsea cable or mooring line but no interaction occurs.

559. As a worst-case, a vessel anchors on or drags anchor over a subsea cable or mooring line with interaction occurring resulting in a snagging event or potential damage to the cable, protection, mooring line, and/or anchor. Potential for loss of stability for a small vessel could also occur. For an interaction with an inter-array cable or mooring line in the water column, a further consequence could be the breaking of the cable, which may have implications for the stability of the floating substructure, depending upon the particular design. This scenario is highly unlikely given that this section of the cable will be in close proximity to the WTG, with vessels expected to be aware of the presence of subsea infrastructure.

19.8.3 Embedded Mitigation Measures

560. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to a CaP (C-02);
- Development of and adherence to an VMNSP (C-16);
- Compliance with regulatory floating guidance (C-26);
- Guard vessel(s) via risk assessment (C-29);
- Promulgation of information (C-19);

- Notification of damage or decay of cables (C-23); and
- Marking on Admiralty charts (C-25).

19.8.4 Significance of Risk

561. The frequency of occurrence in relation to anchor interaction with mooring lines and subsea cables for the Proposed Development during the O&M phase is considered **minor**. The severity of consequence in relation to anchor interaction with mooring lines and subsea cables is considered **negligible**. Overall, it is predicted that the significance of risk due to anchor interaction with mooring lines and subsea cables is **broadly acceptable**.

19.9 Reduction of Emergency Response Capability Including SAR

562. *Presence of structures, increased vessel activity, and personnel numbers may reduce emergency response capability by increasing the number of incidents, increase consequences or reducing access for the responders.*

19.9.1 Qualification of Risk

563. Given the distances that may be covered by air-based SAR support (the SAR helicopter base at Inverness is located approximately 108 nm (200 km) from the Array Area), the spatial extent of this hazard is considered large. The Array Area covers approximately 58 nm^2 (199 km^2) which represents a moderate to large area to search in comparison with other offshore UK developments.

564. Up to 259 return trips per year by O&M vessels may be made throughout the O&M phase. It is estimated that project vessel movements will be more frequent during the summer months. The presence of such vessels will increase the likelihood of an incident and subsequently increase the likelihood of multiple incidents occurring simultaneously in the region as a whole, diminishing emergency response capability.

565. However, with project vessels to be managed through marine coordination and in compliance with Flag State regulations, the likelihood of an incident is minimised. Additionally, should an incident occur, project vessels would likely be well equipped to assist, either through self-help capability or through SOLAS obligations (IMO, 1974), noting this would be undertaken in liaison with the MCA. For a pollution incident, the EMP will also be implemented (**Volume 4, Appendix 2 (Outline Environmental Management Plan)**). Given the distance offshore, it is likely that in the event of an emergency response incident a project vessel would be the first responder.

566. From recent SAR helicopter taskings data, the frequency of SAR operations in proximity to the Proposed Development is low, with no SAR helicopter incidents occurring within the Array Area. The frequency of SAR operations in proximity to the Array Area is not anticipated to change markedly from the current level given the measures noted above which will be in place. However, in the event that a SAR

operation is required internally within the Array Area, its small-scale and the minimum spacing of 1,000 m between WTGs should ensure that access risks are minimal.

567. An ERCoP will be submitted to the MCA post consent in line with the requirements of MGN 654 (MCA, 2021), and a SAR Checklist will be completed and agreed with the MCA. Furthermore, the final array layout will be agreed with the MCA and NLB post consent and be MGN 654 compliant.

19.9.2 Consequences

568. The most likely consequence to occur from a reduction of emergency response capability including SAR would be a delay to any emergency response request.

569. As a worst-case, the consequences of such a situation could include a failure of emergency response to an incident, resulting in PLL and pollution.

19.9.3 Embedded Mitigation Measures

570. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to a DSLP (C-03);
- Development of and adherence to an EMP (C-16);
- Development of adherence to a VMNSP (C-10);
- Compliance with MGN 654 (inclusive of the ERCoP) (C-21);
- Project vessel compliance with international marine regulations (C-22); and
- Lighting and marking (C-24, C-36, C-42).

19.9.4 Significance of Risk

571. The frequency of occurrence in relation to reduction of emergency response capability including SAR for the Proposed Development during the O&M phase is considered **extremely unlikely**. The severity of consequence in relation to reduction of emergency response capability including SAR is considered **serious**. Overall, it is predicted that the significance of risk due to reduction of emergency response capability including SAR is **tolerable with mitigation**.

20 Decommissioning Phase Risk Assessment

20.1 Vessel Displacement

572. *Decommissioning activities associated with the removal of structures and cables may displace existing routes/activity.*

20.1.1 Qualification of Risk

573. Since the methods used to remove structures and subsea cables are expected to be similar to those used to install them, the risk pathway for this hazard is expected to be similar in nature to the equivalent construction phase hazard for vessel displacement (Section 18.1.1). This includes the use of a buoyed decommissioning area.

20.1.2 Consequences

574. Given the broadly similar nature of decommissioning activities when compared to construction activities, the main consequences of vessel displacement during the decommissioning phase for the Array Area and the offshore ECC are considered to be equivalent to that highlighted for the construction phase hazard for vessel displacement (Section 18.1.2), in particular potential for increased journey times and distances. No notable effects on navigational safety are anticipated.

20.1.3 Embedded Mitigation Measures

575. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to a DP (C-09);
- Development and adherence to an VMNSP (C-16);
- Application for safety zones (C-17);
- Marking on Admiralty charts (C-25);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19);
- Compliance with MGN 654 (C-21); and
- Lighting and marking (C-24, C-36, C-42).

20.1.4 Significance of Risk

576. The frequency of occurrence in relation to displacement of vessel traffic for the Array Area during the decommissioning phase is considered **frequent**. The severity of consequence in relation to displacement of vessel traffic is considered **minor**. Overall, it is predicted that the significance of risk due to vessel displacement is **tolerable with mitigation**.

577. The frequency of occurrence in relation to displacement of vessel traffic for the offshore ECC during the decommissioning phase is considered **reasonably probable**.

The severity of consequence in relation to displacement of vessel traffic is considered **negligible**. Overall, it is predicted that the significance of risk due to vessel displacement is **broadly acceptable**.

20.2 Increased Third-Party Vessel Collision Risk

578. *Decommissioning activities associated with the removal of structures and cables may increase encounters and collision risk with other third-party vessels.*

20.2.1 Qualification of Risk

579. Since the methods used to remove structures and subsea cables are expected to be similar to those used to install them, the risk pathway for this hazard is expected to be similar in nature to the equivalent construction phase hazard for increased third-party vessel to vessel collision risk (Section 18.2.1). This includes the use of a buoyed decommissioning area.

20.2.2 Consequences

580. Given the broadly similar nature of decommissioning activities when compared to construction activities, the main consequences of collision risk during the decommissioning phase for the Array Area and the offshore ECC are considered to be equivalent to that highlighted for the construction phase hazard for increased third-party vessel to vessel collision risk (Section 18.2.2), in particular the unlikely worst-case of foundering resulting in PLL and pollution.

20.2.3 Embedded Mitigation Measures

581. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to a DP (C-09);
- Development of and adherence to an EMP (C-08);
- Development of and adherence to an VMNSP (C-16);
- Application for safety zones (C-17);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19);
- Compliance with MGN 654 (C-21);
- Lighting and marking (C-24, C-36, C-42); and
- Marking on Admiralty charts (C-25).

20.2.4 Significance of Risk

582. The frequency of occurrence in relation to increased third-party vessel collision risk for the Array Area during the decommissioning phase is considered **remote**. The severity of consequence in relation to increased third-party vessel collision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to increased third-party vessel collision risk is **tolerable with mitigation**.

583. The frequency of occurrence in relation to increased third-party vessel collision risk for the offshore ECC during the decommissioning phase is considered **extremely unlikely**. The severity of consequence in relation to increased third-party vessel collision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to increased third-party vessel collision risk is **broadly acceptable**.

20.3 Third-Party with Project Vessel Collision Risk

584. *Project vessels associated with decommissioning activities may increase encounters and collision risk for other vessels already operating in the area.*

20.3.1 Qualification of Risk

585. Since the methods used to remove structures and subsea cables are expected to be similar to those used to install them, including the vessels involved, the risk pathway for this hazard is expected to be similar in nature to the equivalent construction phase hazard for third-party to project vessel collision risk (Section 18.3.1), including the number of return trips by project vessels and the use of a buoyed decommissioning area.

20.3.2 Consequences

586. Given the broadly similar nature of decommissioning activities when compared to construction activities, the main consequences in the event of an encounter or collision are considered to be equivalent to that highlighted for the construction phase hazard for third-party to project vessel collision risk (Section 18.3.2), including a worst-case of foundering, PLL, and pollution.

20.3.3 Embedded Mitigation Measures

587. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to a DP (C-09);
- Development of and adherence to an EMP (C-08);
- Development of and adherence to a VMNSP (C-10, C-16);
- Application for safety zones (C-17);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19); and
- Project vessel compliance with international marine regulations (C-22).

20.3.4 Significance of Risk

588. The frequency of occurrence in relation to third-party with project vessel collision risk for the Array Area during the decommissioning phase is considered **extremely unlikely**. The severity of consequence in relation to third-party with project vessel collision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to third-party with project vessel collision risk is **broadly acceptable**.

589. The frequency of occurrence in relation to third-party with project vessel collision risk for the offshore ECC during the decommissioning phase is considered **remote**. The severity of consequence in relation to third-party with project vessel collision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to third-party with project vessel collision risk is **tolerable with mitigation**.

20.4 Reduced Access to Local Ports, Harbours, and Marinas

590. *Decommissioning activities associated with the removal of structures and cables may reduce access to local ports and harbours.*

20.4.1 Qualification of Risk

20.4.2 Since the methods used to remove structures and subsea cables are expected to be similar to those used to install them, the risk pathway for this hazard is expected to be similar in nature to the equivalent construction phase hazard for reduced access to local ports and harbours (Section 18.4.1), including the number of return trips by decommissioning vessels.

20.4.3 Consequences

591. Given the broadly similar nature of decommissioning activities when compared to construction activities, the main consequences during the decommissioning phase are considered to be equivalent to that highlighted for the construction phase hazard for reduced access to local ports and harbours (Section 18.4.2), in particular minor disruption to port access.

20.4.4 Embedded Mitigation Measures

592. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to a DP (C-09);
- Development of and adherence to an EMP (C-08);
- Development of and adherence to a VMNSP (C-10);
- Promulgation of information (C-19); and
- Project vessel compliance with international marine regulations (C-22).

20.4.5 Significance of Risk

593. The frequency of occurrence in relation to reduced access to local ports, harbours, and marinas for the Array Area during the decommissioning phase is considered **remote**. The severity of consequence in relation to reduced access to local ports, harbours, and marinas is considered **minor**. Overall, it is predicted that the significance of risk due to reduced access to local ports, harbours, and marinas is **broadly acceptable**.

594. The frequency of occurrence in relation to reduced access to local ports, harbours, and marinas for the offshore ECC during the decommissioning phase is considered **frequent**. The severity of consequence in relation to reduced access to local ports, harbours, and marinas is considered **minor**. Overall, it is predicted that the significance of risk due to reduced access to local ports, harbours, and marinas is **tolerable with mitigation**.

20.5 Loss of Station

595. *In the event that the mooring system holding a floating substructure fails, or there is failure or damage to tow during WTG towage during decommissioning, the floating substructure may suffer loss of station and become a floating hazard to passing vessels.*

596. As this hazard is only relevant to the floating WTGs associated within the Array Area, this hazard will only assess the Array Area and not the offshore ECC.

20.5.1 Qualification of Risk

20.5.2 Since the methods used to remove structures are expected to be similar to those used to install them, the risk pathway for this hazard is expected to be similar in nature to the equivalent construction phase hazard for loss of station (Section 18.5.1).

20.5.3 Consequences

597. Given the broadly similar nature of decommissioning activities when compared to construction activities, the main consequences during the decommissioning phase are considered to be equivalent to that highlighted for the construction phase hazard for loss of station (Section 18.4.2).

20.5.4 Embedded Mitigation Measures

598. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to a DP (C-09);
- Development of and adherence to an EMP (C-08);
- Fisheries liaison (C-12, C-13);
- Development of and adherence to an VMNSP (C-16);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19);
- Lighting and marking (C-24, C-36, C42);
- Compliance with regulatory floating guidance (C-26); and
- Minimum blade tip clearance (C-33).

20.5.5 Significance of Risk

599. The frequency of occurrence in relation to loss of station for the Array Area during the decommissioning phase is considered **extremely unlikely**. The severity of consequence in relation to loss of station is considered **moderate**. Overall, it is predicted that the significance of risk due to loss of station is **broadly acceptable**.

21 Cumulative Risk Assessment

600. This section provides a qualitative and quantitative risk assessment using (FSA) for the hazards identified due to the Proposed Development cumulatively with those other developments identified from the cumulative screening (Section 13). The same inputs outlined for the in isolation risk assessment are applicable.

601. The hazards assessed are as per the in isolation risk assessment, with the exception of loss of station, reduction of under keel clearance as a result of cable protection, dynamic cables, and mooring lines, and anchor interaction with mooring lines or subsea cables each of which have been scoped out of the cumulative risk assessment due to the nature of the hazards which results in a limited pathway by which the hazard could become cumulative in nature.

602. Again, the risk control log (Section 22) summarises the risk assessment and a concluding risk statement is provided (Section 25.4).

21.1 Vessel Displacement

603. *Construction/decommissioning activities associated with the installation/removal of structures and cables and the presence of structures during O&M may displace existing routes/activity on a cumulative level*.

21.1.1 Tier 1

604. Based on the cumulative assessment of vessel routeing (Section 14.6), a deviation will be required for all 18 main commercial routes identified in a cumulative scenario. One route, Route 5, would not be further affected by cumulative developments and the route remains the same as in the in isolation scenario. It is anticipated that eight of the routes affected by cumulative developments will deviate around CampionWind, five around Aspen, and one route around each of Flora and Salamander.

605. A total of 12 main commercial routes are required to deviate as a result of CampionWind and Aspen, located to the east and north-east of the Proposed Development, respectively. Routes deviate north of the Proposed Development and through the gap between CampionWind and Aspen before returning to their intended route position. This is the case for all 10 routes on an east-west bearing (all oil and gas routes) with the two other routes on a north-south bearing either passing east of both projects (Route 11) or west of the Array Area and south of CampionWind (Route 7). The presence of CampionWind alone would require a further deviation, due to the Proposed Development, to an additional three routes from what was identified in the in isolation scenario.

606. Although an increase in route length would be required for these deviations, the deviations illustrated in Section 14.6 are a conservative worst-case, with vessels on these routes likely to take a more direct approach between port locations on the east

coast of Scotland and the offshore oil and gas fields in particular, given that there is sea room available to do so. This is especially the case for the area between Aberdeen and the Array Area which is clear of cumulative developments.

607. Tidewater Marine Ltd stated during consultation that there is no cumulative effect to Tidewater vessels from the presence of cumulative developments. Commercial routes north-south will also likely take a more direct approach noting these routes are between mainland Europe and North America and the Northern Isles and any deviation in this area would be small in proportion to the entire route. It is also noted that traffic volumes on these routes are considered relatively low.

608. The MCA noted during consultation that vessels may use the gap between the Proposed Development and CampionWind, but the MCA had no concerns over the 6.8 nm (12.6 km) gap and again echoes that vessels will take a more direct approach to routeing in the area than what has been assumed worst-case.

609. Other Tier 1 developments, Flora and Salamander, have a lower level of cumulative impact than CampionWind and Aspen. Both developments only deviate one route each, with both routes only deviating marginally to pass at a mean distance of 1 nm (1.85 km) off each development. It is noted that Route 8, deviated by Flora, is only affected by Flora and no other cumulative development or the Proposed Development. Route 1 which is deviated by Salamander is also deviated due to the presence of CampionWind. Vessels routeing in the vicinity of these developments will already be familiar with offshore wind developments considering Hywind is situated inshore of both developments and so limited impact is expected to occur.

610. The SWFPA noted during consultation that commercial fishing vessels and fishing grounds may be affected cumulatively with vessels being deviated and filtered into gaps between developments especially with vessel numbers increasing over time. The majority of fishing vessels on transits were to the south-east of the Proposed Development and so would not be on passage in proximity to Tier 1 developments unless heading north-west to Fraserburgh in which case vessels would need to deviate around Salamander. Just like commercial vessels, fishing vessels and recreational vessels, especially closer to shore, there will be familiarity transiting around offshore developments and so minor deviations are not considered to impact smaller craft materially.

21.1.2 Tier 2

611. Of the 18 routes requiring a deviation in the cumulative scenario, six are impacted by Tier 2 developments, with three routes not also affected by any Tier 1 developments.

612. The three routes which are impacted by Tier 2 developments only are all low use commercial routes routeing north-south to the west of the Array Area. These routes are not deviated as a result of the in isolation scenario or by the Proposed

Development as a result of other cumulative developments. These routes are deviated to pass at a mean distance of 1 nm (1.85 km) off the Tier 2 developments to the south of the Proposed Development and given the nature of these route, deviations are not considered large.

613. Of the three routes which are impacted by Tier 2 developments as well as Tier 1, the same measures that have been addressed for Tier 1 developments also apply, noting another of these routes is not affected by the Proposed Development in isolation or at a cumulative level (Route 11).

614. The same impacts for smaller craft as detailed for Tier 1 developments is also considered for Tier 2 developments, although Tier 2 developments are further offshore and not in proximity to the Proposed Development and so any impact would be due to the Tier 2 developments only.

21.1.3 Tier 3

615. For this hazard there is no direct link between the Proposed Development and Tier 3 OWF and subsea cable developments due to the distance from the Proposed Development and the lack of interaction with any main commercial routes associated with the Proposed Development or lack of data available. Therefore, no additional assessment of risk has been undertaken.

21.1.4 Embedded Mitigation Measures

616. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development and adherence to an VMNSP (C-16);
- Application for safety zones (C-17);
- Marking on Admiralty charts (C-25);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19);
- Compliance with MGN 654 (C-21); and
- Lighting and marking (C-24, C-36, C-42).

21.1.5 Significance of Risk

617. The frequency of occurrence in relation to cumulative vessel displacement of vessel traffic for the Array Area during all phases is considered **frequent**. The severity of consequence in relation to cumulative vessel displacement of vessel traffic is considered **moderate**. Overall, it is predicted that the significance of risk due to cumulative vessel displacement of vessel traffic is **tolerable with mitigation**.

618. The frequency of occurrence in relation cumulative vessel displacement of vessel traffic for the offshore ECC during all phases is considered **reasonably probable**. The severity of consequence in relation to cumulative vessel displacement of vessel

traffic is considered **minor**. Overall, it is predicted that the significance of risk due to cumulative vessel displacement of vessel traffic is **tolerable with mitigation**.

21.2 Increased Third-Party Vessel Collision Risk

619. *Construction/decommissioning activities associated with the installation/removal of structures and cables and the presence of structures during O&M any increase encounters and collision risk with other third-party vessels on a cumulative level.*

21.2.1 Tier 1/2

620. The same cumulative vessel routeing considered for the vessel displacement hazard is again applicable for Tier 1 and Tier 2 developments. Tier 1 and Tier 2 developments are considered together given that the reduction in navigable sea room resulting from the presence of developments will be greater with Tier 1 and Tier 2 developments present.

621. Vessels using the gap between the Array Area and CampionWind may be subject to a greater collision risk. However, given the frequency with which vessels are anticipated to use this gap the likelihood of an encounter is very low. Should an encounter occur, the width of the gap (6.8 nm [12.6 km]) is sufficient to allow collision avoidance in compliance with COLREGs. This aligns with feedback from the MCA who were not concerned given the width of the gap.

622. The deviation of multiple routes north of the Array Area and through the gap of CampionWind and Aspen could increase collision risk given that the ability to approach this gap is constrained by the presence of the Array Area. However, given the volumes and sizes of traffic associated with these routes, the increase is anticipated to be limited and there is sea room available to ensure vessels are able to pass each other safely in compliance with the COLREGs should an encounter arise.

623. For small craft, the option to pass between the Array Area and other Tier 1 and Tier 2 developments is feasible, noting that small craft traffic volumes in the area are low. This may allow small craft to avoid commercial routeing and thus minimise collision risk, noting that the consequences should a small craft collide with a larger vessel would likely be exacerbated.

21.2.2 Tier 3

624. For this hazard there is no direct link between the Proposed Development and Tier 3 OWF and subsea cable developments due to the distance from the Proposed Development and the lack of interaction with any main commercial routes associated with the Proposed Development or lack of data available. Therefore, no additional assessment of risk has been undertaken.

21.2.3 Embedded Mitigation Measures

625. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to an EMP (C-08);
- Development of and adherence to an VMNSP (C-16);
- Application for safety zones (C-17);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19);
- Compliance with MGN 654 (C-21);
- Lighting and marking (C-24, C36, C42); and
- Marking on Admiralty charts (C-25).

21.2.4 Significance of Risk

626. The frequency of occurrence in relation to cumulative increased third-party vessel collision risk for the Array Area during all phases is considered **remote**. The severity of consequence in relation to cumulative increased third-party vessel collision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to cumulative increased third-party vessel collision risk is **tolerable with mitigation**.

627. The frequency of occurrence in relation cumulative increased third-party vessel collision risk for the offshore ECC during all phases is considered **extremely unlikely**. The severity of consequence in relation to cumulative increased third-party vessel collision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to cumulative increased third-party vessel collision risk is **broadly acceptable**.

21.3 Third-Party with Project Vessel Collision

628. *Project vessels associated with construction, O&M, and decommissioning activities may increase encounters and collision risk for other vessels already operating in the area on a cumulative level.*

21.3.1 Tier 1/2/3

629. All tiers of development are considered together given that the presence of project vessels will be greater with all tiers of development present.

630. There is the potential that the same base port(s) or similarly located ports could be used by cumulative developments for construction, O&M, and/or decommissioning vessels. On this basis, there may be an overall cumulative increase in project vessel presence within the general area, and as such the potential for increased encounters and collision risk with third party traffic. However, details of base ports are not currently available (across all cumulative tiers) and so a detailed risk assessment is not possible.

631. However, all developers are expected to establish appropriate marine coordination and vessel management systems with project vessels complying with Flag State regulations including the COLREGs and SOLAS.

21.3.2 Embedded Mitigation Measures

632. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to an EMP (C-08);
- Development of and adherence to a VMNSP (C-10, C-16);
- Application for safety zones (C-17);
- Guard vessel(s) via risk assessment (C-18);
- Promulgation of information (C-19); and
- Project vessel compliance with international marine regulations (C-22).

21.3.3 Significance of Risk

633. The frequency of occurrence in relation to cumulative third-party with project vessel collision risk for the Array Area during all phases is considered **reasonably probable**. The severity of consequence in relation to cumulative third-party with project vessel collision risk is considered **minor**. Overall, it is predicted that the significance of risk due to cumulative third-party with project vessel collision risk is **broadly acceptable**.

634. The frequency of occurrence in relation cumulative third-party with project vessel collision risk for the offshore ECC during all phases is considered **reasonably probable**. The severity of consequence in relation to cumulative third-party with project vessel collision risk is considered **minor**. Overall, it is predicted that the significance of risk due to cumulative third-party with project vessel collision risk is **broadly acceptable**.

21.4 Reduced Access to Local Ports, Harbours, and Marinas

635. *Construction, O&M, and decommissioning activities and the presence of the Proposed Development alongside other cumulative developments may reduce access to local ports and harbours.*

21.4.1 Tier 1/2

636. Tier 1 and Tier 2 developments are considered together given that the reduction in navigable sea room resulting from the presence of developments and potential for overlapping programmes will be greater with Tier 1 and Tier 2 developments present.

637. Given the relative distance to ports in the area and the anticipated cumulative deviations for the main commercial routes, it is not anticipated that there will be any substantial effect due to activities associated with Tier 1 and Tier 2 cumulative developments beyond the deviations already outlined for hazards relating to vessel

displacement. This assumes that the duration and nature of such activities are analogous to that considered for the Proposed Development, especially for the areas on approach to the offshore ECC landfall.

638. There is also no current known programmes of construction or cable installation activities associated with Tier 1 or Tier 2 developments that will overlap temporally with the Proposed Development. However, in the event this did occur, it is anticipated that the developments would coordinate activities in liaison with local ports so as to ensure that access constraints are minimised. As is the case for the assessment of the Proposed Development in isolation, promulgation of information to allow mariners to passage plan accordingly is key.

21.4.2 Tier 3

639. Again, it is not anticipated that there will be any substantial effect due to activities associated with Tier 3 cumulative developments beyond the deviations already outlined for hazards relating to vessel displacement.

21.4.3 Embedded Mitigation Measures

640. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to an EMP (C-08);
- Development of and adherence to a VMNSP (C-10);
- Promulgation of information (C-19); and
- Project vessel compliance with international marine regulations (C-22).

21.4.4 Significance of Risk

641. The frequency of occurrence in relation to cumulative reduced access to local ports, harbours, and marinas for the Array Area during all phases is considered **reasonably probable**. The severity of consequence in relation to cumulative reduced access to local ports, harbours, and marinas is considered **minor**. Overall, it is predicted that the significance of risk due to cumulative reduced access to local ports, harbours, and marinas is **tolerable with mitigation**.

642. The frequency of occurrence in relation to cumulative reduced access to local ports, harbours, and marinas for the offshore ECC during all phases is considered **frequent**. The severity of consequence in relation to cumulative reduced access to local ports, harbours, and marinas is considered **minor**. Overall, it is predicted that the significance of risk due to cumulative reduced access to local ports, harbours, and marinas is **tolerable with mitigation**.

21.5 Creation of Vessel to Structure Allision Risk

643. *The presence of structures within the Array Area and other cumulative developments will lead to the creation of powered, drifting and internal allision risk for vessels.*

21.5.1 Tier 1

644. Given the localised nature of vessel to structure allision risk, cumulative risk is limited. However, given that small craft may choose to navigate between the Array Area and nearby Tier 1 developments, especially CampionWind, there is some potential cumulative allision risk. This sea room is considered adequate to allow safe navigation by small craft, noting the 6.8 nm gap (12.6 km) between the Array Area and CampionWind was deemed suitable by the MCA during consultation for commercial routeing vessels to utilise. The NLB will give due consideration to cumulative lighting and marking requirements across both the Proposed Development and other developments (most notably CampionWind).

21.5.2 Tier 2/3

645. The distance between the Array Area and Tier 2 and Tier 3 developments is sufficient that no potential cumulative allision risk is considered and therefore Tier 2 and Tier 3 developments are considered together for this hazard. All developments will be required to implement marine lighting and marking in agreement with NLB and in compliance with IALA G1162 (IALA, 2021), meaning the localised risk is managed.

21.5.3 Embedded Mitigation Measures

646. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to a DSLP (C-03);
- Development of and adherence to an EMP (C-08);
- Development of and adherence to a VMNSP (C-10);
- Fisheries liaison (C-12, C-13);
- Application for safety zones (C-17);
- Promulgation of information (C-19);
- Compliance with MGN 654 (C-21);
- Project vessel compliance with international marine regulations (C-22);
- Lighting and marking (C24, C-36, C42);
- Marking on Admiralty charts (C-25); and
- Minimum blade tip clearance (C-33).

21.5.4 Significance of Risk

647. The frequency of occurrence in relation to the cumulative creation of vessel to structure allision risk for the Array Area during the O&M phase is considered **remote**. The severity of consequence in relation to cumulative creation of vessel to structure allision risk is considered **moderate**. Overall, it is predicted that the significance of risk due to cumulative creation of vessel to structure allision risk is **tolerable with mitigation**.

21.6 Reduction in Under Keel Clearance as a Result of Cable Protection, Dynamic Cables, or Mooring Lines

648. *Presence of mooring lines, buoyant inter-array cables, or protection over subsea cables of other cumulative developments may reduce charted water depths leading to increased risk of under keel interaction for passing vessels.*

21.6.1 Tier 1/2

649. Given the localised nature of under keel clearance risk, cumulative risk is limited. However, given the potential for the export cable route corridors for the Proposed Development and Tier 1 and Tier 2 developments to be in relatively close proximity, there is some potential cumulative under keel clearance risk associated with the presence of cable protection. Tier 1 and Tier 2 developments are considered together given the similar nature of these developments and the export cable related mitigation.

650. Portions of the offshore ECC which may be shared with the Tier 1 or Tier 2 export cable routes are expected to be outside of the nearshore area such that the likelihood of a reduction in charted water depth greater than 5% is low. Nevertheless, as per the assessment of the Proposed Development in isolation, in such circumstances the MCA will be consulted on appropriate mitigation (if required) to ensure the under keel interaction risk is ALARP.

21.6.2 Tier 3

651. RYA Scotland noted during consultation that subsea cables may have a cumulative impact. Where Tier 3 subsea cable developments may cross the offshore ECC a further reduction in under keel clearance may occur at the site of cable crossing. The spatial extent of the hazard is small given that a vessel must be in close proximity to the cable crossing for any risk to occur. Any reduction in under keel clearance created by cable crossings will be determined within the cable burial risk assessment which will be undertaken by both developments. At the time of instalment of a cable crossing, a cable crossing agreement will also likely occur between developments.

21.6.3 Embedded Mitigation Measures

652. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to a CaP (C-02);
- Compliance with MGN 654 (C-21);
- Compliance with regulatory floating guidance (C-26);
- Notification of damage or decay of cables (C-23);
- Marking on Admiralty charts (C-25); and
- Cable burial risk assessment (C-29).

21.6.4 Significance of Risk

653. The frequency of occurrence in relation to cumulative reduction of under keel clearance as a result of cable protection, dynamic cables, and mooring lines for the Proposed Development during the O&M phase is considered **frequent**. The severity of consequence in relation to cumulative reduction of under keel clearance as a result of cable protection, dynamic cables, and mooring lines is considered **minor**. Overall, it is predicted that the significance of risk due to cumulative reduction of under keel clearance as a result of cable protection, dynamic cables, and mooring lines is **tolerable with mitigation**.

21.7 Reduction in Emergency Response Capabilities Including SAR

654. *The presence and activities associated with additional cumulative development may further increase the likelihood of incidents requiring an emergency response and could subsequently increase the likelihood of multiple incidents occurring simultaneously, adding additional stress on emergency responders*.

21.7.1 Tier 1/2/3

655. The presence and activities associated with additional cumulative development may further increase the likelihood of incidents requiring an emergency response and could subsequently increase the likelihood of multiple incidents occurring simultaneously, adding additional stress on emergency responders.

656. As for the Proposed Development in isolation, it is assumed that cumulative developments will have mitigation measures in place to reduce the likelihood of emergency response capability being compromised. This includes marine coordination for project vessels and compliance with Flag State regulations. SOLAS obligations will also be applicable to all cumulative developments and may have a positive effect, e.g., a project vessel for any other nearby offshore wind developments may be able to assist with an incident associated with the Proposed Development, or vice-versa. Nevertheless, the presence of structures and associated activities across multiple developments will increase the likelihood of an incident occurring that requires an emergency response.

657. Given that the Array Area is not immediately adjacent to any cumulative development, there is not considered to be any cumulative risk associated with SAR access, noting that a 1 nm (1.85 km) separation is required by MGN 654.

21.7.2 Embedded Mitigation Measures

658. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- Development of and adherence to a DSLP (C-03);
- Development of and adherence to an EMP (C-08);

- Development of adherence to a VMNSP (C-10);
- Compliance with MGN 654 (C-21);
- Project vessel compliance with international marine regulations (C-22); and
- Lighting and marking (C-24, C36, C-42).

21.7.3 Significance of Risk

659. The frequency of occurrence in relation to cumulative reduction of emergency response capability including SAR for the Proposed Development during the O&M phase is considered **remote**. The severity of consequence in relation to cumulative reduction of emergency response capability including SAR is considered **serious**. Overall, it is predicted that the significance of risk due to cumulative reduction of emergency response capability including SAR is **tolerable with mitigation**.

22 Risk Control Log

660. Table 22-1 presents a summary of the assessment of Shipping and Navigation hazards risk assessed. This includes the proposed embedded mitigation measures, frequency of occurrence, severity of consequence and significance of risk, per hazard.

661. Addition mitigation measures and subsequent residual significance of risk is considered in Section 25.

Table 22-1 Risk Control Log

Hazard	Scenario	Component	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk
Vessel displacement	In isolation	Array Area	Construction	▪ Development and adherence to an VMNSP; ▪ Application for safety zones; ▪ Marking on Admiralty charts; ▪ Guard vessel(s) via risk assessment; ▪ Promulgation of information; ▪ Compliance with MGN 654; and ▪ Lighting and marking.	Frequent	Minor	**Tolerable with Mitigation**
			O&M		Frequent	Minor	**Tolerable with Mitigation**
			Decommissioning		Frequent	Minor	**Tolerable with Mitigation**
		Offshore ECC	Construction		Reasonably Probable	Negligible	**Broadly Acceptable**
			O&M		Reasonably Probable	Negligible	**Broadly Acceptable**
			Decommissioning		Reasonably Probable	Negligible	**Broadly Acceptable**
	Cumulative	Array Area	All Phases		Frequent	Moderate	**Tolerable with Mitigation**
		Offshore ECC	All Phases		Reasonably Probable	Minor	**Tolerable with Mitigation**
Increased third-party vessel collision risk	In isolation	Array Area	Construction	▪ Development of and adherence to an EMP; ▪ Development of and adherence to an VMNSP; ▪ Application for safety zones; ▪ Guard vessel(s) via risk assessment; ▪ Promulgation of information;	Remote	Moderate	**Tolerable with Mitigation**
			O&M		Remote	Moderate	**Tolerable with Mitigation**
			Decommissioning		Remote	Moderate	**Tolerable with Mitigation**
		Offshore ECC	Construction		Extremely Unlikely	Moderate	**Broadly Acceptable**

Hazard	Scenario	Component	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk
			O&M	▪ Compliance with MGN 654 ▪ Lighting and marking; and ▪ Marking on Admiralty charts.	Negligible	Moderate	**Broadly Acceptable**
			Decommissioning		Extremely Unlikely	Moderate	**Broadly Acceptable**
	Cumulative	Array Area	All Phases		Remote	Moderate	**Tolerable with Mitigation**
		Offshore ECC	All Phases		Extremely Unlikely	Moderate	**Broadly Acceptable**
Third-party with project vessel collision risk	In isolation	Array Area	Construction	▪ Development of and adherence to an EMP; ▪ Development of and adherence to a VMNSP; ▪ Application for safety zones; ▪ Guard vessel(s) via risk assessment; ▪ Promulgation of information; and ▪ Project vessel compliance with international marine regulations.	Extremely Unlikely	Moderate	**Broadly Acceptable**
			O&M		Extremely Unlikely	Moderate	**Broadly Acceptable**
			Decommissioning		Extremely Unlikely	Moderate	**Broadly Acceptable**
		Offshore ECC	Construction		Remote	Moderate	**Tolerable with Mitigation**
			O&M		Extremely Unlikely	Moderate	**Broadly Acceptable**
			Decommissioning		Remote	Moderate	**Tolerable with Mitigation**
	Cumulative	Array Area	All Phases		Reasonably Probable	Minor	**Broadly Acceptable**
		Offshore ECC	All Phases		Reasonably Probable	Minor	**Broadly Acceptable**
Reduced access to local port, harbours, and marinas	In isolation	Array Area	Construction	▪ Development of and adherence to an EMP; ▪ Development of and adherence to a VMNSP; ▪ Promulgation of information; and	Remote	Minor	**Broadly Acceptable**
			O&M		Extremely Unlikely	Minor	**Broadly Acceptable**
			Decommissioning		Remote	Minor	**Broadly Acceptable**
		Offshore ECC	Construction		Frequent	Minor	**Tolerable with Mitigation**

Hazard	Scenario	Component	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk
			O&M	▪ Project vessel compliance with international marine regulations.	Reasonably Probable	Minor	**Tolerable with Mitigation**
			Decommissioning		Frequent	Minor	**Tolerable with Mitigation**
	Cumulative	Array Area	All Phases		Reasonably Probable	Minor	**Tolerable with Mitigation**
		Offshore ECC	All Phases		Frequent	Minor	**Tolerable with Mitigation**
Loss of station	In isolation	Array Area	Construction	▪ Development of and adherence to an EMP; ▪ Fisheries liaison; ▪ Development of and adherence to a VMNSP; ▪ Guard vessel(s) via risk assessment; ▪ Promulgation of information; ▪ Lighting and marking; ▪ Compliance with regulatory floating guidance; and ▪ Minimum blade tip clearance.	Extremely Unlikely	Moderate	**Broadly Acceptable**
			O&M		Remote	Moderate	**Tolerable with Mitigation**
			Decommissioning		Extremely Unlikely	Moderate	**Broadly Acceptable**

Hazard	Scenario	Component	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk
Creation of vessel to structure allision risk	In isolation	Array Area	O&M	▪ Development of and adherence to a DSLP; ▪ Development of and adherence to an EMP; ▪ Development of and adherence to a VMNSP; ▪ Fisheries liaison; ▪ Application for safety zones; ▪ Promulgation of information; ▪ Compliance with MGN 654; ▪ Project vessel compliance with international marine regulations; ▪ Lighting and marking; ▪ Marking on Admiralty charts; ▪ Minimum blade tip clearance; and ▪ Development of and adherence to a WSP	Remote	Moderate	**Tolerable with Mitigation**
	Cumulative	Array Area	O&M		Remote	Moderate	**Tolerable with Mitigation**
Reduction of under keel	In isolation	Proposed Development	O&M	▪ Development of and adherence to a CaP; ▪ Compliance with MGN 654;	Reasonably Probable	Minor	**Tolerable with Mitigation**

Hazard	Scenario	Component	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk
clearance as a result of cable protection, dynamic cables, and mooring lines	Cumulative	Proposed Development	O&M	▪ Compliance with regulatory floating guidance; ▪ Notification of damage or decay of cables; ▪ Marking on Admiralty charts; and ▪ Cable burial risk assessment.	Frequent	Minor	**Tolerable with Mitigation**
Anchor interaction with mooring lines or subsea cables	In isolation	Proposed Development	O&M	▪ Development of and adherence to a CaP; ▪ Development of and adherence to an VMNSP; ▪ Compliance with regulatory floating guidance; ▪ Guard vessel(s) via risk assessment; ▪ Promulgation of information; ▪ Notification of damage or decay of cables; ▪ Marking on Admiralty charts; and ▪ Compliance with regulatory floating guidance.	Minor	Negligible	**Broadly Acceptable**

Hazard	Scenario	Component	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk
Reduction of emergency response capability including SAR	In isolation	Proposed Development	O&M	▪ Development of and adherence to a DSLP; ▪ Development of and adherence to an EMP; ▪ Development of adherence to a VMNSP; ▪ Compliance with MGN 654; ▪ Project vessel compliance with international marine regulations; and ▪ Lighting and marking.	Extremely Unlikely	Serious	**Tolerable with Mitigation**
	Cumulative	Proposed Development	O&M		Remote	Serious	**Tolerable with Mitigation**

23 Embedded Mitigation Measures

662. As part of the Proposed Development design process, a number of embedded mitigation measures have been adopted to reduce the potential for risk to Shipping and Navigation.

663. These measures typically include those that have been identified as good or standard practice and include actions that would 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 Proposed Development.

664. The embedded mitigation measures within the design relevant to Shipping and Navigation together with their code applied in the Commitments Register (**Volume 3, Appendix 6.1 (Commitments Register)**) are outlined in Table 23-1.

Table 23-1 Embedded Mitigation Measures Relevant to Shipping and navigation

Code	Subject Matter	Details	How the Embedded Mitigation Measures will be Secured
C-02	Development of and adherence to a CaP.	The CaP will confirm planned cable routeing, installation methods, cable specifications and any additional protection and any post-installation monitoring.	CaP
C-03	Development of and adherence to a DSLP.	The DSLP will confirm layout and relevant design parameters.	DSLP
C-08	Development of and adherence to an EMP.	This will set out mitigation measures and procedures relevant to environmental management, including but not limited to chemical usage, invasive and non-native species, pollution prevention and waste management.	EMP
C-09	Development of and adherence to a DP.	The DP will outline measures for the decommissioning of the Proposed Development.	DP
C-10	Development of and adherence to a VMP (forming part of the VMNSP).	The VMNSP will confirm the types and numbers of vessels that will be engaged on the Proposed Development and consider vessel coordination including indicative transit route planning.	VMNSP
C-12	Fisheries liaison	Ongoing liaison with fishing fleets will be maintained during construction, maintenance and decommissioning operations via an appointed FLO and Fishing Industry Representative.	FMMS

Code	Subject Matter	Details	How the Embedded Mitigation Measures will be Secured
C-13		Adherence to best practice guidance with regards to fisheries liaison and procedures in the event of interactions between the Proposed Development and fishing activities (e.g., FLOWW, 2014; 2015).	FMMS
C-16	Development of and adherence to a Navigational Safety Plan (NSP) (forming part of the VMNSP).	The VMNSP will describe measures put in place by the Proposed Development related to navigational safety, including information on safety zones, charting, construction buoyage, temporary lighting and marking, and means of notification of Proposed Development activity to other sea users (e.g., via Notifications to Mariners).	NSP
C-17	Application for safety zones	Applications to be made, where appropriate, for safety zones (500 m) for construction and major maintenance works, and pre commissioning (50 m).	VMNSP
C-18	Guard vessel(s) via risk assessment	Use of guard vessels where deemed appropriate to ensure adherence with safety zones or advisory passing distances, as defined by risk assessment, to mitigate any impact which poses a risk to surface navigation during construction, maintenance and decommissioning phases. Such impacts may include partially installed structures or cables, extinguished navigation lights or other unmarked hazards.	VMNSP
C-19	Promulgation of information	Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated safety zones and advisory passing distances will be given via Notifications to Mariners and Kingfisher Bulletins.	VMNSP
C-21	Compliance with MGN 654	Compliance with MGN 654 (MCA, 2021) and its annexes where applicable including consideration of a SAR Checklist, an ERCoP and under keel clearance requirements. Consideration will also be given to MGN 543 Search and Rescue (SAR) Annex 5 (MCA, 2018).	CaP CMS DSLP
C-22	Project vessel compliance with international marine regulations	Compliance of all project vessels with international marine regulations as adopted by the Flag State, notably the COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974).	VMNSP

Code	Subject Matter	Details	How the Embedded Mitigation Measures will be Secured
C-23	Notification of damage or decay to cables	Notification of damage or decay to cables to the MCA, NLB Kingfisher and UKHO within 24 hours of discovery.	CaP VMNSP
C-24	Lighting and marking	AtoNs (marking and lighting) will be deployed in accordance with the latest relevant available standard industry guidance and as advised by NLB, MCA, Civil Aviation Authority (CAA) and Ministry of Defence (MoD) as appropriate. This will include a buoyed construction area around the Array Area in consultation with NLB and all AtoNs will be subject to a AtoN Management Plan undertaken post consent.	VMNSP LMP AtoN Management Plan
C-36		The LMP will confirm compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.	LMP
C-42		Lighting and marking failures appropriately reported/rectified as soon as possible and interim hazard warnings put in place as required.	LMP
C-25	Marking on Admiralty charts	Appropriate marking of the Proposed Development on Admiralty and aeronautical charts. This will include provision of the positions and heights of structures to the UKHO, CAA, MoD and Defence Geographic Centre (DGC).	NSP LMP
C-26	Compliance with regulatory floating guidance	Compliance with regulatory expectations on moorings for floating wind and marine devices published by MCA and the HSE.	CMS
C-29	Cable burial risk assessment	Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the cable burial risk assessment and detailed within the CaP. In areas where the cable burial risk assessment deems burial not feasible, suitable implementation and monitoring of cable protection will be employed.	CaP
C-33	Minimum blade tip clearance	Minimum blade clearance of 30 m above MSL.	DSLP CMS

23.1 Marine Aids to Navigation

665. Throughout all phases, AtoNs will be provided in accordance with NLB and MCA requirements, with consideration being given to IALA Recommendation O-139 and G1162 (IALA, 2021) and MGN 654 (MCA, 2021) as per **Volume 4, Appendix 5 (Outline Vessel Management and Navigation Safety Plan)**, **Volume 4, Appendix 6 (Outline AtoN Management Plan)**, and **Volume 4, Appendix 7 (Outline Lighting and Marking Plan)**.

23.1.1 Construction and Decommissioning Phases

666. During the construction and decommissioning phases, buoyed construction and decommissioning areas will be established and marked, where required, in accordance with NLB requirements based on the IALA Maritime Buoyage System. In addition, where advised by NLB, additional marking on structures may also be applied as per.

23.1.2 Operation and Maintenance Phase

667. Marking during the O&M phase will be agreed in consultation with NLB once the final array layout has been selected post consent; however, the following subsections summarise likely requirements.

23.1.2.1 Marking of Individual Array Structures

668. As per IALA Guideline G1162, each surface structure within the Array Area will be painted yellow from the level of Highest Astronomical Tide (HAT) to at least 15 m 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.

669. 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 3 m above sea level and at a distance of at least 150 m from the WTG. The light will be either hooded or baffled so as to avoid unnecessary light pollution or confusion with navigational marks.

23.1.2.2 Marking of Array as a Whole

670. The marking of the array as a whole will be agreed with NLB once the final array layout has been selected and will be in line with IALA Recommendation O-139 and G1162. As per the IALA guidance, and in consultation with NLB, 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 5 nm (9.26 km) nominal range and omnidirectional fog signals as appropriate and where prescribed by NLB, and will be sounded at least when the visibility is 2 nm (3.70 km) 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 2 nm (3.70 km) 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 6 m above HAT and below the arc of the lowest WTG blades;
- 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; however, will likely be synchronised Morse "W" at the request of NLB; and
- All lighting will be considered cumulatively with existing aids to navigation to avoid the potential for light confusion to passing traffic.

671. Consideration will also be given to the use of marking via AIS, or other electronic means (such as 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 Area.

23.1.2.3 Marking of Export Cables

672. No lighting or physical marking will be required during the O&M phase for the export cables.

23.2 Design Specifications Noted in Marine Guidance Note 654

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

24 Through Life Safety Management

24.1 Quality, Health, Safety and Environment

674. QHSE documentation including a Safety Management System (SMS) will be in place for the Proposed Development and will be continually updated throughout the development process. The following subsections provide an overview of this documentation and how it will be maintained and reviewed with reference, where required, to specific marine documentation.

675. Monitoring, reviewing, and auditing will be carried out on all procedures and activities and feedback actively sought. Any designated person (identified in QHSE documentation), managers, and supervisors are to maintain continuous monitoring of all marine operations and determine if all required procedures and processes are being correctly implemented.

24.2 Incident Reporting

676. After any incidents, including near misses, an incident report form will be completed in line with the Proposed Development QHSE documentation. This will then be assessed for relevant outcomes and reviewed for possible changes required to operations.

677. The Developer will maintain records of investigation and analyse incidents in order to:

- Determine underlying deficiencies and other factors that may be causing or contributing to the occurrence of incidents;
- Identify the need for corrective action;
- Identify opportunities for preventative action;
- Identify opportunities for continual improvement; and
- Communicate the results of such investigations.

678. All investigations shall be performed in a timely manner.

679. A database of lessons learnt from all marine incidents will be developed. It will include the outcomes of investigations and any resulting actions. The Developer will promote awareness of incident occurrence and provide information to assist monitoring, inspection and auditing of documentation.

680. When appropriate, the designated person (noted within the ERCoP) should inform the MCA of any exercise or incidents including any implications on emergency response. If required, the MCA should be invited to take part in incident debriefs.

24.3 Review of Documentation

681. The Developer will be responsible for reviewing and updating all documentation including the risk assessments, ERCoP, SMS and, if required, will convene a review panel of stakeholders to quantify risk.

682. Reviews of the risk register should be made after any of the following occurrences:

- Changes to the development, conditions of operation and prior to decommissioning;
- Planned reviews; and
- Following an incident or exercise.

683. A review of potential risks should be carried out annually. A review of the response charts should be undertaken annually to ensure that response procedures are up to date and should include any amendments from audits, incident reports and identified deficiencies.

24.4 Inspection of Resources

684. All vessels, facilities, and equipment necessary for marine operations are to be subject to appropriate inspection and testing to determine fitness for purpose and availability in relation to their performance standards. This will include monitoring and inspection of all aids to navigation to determine compliance with the performance standards specified by NLB.

24.5 Audit Performance

685. Auditing and performance review are the final steps in QHSE management systems. The feedback loop enables an organisation to reinforce, maintain and develop its ability to reduce risks to the fullest extent, and to ensure the continued effectiveness of the system. The Developer will carry out audits and periodically evaluate the efficiency of the marine safety documentation.

686. The audits and possible corrective actions should be undertaken in accordance with standard procedures and results of the audits and reviews should be brought to the attention of all personnel having responsibility in the area involved.

24.6 Safety Management System

687. The Developer will manage the risk associated with the activities undertaken at the Proposed Development. An integrated SMS, which ensures that the safety and environmental risks of those activities are ALARP, will be established. This includes the use of remote monitoring and switching for aids to navigation to ensure that if a light is faulty a quick fix can be instigated, which will allow IALA availability requirements to be met.

24.7 Cable Monitoring

688. The subsea cable routes will be subject to periodic inspection post-construction to monitor the condition of the cable, any installed cable protection, and cable burial depths. Maintenance of the cable protection will be undertaken as necessary.

689. If exposed cables or ineffective cable protection measures are identified during post-construction monitoring, these would be promulgated to relevant sea users including via Notifications to Mariners and Kingfisher Bulletins. Where immediate risk was observed, the Developer would also employ additional temporary measures (such as a guard vessel or temporary buoyage) until such time as the risk was adequately mitigated.

690. Details will be included in full within the assessment of cable burial and protection document, to be produced post-consent.

24.8 Hydrographic Surveys

691. As required by Annex 4 of MGN 654, detailed and accurate hydrographic surveys will be undertaken periodically at intervals agreed with the MCA.

24.9 Decommissioning Programme

692. A DP will be developed post consent. With regards to hazards to Shipping and Navigation, this will also include consideration of the scenario where upon decommissioning and completion of removal operations, an obstruction is left on-site (attributable to the Proposed Development) which is considered to be a danger to navigation and which it has not proved possible to remove. Such an obstruction may result is a requirement for the Developer or Operator of the Proposed Development to implement marking until such time as it is either removed or no longer considered a danger to navigation.

25 Summary

25.1 Consultation

693. The NRA process has included consultation with stakeholders of relevance to Shipping and Navigation. This has included consideration of the outputs of the scoping process, direct liaison with key stakeholders (both statutory and non-statutory), outreach to Regular Operators of the area, and a Hazard Workshop. Stakeholders which were consulted include the following:

- MCA;
- NLB;
- UK Chamber of Shipping;
- RYA Scotland;
- SWFPA;
- Peterhead Port Authority; and
- Tidewater Marine UK Ltd.

25.2 Existing Environment

25.2.1 Navigational Features

694. Key navigational features in the area include Peterhead Port located 34 nm (62.9 km) west of the Array Area, as well as its associated pilot boarding station. Peterhead Port is the largest fishing port in Europe as well as being an important base for serving a range of commercial vessels. Hywind Scotland floating OWF is situated approximately 19 nm (35.2 km) to the west of the Array Area and shares a point of its northern border with the offshore ECC. Hywind's export cable intersects the offshore ECC near shore. The electrical cable and subsea pipeline linking the Forties Field to Cruden Bay intersect the offshore ECC at the same point approximately 15 nm (27.8 km) offshore. Many oil and gas field are in proximity to the Proposed Development with the closest the Buzzard Field and associated surface platforms approximately 20 nm (37.0 km) north and the Ettrick Field approximately 22 nm (44.7 km) north.

25.2.2 Maritime Incidents

695. From DfT SAR helicopter taskings data recorded between April 2015 and March 2023, there were a total of 10 helicopter taskings were recorded within the combined study areas, equating to an average of one per year. No taskings were recorded within the Array Area or offshore ECC.

696. Within the combined study areas, there was an average of four to five unique RNLI incidents per year with unspecified incidents (46%) the most frequently recorded incident type with '*machinery failure*' following (26%). Approximately 85% of

incidents occurred within 5 nm (9.26 km) of the coast and no incidents were located within the Array Area itself. Peterhead RNLI station responded to 78% of all incidents.

697. Within the combined study areas, there was an average of three unique MAIB incident per year with '*accident to person*' (32%) and '*machinery failure*' (30%) the most frequently recorded incident types. One incident was recorded within the Array Area – a near miss collision. Approximately 71% of incidents occurred within 6 nm (11.1 km) of the coast.

25.2.3 Vessel Traffic Movements

25.2.3.1 Array Area

698. From the 28-days of vessel traffic survey data recorded in February 2023 and July/August 2023 within the study area, there was an average of 12 unique vessels per day recorded within the study area during the winter survey period, with an average of three unique vessels recorded within the Array Area. During the summer survey period, an average of 18 unique vessels were recorded within the study area per day with an average of three vessels per day within the Array Area.

699. The main vessel types within the study area during the winter survey period were oil and gas vessels (73%) and cargo vessels (13%). The main vessel types within the study area during the summer survey period were oil and gas vessels (48%), cargo vessels (19%), and fishing vessels (18%).

700. A total of 18 main commercial routes were identified from the vessel traffic survey data and the long-term vessel traffic data. The highest use main commercial route was an oil and gas specific route between Aberdeen – Alba/Britannia/Andrew Fields. Approximately eight vessels per week were recorded on this route.

25.2.3.2 Offshore ECC

701. During the 28-days of AIS-only vessel traffic data from February 2023 and July/August 2023 within the offshore ECC study area, there was an average of 48 unique vessels per day during the winter data period, with an average of 39 unique vessels recorded crossing the offshore ECC. During the summer data period, an average of 62 unique vessels were recorded within the offshore ECC study area per day with an average of 45 crossing the offshore ECC.

702. The main vessel types within the offshore ECC study area during the winter data period were oil and gas vessels (43%) and fishing vessels (32%). The main vessel types within the offshore ECC study area during the summer data period were fishing vessels (31%) and oil and gas vessels (30%).

25.3 Collision and Allision Risk Modelling

703. Of the 18 main routes identified, it is anticipated that seven will require a deviate as a result of the Proposed Development. The largest increase was to Route 4, with a

1.5 nm (2.78 km) increase – however, the percentage increase to this route was 1.5%, and so relatively small.

704. The NRA process included quantitative modelling of the change in allision and collision frequency as a result of the Proposed Development, with consideration given to future cases in terms of potential future traffic increases. For allision modelling, an indicative layout including 69 locations was used, noting that this provides conservative results for quantifying allision risk.

705. Assuming commercial routes deviate in the presence of the Array Area, it was estimated that the return period of a vessel being involved in a collision post wind farm was 3,359 years assuming base case traffic levels. This represents a 28% increase in collision frequency compared to the pre wind farm base case result.

706. The powered allision return period post wind farm was estimated at 4,376 years assuming base case traffic levels. The corresponding drifting allision return period post wind farm was estimated at 33,517 years. The fishing vessel allision return period was estimated at 34 years, noting that this conservatively assumes that there is no change in baseline fishing activity.

25.4 Risk Statement

707. Overall, the risk assessment of both the Proposed Development in isolation and cumulatively with other developments concluded that there will be no significant risks arising from the Proposed Development with embedded mitigation measures in place during the construction, O&M or decommissioning phases. The significance of risk for all hazards across the in isolation and cumulative risk assessments were predicted to be of **broadly acceptable** or **tolerable with mitigation** and ALARP assuming the implementation of the embedded mitigation measures identified.

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Annex A MGN 654 Checklist

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

709. 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 10: Vessel Traffic Movements** All vessel types are considered with specific breakdowns by vessel type given within the study area.
At least 28 days duration, within either 12 or 24 months prior to submission of the EIAR.	✓	**Section 5: Data Sources** A total of 28 full days of vessel traffic survey data from February 2023 and July/August 2023 has been assessed within the study area.
Multiple data sources.	✓	**Section 5: Data Sources** The vessel traffic survey data includes AIS, Radar and visual observations to maximise coverage of vessels not broadcasting on AIS. Geophysical survey data consisting of non-AIS visual observations and long-term vessel traffic data recorded on AIS have also been considered.
Seasonal variations.	✓	**Section 5: Data Sources** A total of 28 full days of vessel traffic survey data from February 2023 and July/August 2023 has been assessed within the study area. **Annex E: Long-Term Vessel Traffic Movements** To assist with the assessment of seasonal variation a long-term AIS dataset covering 12 months in 2022 has also been assessed.

Issue	Compliance	Comments
MCA consultation.	✓	**Section 4: Consultation** The MCA has been consulted as part of the NRA process including through the Hazard Workshop.
General Lighthouse Authority (GLA) consultation.	✓	**Section 4: Consultation** NLB has been consulted as part of the NRA process including through the Hazard Workshop.
UK Chamber of Shipping consultation.	✓	**Section 4: Consultation** The UK Chamber of Shipping has been consulted as part of the NRA process including through a follow up of the Hazard Workshop.
Recreational and fishing vessel organisations consultation.	✓	**Section 4: Consultation** The RYA and SWFPA have been consulted as part of the NRA process including through the Hazard Workshop.
Port and navigation authorities consultation, as appropriate.	✓	**Section 4: Consultation** Peterhead Port Authority have been consulted as part of the NRA process including through the Hazard Workshop.
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 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Proposed Development has been analysed. **Section 17: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase – Sections 18 to 20 . **Section 21: Cumulative Risk Assessment** The hazards due to the Proposed Development and cumulative developments have been assessed for each phase.
ii. Numbers, types and sizes of vessels presently using such areas.	✓	**Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Proposed Development 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 10: Vessel Traffic Movements** Non-transit users were identified in the vessel traffic survey data and included fishing vessels engaged in fishing activities, pilotage activities and waiting activities.
iv. Whether these areas contain transit routes used by coastal or deep-draught vessels on passage.	✓	**Section 11: Base Case Vessel Routeing** Main commercial routes have been identified using the principles set out in MGN 654 in proximity to the Proposed Development, with these routes taking into account coastal, deep-draught and internationally scheduled vessels.
v. Alignment and proximity of the site relative to adjacent shipping lanes.	✓	**Section 7: Navigational Features** No IMO routeing measures were in proximity to the Proposed Development.

Issue	Compliance	Comments
vi. Whether the nearby area contains prescribed routeing schemes or precautionary areas.	✓	**Section 7: Navigational Features** No IMO routeing measures or military PEXAs were in proximity to the Proposed Development.
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** Section 7.2 identifies port approaches and pilot boarding stations in proximity to the Proposed Development. No anchorage areas are in proximity to the Proposed Development.
viii. Whether the site lies within the jurisdiction of a port and/or navigation authority.	✓	**Section 7: Navigational Features** Section 7.2 identifies the locations of ports in proximity to the Proposed Development.
ix. Proximity of the site to existing fishing grounds, or to routes used by fishing vessels to such grounds.	✓	**Section 10: Vessel Traffic Movements** Fishing vessel movements are considered within the study area. Detailed analysis of dedicated fishing vessel activities is undertaken in **Volume 2, Chapter 13 (Commercial Fisheries)**.
x. Proximity of the site to offshore firing/bombing ranges and areas used for any marine military purposes.	✓	**Section 7: Navigational Features** There are no military PEXAs in proximity to the Proposed Development.
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** There are no marine aggregate dredging areas in proximity to the Proposed Development and Section 7.6 identifies the charted wrecks in proximity to the Proposed Development.
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** Section 7.1 Identifies other OWF developments in proximity to the Proposed Development. **Section 13: Cumulative and Transboundary Overview** Considers other OREI sites in proximity to the Proposed Development cumulatively.
xiii. Proximity of the site relative to any designated areas for the disposal of dredging spoil or other dumping ground.	✓	**Section 7: Navigational Features** Section 7.6 identifies spoil and dumping rounds in proximity to the Proposed Development.
xiv. Proximity of the site to AtoNs and/or VTS in or adjacent to the area and any impact thereon.	✓	**Section 7: Navigational Features** Section 7.2 identifies VTS areas in proximity to the Proposed Development and Section 7.3 identifies AtoNs in proximity to the Proposed Development.

Issue	Compliance	Comments
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.	✓	**Section 16: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the Proposed Development including pinch (or choke) points in proximity to the Proposed Development.
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 9: Emergency Response and Incident Overview** Historical vessel incident data published by DfT (Section 9.1), RNLI (Section 9.1) and MAIB (Section 9.4) in proximity to the Proposed Development has been considered alongside historical OWF incident data throughout the UK (Section 9.5).
xvii. Proximity of the site to areas used for recreation which depend on specific features of the area.	✓	**Section 10: Vessel Traffic Movements** Non-transit users were identified in the vessel traffic survey data and included recreational activities.
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** A methodology for post wind farm routeing is outlined and includes a minimum distance of 1 nm (1.85 km) from offshore installations and existing OWF boundaries.
b. The width of a corridor between sites or OREIs to allow safe passage of shipping.	✓	**Section 21: Cumulative Risk Assessment** Not directly applicable to the Proposed Development although the safe passage of shipping between developments is discussed cumulatively.
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 16: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the Proposed Development. **Section 17: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase and include consideration of users such as commercial vessels, commercial fishing vessels in transit, recreational vessels, anchored vessels and emergency responders – Sections 18 to 20.

Issue	Compliance	Comments
b. Clearances of fixed or floating WTG blades above the sea surface are not less than 22 m (above MHWS for fixed). Floating turbines allow for degrees of motion.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** Section 6.2 outlines the Shipping and Navigation WCS for WTGs including the minimum air gap above MHWS.
c. Underwater devices: i. Changes to charted depth; ii. Maximum height above seabed; and iii. Under keel clearance.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** Section 6.3 outlines the Shipping and Navigation WCS for subsea cables including the cable burial specifications.
d. Whether structures block or hinder the view of other vessels or other navigational features.	✓	**Section 17: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase and include consideration of the potential for vessels navigating in proximity to structures to be visually obscured or inhibit the use of existing AtoNs – Sections 18 to 20.
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** Section 6.1 outlines the Shipping and Navigation worst-case scenario for the Proposed Development and includes the range of existing water depths. **Section 8: Meteorological Ocean Data** Section 8.4 provides meteorological data in proximity to the Proposed Development relating to various states of the tide. **Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Proposed Development has been analysed including vessel draught. **Section 16: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the Proposed Development including accounting for tidal conditions.
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.	✓	**Section 8: Meteorological Ocean Data** Section 8.4 provides meteorological data in proximity to the Proposed Development relating to various states of the tide. **Section 16: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the Proposed Development including accounting for tidal conditions.
c. The maximum rate tidal stream runs parallel to the major axis of the proposed site layout, and, if so, its effect.	✓	
d. The set is across the major axis of the layout at any time, and, if so, at what rate.	✓	

Issue	Compliance	Comments
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 8: Meteorological Ocean Data** Section 8.4 provides meteorological data in proximity to the Proposed Development relating to various states of the tide. **Section 16: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the Proposed Development including accounting for tidal conditions and assessment of whether machinery failure could cause vessels to be set into danger.
f. The structures themselves could cause changes in the set and rate of the tidal stream.	✓	**Section 8: Meteorological Ocean Data** Section 8.4 provides meteorological data in proximity to the Proposed Development relating to various states of the tide and notes that no effects are anticipated.
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 8: Meteorological Ocean Data** Section 8.4 provides meteorological data in proximity to the Proposed Development relating to various states of the tide. **Section 17: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase and include consideration of the potential for reduction in under keel clearance – Sections 18 to 20.
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 8: Meteorological Ocean Data** Provides meteorological data in proximity to the Proposed Development relating to weather and visibility. **Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Proposed Development has been analysed including recreational vessels. **Section 12: Adverse Weather Routeing** Section 12.2 identifies potential alternative vessel routeing in proximity to the Proposed Development in adverse weather. **Section 17: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase and include consideration of adverse weather routeing – Sections 18 to 20.
i. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer.	✓	**Section 17: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase and include consideration of internal allision risk for vessels under sail – Sections 18 to 20.

Issue	Compliance	Comments
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 8: Meteorological Ocean Data** Provides meteorological data in proximity to the Proposed Development relating to wind direction and various states of the tide. **Section 16: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the Proposed Development including accounting for weather conditions and assessment of whether machinery failure could cause vessels to be set into danger. **Section 17: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase and include consideration of drifting allision risk – Sections 18 to 20.
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** Section 4.2 outlines Regular Operator consultation undertaken following the vessel traffic surveys. **Section 12: Adverse Weather Routeing** Section 12.2 identifies potential alternative vessel routeing in proximity to the Proposed Development in adverse weather. **Section 16: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the Proposed Development including accounting for weather and tidal conditions. **Section 17: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase and include consideration of internal allision risk – Sections 18 to 20.
ii. For specified vessel types, operations and/or sizes.		
iii. In all directions or areas.		
iv. In specified directions or areas.		
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 15: Navigation, Communication and Position Fixing Equipment** Assesses potential hazards on navigation of the different communications and position fixing devices used in and around OWFs. **Section 14: Future Case Vessel Traffic**
ii. In respect of specific activities.	✓	
iii. In all areas or directions.	✓	
iv. In specified areas or directions.	✓	

Issue	Compliance	Comments
v. In specified tidal or weather conditions.	✓	A methodology for post wind farm routeing is outlined and includes a minimum distance of 1 nm (1.85 km) from offshore installations and existing OWF boundaries, i.e., it is assumed that commercial vessels will avoid the Array Area. **Section 17: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase and include consideration of vessel displacement – Sections 18 to 20.
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 17: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase and include consideration of vessel displacement and emergency response capability – Sections 18 to 20.
d. Guidance on the calculation of safe distance of OREI boundaries from shipping routes has been considered.		**Section 14: Future Case Vessel Traffic** 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, O&M and decommissioning phases of the OREI.	✓	**Section 24: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of Shipping and Navigation hazards including compliance with MGN 654 which includes the provision of an ERCoP.
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 2: Guidance and Legislation** Outlines the guidance and legislation used within the NRA including Annex 5 of MGN 654. **Section 24: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of Shipping and Navigation hazards including compliance with MGN 654 and its annexes.

Issue	Compliance	Comments
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 24: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of Shipping and Navigation hazards including compliance with MGN 654 which includes 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 24: Through Life Safety Management** Confirms that hydrographic surveys will be undertaken in agreement with the MCA.
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 15: Navigation, Communication and Position Fixing Equipment** Assesses the potential risks associated with the use of navigation, communication and position fixing equipment due to the Proposed Development including in relation to radio interference.
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.	✓	
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 15: Navigation, Communication and Position Fixing Equipment**
ii. Vessel to shore.	✓	
iii. VTS Radar to vessel.	✓	

Issue	Compliance	Comments
iv. Racon to/from vessel.	✓	Assesses the potential risks associated with the use of navigation, communication and position fixing equipment due to the Proposed Development including in relation to marine Radar.
c. The structures and generators might produce SONAR interference affecting fishing, industrial or military systems used in the area.	✓	**Section 15: Navigation, Communication and Position Fixing Equipment** Assesses the potential risks associated with the use of navigation, communication and position fixing equipment due to the Proposed Development including in relation to SONAR.
d. The site might produce acoustic noise which could mask prescribed sound signals.	✓	**Section 15: Navigation, Communication and Position Fixing Equipment** Assesses the potential risks associated with the use of navigation, communication and position fixing equipment due to the Proposed Development including in relation to noise.
e. Generators and the seabed cabling within the site and onshore might produce EMFs affecting compasses and other navigation systems.	✓	**Section 15: Navigation, Communication and Position Fixing Equipment** Assesses the potential risks associated with the use of navigation, communication and position fixing equipment due to the Proposed Development including in relation to electromagnetic interference.
Risk mitigation measures recommended for OREI during construction, O&M 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 24: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of Shipping and Navigation hazards including promulgation of information.
ii. Continuous watch by multi-channel VHF, including DSC.	✓	**Section 24: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of Shipping and Navigation hazards including marine coordination.
iii. Safety zones of appropriate configuration, extent and application to specified vessels[5].	✓	**Section 24: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of Shipping and Navigation hazards including the application for Safety Zones.
iv. Designation of the site as an Area to be Avoided (ATBA).	✓	There are no plans to designate the Proposed Development as an ATBA.

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

Issue	Compliance	Comments
v. Provision of aids to navigation as determined by the GLA.	✓	**Section 24: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of Shipping and Navigation hazards including lighting and marking in accordance with NLB and MCA requirements.
vi. Implementation of routeing measures within or near to the development.	✓	There are no plans to implement any new routeing measures in proximity to the Proposed Development.
vii. Monitoring by Radar, AIS, Closed Circuit Television (CCTV) or other agreed means.	✓	**Section 24: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of Shipping and Navigation hazards including traffic monitoring.
viii. Appropriate means for OREI operators to notify, and provide evidence of, the infringement of Safety Zones.	✓	**Section 24: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of Shipping and Navigation hazards including the application for Safety Zones and use of guard vessels, which will be considered in further detail 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 24: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of Shipping and Navigation hazards including compliance with MGN 654 which include the provision of an ERCoP.
x. Use of guard vessels, where appropriate.	✓	**Section 24: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of Shipping and Navigation hazards including the use of guard vessels.
xi. Update NRAs every two years, e.g. at testing sites.	✓	Not applicable to the Proposed Development.
xii. Device-specific or array-specific NRAs.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** All offshore elements of the Proposed Development have been considered in this NRA including all infrastructure (surface and subsea) within the Array Area and offshore ECC.
xiii. Design of OREI structures to minimise risk to contacting vessels or craft.	✓	There is no additional risk posed to craft compared to previous OWFs and so no additional measures are identified.
xiv. Any other measures and procedures considered appropriate in consultation with other stakeholders.	✓	**Section 24: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of Shipping and Navigation hazards. **Section 24: Through life safety management** Outlines how QHSE documentation will be maintained and reviewed.

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 17: Introduction to Risk Assessment** The risk assessment provides a risk claim for a range of hazards based on a number of inputs including (but not limited to) baseline data, expert opinion, outputs of the Hazard Workshop, stakeholder concerns and lessons learnt from existing offshore developments – Section 18 to 20.
Description of the marine environment.	✓	**Section 7: Navigational Features** Relevant navigational features in proximity to the Proposed Development have been described including (but not limited to) other OWF developments, ports, harbours and related facilities, aids to navigation, subsea cables, oil and gas infrastructure, and charted wrecks. **Section 13: Cumulative and Transboundary Overview** Potential future developments have been screened in to the cumulative risk assessment where a cumulative or in combination activity has been identified based upon the location and distance from the Proposed Development, including consideration of other OWFs and oil and gas infrastructure.
SAR overview and assessment.	✓	**Section 9: Emergency Response and Incident Overview** Existing SAR resources in proximity to the Proposed Development are summarised including the UK SAR operations contract, RNLI stations and assets and HM Coastguard stations. **Section 17: Introduction to Risk Assessment** The risk assessment includes an assessment of how activities associated with the Proposed Development may restrict emergency response capability of existing resources – Section 18 to 20.
Description of the OREI development and how it changes the marine environment.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** The maximum extent of the Proposed Development for which any Shipping and Navigation hazards are assessed is provided including a description of the Array Area and offshore ECC infrastructure, construction phase programme and indicative vessel and helicopter numbers during the construction and O&M phases. **Section 14: Future Case Vessel Traffic** Worst case alternative routeing for commercial traffic has been considered.

Annex B Hazard Log

Table B-1 Hazard Log

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Separate Sheet)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required	Additional Comments
							Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk		Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk		
Vessels Displacement (Including Adverse Weather)																							
Commercial vessels	Isolation	Array Area	C/D	Development of and adherence to an VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of buoyed construction area Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on schedules or compliance with COLREGs	5	1	1	1	2	1.3	Tolerable with Mitigation	Increased journey time/distance which impacts on schedules or compliance with COLREGs	3	1	2	1	3	1.8	Broadly Acceptable		
			O	Development of and adherence to an VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased journey time/distance but does not impact on schedules or compliance with COLREGs	5	1	1	1	2	1.3	Tolerable with Mitigation	Increased journey time/distance which impacts on schedules or compliance with COLREGs	3	1	2	1	3	1.8	Broadly Acceptable		

		Offshore export cable corridor	C/D	Development of and adherence to an VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on schedules or compliance with COLREGs	4	1	1	1	2	1.3	Broadly Acceptable	Increased journey time/distance which impacts on schedules or compliance with COLREGs	2	1	1	1	2	1.3	Broadly Acceptable		
		Offshore export cable corridor	O	Development of and adherence to an VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM	Increased journey time/distance but does not impact on schedules or compliance with COLREGs	2	1	1	1	2	1.3	Broadly Acceptable	Increased journey time/distance which impacts on schedules or compliance with COLREGs	1	1	1	1	2	1.3	Broadly Acceptable		
	Cumulative	Array Area	C/D	Development of and adherence to an VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of buoyed construction areas Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on schedules or compliance with COLREGs	5	1	1	1	2	1.3	Tolerable with Mitigation	Increased journey time/distance which impacts on schedules or compliance with COLREGs	3	1	2	1	3	1.8	Broadly Acceptable		MCA have no concerns with the gap between the Array Area and the CampionWind development noting commercial routeing vessels will use this gap.

			O	Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of other Relevant Projects Adverse weather Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased journey time/distance but does not impact on schedules or compliance with COLREGs	5	1	1	1	2	1.3	Tolerable with Mitigation	Increased journey time/distance which impacts on schedules or compliance with COLREGs	3	1	2	1	3	1.8	Broadly Acceptable		MCA have no concerns with the gap between the Array Area and the CampionWind development noting commercial routeing vessels will use this gap.
		Offshore export cable corridor	C/D	Development of and adherence to an VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on schedules or compliance with COLREGs	4	1	1	1	2	1.3	Broadly Acceptable	Increased journey time/distance which impacts on schedules or compliance with COLREGs	2	1	1	1	2	1.3	Broadly Acceptable		
			O	Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM	Increased journey time/distance but does not impact on schedules or compliance with COLREGs	3	1	1	1	2	1.3	Broadly Acceptable	Increased journey time/distance which impacts on schedules or compliance with COLREGs	2	1	1	1	2	1.3	Broadly Acceptable		

Commercial fishing vessels in transit	Isolation	Array Area	C/D	Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of buoyed construction area Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	3	1	1	1	2	1.3	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	2	1	1	1	3	1.5	Broadly Acceptable		
			O	Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	2	1	1	1	2	1.3	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	2	1	1	1	3	1.5	Broadly Acceptable		SWFPA noted larger pelagic fishing vessels will not transit internally within the array and smaller fishing vessel transits will depend on weather conditions and time of day and will be down to skipper preference.
		Offshore export cable corridor	C/D	Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	2	1	1	1	2	1.3	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	2	1	1	1	2	1.3	Broadly Acceptable		

			O	Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	1	1	1	1	2	1.3	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	1	1	1	1	2	1.3	Broadly Acceptable		
	Cumulative	Array Area	C/D	Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of buoyed construction area Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	4	1	1	1	2	1.3	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	2	1	1	1	3	1.5	Broadly Acceptable		SWFPA noted commercial vessels filtering into gaps between developments will affect fishing vessels and fishing grounds in the area, especially with vessel numbers increasing over time.
			O	Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	4	1	1	1	2	1.3	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	2	1	1	1	3	1.5	Broadly Acceptable		SWFPA noted larger pelagic fishing vessels will not transit internally within the array and smaller fishing vessel transits will depend on weather conditions and time of day and will be down to skipper preference. SWFPA noted commercial vessels filtering into gaps between developments

																							will affect fishing vessels and fishing grounds in the area, especially with vessel numbers increasing over time.
		Offshore export cable corridor	C/D	Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	3	1	1	1	2	1.3	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	2	1	1	1	2	1.3	Broadly Acceptable		
			O	Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	2	1	1	1	2	1.3	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	1	1	1	1	2	1.3	Broadly Acceptable		

Recreational vessels (2.5 to 24m length)	Isolation	Array Area	C/D	Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of buoyed construction area Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable		RYA Scotland noted this also considers increased voyages for recreational users which includes tiredness.
			O	Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable		RYA Scotland noted this also considers increased voyages for recreational users which includes tiredness.
		Offshore export cable corridor	C/D	Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable		RYA Scotland confirmed the cable installation does not pose many problems for recreational vessels as COLREGs will apply and vessels will work around any ongoing project works. Worst case frequency ranking increased following MCA feedback.

			O	Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	1	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	1	1	1	1	1	1.0	Broadly Acceptable		
	Cumulative	Array Area	C/D	Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of buoyed construction area Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable		RYA Scotland noted this also considers increased voyages for recreational users which includes tiredness.
			O	Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable		RYA Scotland noted this also considers increased voyages for recreational users which includes tiredness.
		Offshore export cable corridor	C/D	Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and	Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable		RYA Scotland confirmed the cable installation does not pose many problems for recreational vessels as COLREGs will apply and vessels will work around any ongoing project works.

				marking Marking on Admiralty charts																			Worst case frequency ranking increased following MCA feedback.
			O	Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits or impact compliance with COLREGs	1	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance which impacts on transits or compliance with COLREGs	1	1	1	1	1	1.0	Broadly Acceptable		
Increased Vessel to Vessel Collision Risk Between Third-Party Vessels																							
Commercial vessels	Isolation	Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of buoyed construction area Adverse weather Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	3	2	2	3	2	2.3	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	2	4	4	4	4	4.0	Tolerable with Mitigation		Worst case consequence ranking for people increased following MCA feedback.

			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased encounters resulting in a low impact collision event	3	2	2	3	2	2.3	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	2	4	4	4	4	4.0	Tolerable with Mitigation		Worst case consequence ranking for people increased following MCA feedback.
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	2	2	2	3	2	2.3	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	4	4	4	4.0	Tolerable with Mitigation		Worst case consequence ranking for people increased following MCA feedback.
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	2	2	3	2	2.3	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	4	4	4	4.0	Tolerable with Mitigation		Worst case consequence ranking for people increased following MCA feedback.

		Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of buoyed construction areas Adverse weather Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	3	2	2	3	2	2.3	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	3	4	4	4	4	4.0	Tolerable with Mitigation		Worst case consequence ranking for people increased following MCA feedback.
	Cumulative		O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of other Relevant Projects Adverse weather Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased encounters resulting in a low impact collision event	3	2	2	3	2	2.3	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	3	4	4	4	4	4.0	Tolerable with Mitigation		Worst case consequence ranking for people increased following MCA feedback.
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	2	2	2	3	2	2.3	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	2	4	4	4	4	4.0	Tolerable with Mitigation		Worst case consequence ranking for people increased following MCA feedback.

			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	2	2	3	2	2.3	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	2	4	4	4	4	4.0	Tolerable with Mitigation		Worst case consequence ranking for people increased following MCA feedback.
Commercial fishing vessels in transit	Isolation	Array Area	C/D	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of buoyed construction area Adverse weather Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	2	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	5	3.8	Broadly Acceptable		
			O	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and	Adverse weather Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased encounters resulting in a low impact collision event	2	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	5	3.8	Broadly Acceptable		SWFPA noted larger pelagic fishing vessels will not transit internally within the array and smaller fishing vessel transits will depend on weather conditions and time of day and will be down to skipper preference.

				marking Marking on Admiralty charts																			
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	3	3.3	Broadly Acceptable		
			O	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on	Adverse weather Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	3	3.3	Broadly Acceptable		

				Admiralty charts																			
	Cumulative	Array Area	C/D	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of buoyed construction area Adverse weather Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	3	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	5	3.8	Broadly Acceptable		
			O	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on	Adverse weather Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased encounters resulting in a low impact collision event	3	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	5	3.8	Broadly Acceptable		SWFPA noted larger pelagic fishing vessels will not transit internally within the array and smaller fishing vessel transits will depend on weather conditions and time of day and will be down to skipper preference.

				Admiralty charts																			
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	2	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	3	3.3	Broadly Acceptable		
			O	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on	Adverse weather Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	3	3.3	Broadly Acceptable		

				Admiralty charts																			
Recreational vessels (2.5 to 24m length)	Isolation	Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of buoyed construction area Adverse weather Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	2	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	2	3.0	Broadly Acceptable		
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	2	3.0	Broadly Acceptable		

		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	2	4	2	4	2	3.0	Broadly Acceptable		
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	2	4	2	4	2	3.0	Broadly Acceptable		
	Cumulative	Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Presence of buoyed construction area Adverse weather Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	2	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	2	3.0	Broadly Acceptable		

			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	2	3.0	Broadly Acceptable		
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	2	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	2	3.0	Broadly Acceptable		
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Compliance with MGN 654 Lighting and marking Marking on Admiralty charts	Adverse weather Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters resulting in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	2	3.0	Broadly Acceptable		
Increased Vessel to Vessel Collision Risk Between a Third-Party Vessel and a Project Vessel																							

Commercial vessels	Isolation	Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit including towage operation Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	2	2	2	3	2	2.3	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	5	4	5	4	4.5	Tolerable with Mitigation		Worst case consequence rankings for people and environment increased following UK Chamber of Shipping feedback.
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit including towage operation Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	2	2	3	2	2.3	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	5	4	5	4	4.5	Tolerable with Mitigation		Worst case consequence rankings for people and environment increased following UK Chamber of Shipping feedback.
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	2	2	2	3	2	2.3	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	4	4	4	4.0	Tolerable with Mitigation		

			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	2	2	3	2	2.3	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	4	4	4	4.0	Tolerable with Mitigation		
	Cumulative	Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit including towage operation Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	3	2	2	3	2	2.3	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	5	4	5	4	4.5	Tolerable with Mitigation		Worst case consequence rankings for people and environment increased following UK Chamber of Shipping feedback.
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit including towage operation Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	2	2	2	3	2	2.3	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	5	4	5	4	4.5	Tolerable with Mitigation		Worst case consequence rankings for people and environment increased following UK Chamber of Shipping feedback.

		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	3	2	2	3	2	2.3	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	4	4	4	4.0	Tolerable with Mitigation		
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	2	2	2	3	2	2.3	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	4	4	4	4.0	Tolerable with Mitigation		
Commercial fishing vessels in transit	Isolation	Array Area	C/D	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit including towage operation Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	5	3.8	Broadly Acceptable		

			O	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit or within array including towage operation Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	5	3.8	Broadly Acceptable		
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	2	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	3	3.3	Broadly Acceptable		
			O	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	3	3.3	Broadly Acceptable		

				compliance with international marine regulations																			
	Cumulative	Array Area	C/D	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit including towage operation Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	5	3.8	Broadly Acceptable		
			O	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit or within array including towage operation Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	5	3.8	Broadly Acceptable		

		Offshore export cable corridor	C/D	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	3	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	2	4	2	4	3	3.3	Broadly Acceptable		
			O	Development of and adherence to an EMP Fisheries liaison and Fishing Industry Representative Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	2	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	2	4	2	4	3	3.3	Broadly Acceptable		
Recreational vessels (2.5 to 24m length)	Isolation	Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international	Project vessels in transit including towage operation Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	2	3.0	Broadly Acceptable		

				marine regulations																			
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit or within array including towage operation Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	2	4	2	4	2	3.0	Broadly Acceptable		
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	2	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	2	3.0	Broadly Acceptable		

			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	2	3.0	Broadly Acceptable		
	Cumulative	Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit including towage operation Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	2	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	1	4	2	4	2	3.0	Broadly Acceptable		
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit or within array including towage operation Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	2	4	2	4	2	3.0	Broadly Acceptable		

		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in a low impact collision event	2	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	2	4	2	4	2	3.0	Broadly Acceptable		
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Guard vessel (s) (via risk assessment) Promulgation of information Project vessel compliance with international marine regulations	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in a low impact collision event	1	3	1	3	1	2.0	Broadly Acceptable	Increased encounters results in a high impact collision event with vessel damage, PLL, and/or pollution	2	4	2	4	2	3.0	Broadly Acceptable		
Reduced Access to Local Ports, Harbours and Marinas																							
Commercial vessels	Isolation	Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	3	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	2	1	1	1	3	1.5	Broadly Acceptable		SWFPA raised that depending on the location of O&M ports, vessel traffic in the area may increase. Ports will undertake their own EIA regarding wet storage within port limits.
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance	Project vessel use of local ports	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	1	1	1	1	3	1.5	Broadly Acceptable		SWFPA raised that depending on the location of O&M ports, vessel traffic in the area may increase. Ports will undertake their

				with international marine regulations																			own EIA regarding wet storage within port limits.
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports Project vessels which are RAM	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	5	1	1	1	1	1.0	Tolerable with Mitigation	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	2	1	2	1	2	1.5	Broadly Acceptable		SWFPA raised that depending on the location of O&M ports, vessel traffic in the area may increase.
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports Project vessels which are RAM	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	4	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	1	1	2	1	2	1.5	Broadly Acceptable		SWFPA raised that depending on the location of O&M ports, vessel traffic in the area may increase.
	Cumulative	Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	3	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	2	1	1	1	4	1.8	Broadly Acceptable		SWFPA raised that depending on the location of O&M ports, vessel traffic in the area may increase. Ports will undertake their own EIA regarding wet storage within port limits.
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international	Project vessel use of local ports	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	2	1	1	1	4	1.8	Broadly Acceptable		SWFPA raised that depending on the location of O&M ports, vessel traffic in the area may increase. Ports will undertake their own EIA regarding wet

				marine regulations																			storage within port limits.
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports Project vessels which are RAM	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	5	1	1	1	1	1.0	Tolerable with Mitigation	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	2	1	2	1	3	1.8	Broadly Acceptable		SWFPA raised that depending on the location of O&M ports, vessel traffic in the area may increase.
		Offshore export cable corridor	O	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports Project vessels which are RAM	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	4	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	1	1	2	1	3	1.8	Broadly Acceptable		SWFPA raised that depending on the location of O&M ports, vessel traffic in the area may increase.
Commercial fishing vessels in transit	Isolation	Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Fisheries liaison and Fishing Industry Representative Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports	Increased journey time/distance but does not impact on transits or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	1	2	2	3	2	2.3	Broadly Acceptable		SWFPA raised a lot of fishing vessels may be coming in to land at Peterhead Port and then returning to their home port of Fraserburgh. Ports will undertake their own EIA regarding wet storage within port limits.

			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Fisheries liaison and Fishing Industry Representative Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports	Increased journey time/distance but does not impact on transits or compliance with COLREGs	1	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	1	2	2	3	2	2.3	Broadly Acceptable		SWFPA raised a lot of fishing vessels may be coming in to land at Peterhead Port and then returning to their home port of Fraserburgh. Ports will undertake their own EIA regarding wet storage within port limits.
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Fisheries liaison and Fishing Industry Representative Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports Project vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	3	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	3	2	2	3	2	2.3	Broadly Acceptable		SWFPA raised a lot of fishing vessels may be coming in to land at Peterhead Port and then returning to their home port of Fraserburgh.
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Fisheries liaison and Fishing Industry Representative Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports Project vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	1	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	2	2	3	2	2.3	Broadly Acceptable		SWFPA raised a lot of fishing vessels may be coming in to land at Peterhead Port and then returning to their home port of Fraserburgh.

	Cumulative	Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Fisheries liaison and Fishing Industry Representative Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports	Increased journey time/distance but does not impact on transits or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	2	2	3	2	2.3	Broadly Acceptable		SWFPA raised a lot of fishing vessels may be coming in to land at Peterhead Port and then returning to their home port of Fraserburgh. Ports will undertake their own EIA regarding wet storage within port limits.
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Fisheries liaison and Fishing Industry Representative Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports	Increased journey time/distance but does not impact on transits or compliance with COLREGs	1	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	2	2	3	2	2.3	Broadly Acceptable		SWFPA raised a lot of fishing vessels may be coming in to land at Peterhead Port and then returning to their home port of Fraserburgh. Ports will undertake their own EIA regarding wet storage within port limits.
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Fisheries liaison and Fishing Industry Representative Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports Project vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	3	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	3	2	2	3	4	2.8	Broadly Acceptable		SWFPA raised a lot of fishing vessels may be coming in to land at Peterhead Port and then returning to their home port of Fraserburgh.

			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Fisheries liaison and Fishing Industry Representative Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports Project vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	2	2	3	4	2.8	Broadly Acceptable		SWFPA raised a lot of fishing vessels may be coming in to land at Peterhead Port and then returning to their home port of Fraserburgh.
Recreational vessels (2.5 to 24m length)	Isolation	Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports	Increased journey time/distance but does not impact on transits or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	3	2	3	2	2.5	Broadly Acceptable		RYA Scotland noted Peterhead Bay Marina is a popular stop for transiting recreational vessels. Ports will undertake their own EIA regarding wet storage within port limits.
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports	Increased journey time/distance but does not impact on transits or compliance with COLREGs	1	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	3	2	3	2	2.5	Broadly Acceptable		RYA Scotland noted Peterhead Bay Marina is a popular stop for transiting recreational vessels. Ports will undertake their own EIA regarding wet storage within port limits.
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports Project vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	3	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	3	3	2	3	2	2.5	Broadly Acceptable		RYA Scotland noted Peterhead Bay Marina is a popular stop for transiting recreational vessels.

			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports Project vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	3	3	2	3	2	2.5	Broadly Acceptable		RYA Scotland noted Peterhead Bay Marina is a popular stop for transiting recreational vessels.
	Cumulative	Array Area	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports	Increased journey time/distance but does not impact on transits or compliance with COLREGs	2	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	3	2	3	2	2.5	Broadly Acceptable		RYA Scotland noted Peterhead Bay Marina is a popular stop for transiting recreational vessels. Ports will undertake their own EIA regarding wet storage within port limits.
			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports	Increased journey time/distance but does not impact on transits or compliance with COLREGs	1	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	3	2	3	2	2.5	Broadly Acceptable		RYA Scotland noted Peterhead Bay Marina is a popular stop for transiting recreational vessels. Ports will undertake their own EIA regarding wet storage within port limits.
		Offshore export cable corridor	C/D	Development of and adherence to an EMP Development of and adherence to a VMNSNP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports Project vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	3	3	2	3	3	2.8	Broadly Acceptable		RYA Scotland noted Peterhead Bay Marina is a popular stop for transiting recreational vessels.

			O	Development of and adherence to an EMP Development of and adherence to a VMNSP Promulgation of information Project vessel compliance with international marine regulations	Project vessel use of local ports Project vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	3	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	3	2	3	3	2.8	Broadly Acceptable		RYA Scotland noted Peterhead Bay Marina is a popular stop for transiting recreational vessels.
Creation of Vessel to Structure Allision Risk (Including Powered, Drifting and Internal)																							
Commercial vessels	Isolation	Array Area	O	Development of and adherence to a DSLP Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Promulgation of information Compliance with MGN 654 Project vessel compliance with international marine regulations Lighting and marking Marking on Admiralty charts Minimum blade tip clearance Development of and adherence to a WSP	Presence of surface structures Human/navigational error Mechanical/technical failure Adverse weather Aid to navigation failure	Vessel passes at an unsafe distance resulting in a need to make a late adjustment to course/speed	3	1	1	1	1	1.0	Broadly Acceptable	Allision event occurs involving vessel damage, PLL and/or pollution	2	5	4	5	4	4.5	Tolerable with Mitigation		

	Cumulative	Array Area	O	Development of and adherence to a DSLP Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Promulgation of information Compliance with MGN 654 Project vessel compliance with international marine regulations Lighting and marking Marking on Admiralty charts Minimum blade tip clearance Development of and adherence to a WSP	Presence of surface structures Human/navigational error Mechanical/technical failure Adverse weather Aid to navigation failure Navigation between adjacent arrays (CampionWind)	Vessel passes at an unsafe distance resulting in a need to make a late adjustment to course/speed	4	1	1	1	1	1.0	Broadly Acceptable	Allision event occurs involving vessel damage, PLL and/or pollution	3	5	4	5	4	4.5	Tolerable with Mitigation		MCA have no concerns with the gap between the Array Area and the CampionWind development noting commercial routeing vessels will use this gap.
Commercial fishing vessels in transit	Isolation	Array Area	O	Development of and adherence to a DSLP Development of and adherence to an EMP Development of and adherence to a VMNSP Fisheries liaison and Fishing Industry Representative Application for safety zones Promulgation of information Compliance with MGN 654 Project vessel compliance with international marine regulations Lighting and marking Marking on Admiralty charts Minimum blade tip clearance Development of	Presence of surface structures Human/navigational error Mechanical/technical failure Adverse weather Aid to navigation failure	Vessel passes at an unsafe distance resulting in a need to make a late adjustment to course/speed	3	1	1	1	1	1.0	Broadly Acceptable	Allision event occurs potentially internally within the array involving vessel damage, PLL and/or pollution	3	5	4	5	4	4.5	Tolerable with Mitigation		SWFPA noted larger pelagic fishing vessels will not transit internally within the array and smaller fishing vessel transits will depend on weather conditions and time of day and will be down to skipper preference.

				and adherence to a WSP																			
	Cumulative	Array Area	O	Development of and adherence to a DSLP Development of and adherence to an EMP Development of and adherence to a VMNSP Fisheries liaison and Fishing Industry Representative Application for safety zones Promulgation of information Compliance with MGN 654 Project vessel compliance with international marine regulations Lighting and marking Marking on Admiralty charts Minimum blade tip clearance Development of and adherence to a WSP	Presence of surface structures Human/navigational error Mechanical/technical failure Adverse weather Aid to navigation failure Navigation between adjacent arrays (CampionWind)	Vessel passes at an unsafe distance resulting in a need to make a late adjustment to course/speed	4	1	1	1	1	1.0	Broadly Acceptable	Allision event occurs potentially internally within the array involving vessel damage, PLL and/or pollution	3	5	4	5	4	4.5	Tolerable with Mitigation		SWFPA noted commercial vessels filtering into gaps between developments will affect fishing vessels and fishing grounds in the area, especially with vessel numbers increasing over time. SWFPA noted larger pelagic fishing vessels will not transit internally within the array and smaller fishing vessel transits will depend on weather conditions and time of day and will be down to skipper preference.

Recreational vessels (2.5 to 24m length)	Isolation	Array Area	O	Development of and adherence to a DSLP Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Promulgation of information Compliance with MGN 654 Project vessel compliance with international marine regulations Lighting and marking Marking on Admiralty charts Minimum blade tip clearance Development of and adherence to a WSP	Presence of surface structures Human/navigational error Mechanical/technical failure Adverse weather Aid to navigation failure	Vessel passes at an unsafe distance resulting in a need to make a late adjustment to course/speed	2	1	1	1	1	1.0	Broadly Acceptable	Allision event occurs potentially internally within the array involving vessel damage, PLL and/or pollution	2	4	4	4	4	4.0	Tolerable with Mitigation		RYA Scotland noted that recreational vessels may choose to transit within the array during periods of adverse weather conditions and also to avoid larger commercial vessels.
	Cumulative	Array Area	O	Development of and adherence to a DSLP Development of and adherence to an EMP Development of and adherence to a VMNSP Application for safety zones Promulgation of information Compliance with MGN 654 Project vessel compliance with international marine regulations Lighting and marking Marking on Admiralty charts Minimum blade tip clearance Development of and adherence to a WSP	Presence of surface structures Human/navigational error Mechanical/technical failure Adverse weather Aid to navigation failure Navigation between adjacent arrays (CampionWind)	Vessel passes at an unsafe distance resulting in a need to make a late adjustment to course/speed	2	1	1	1	1	1.0	Broadly Acceptable	Allision event occurs potentially internally within the array involving vessel damage, PLL and/or pollution	2	4	4	4	4	4.0	Tolerable with Mitigation		RYA Scotland noted that recreational vessels may choose to transit within the array during periods of adverse weather conditions and also to avoid larger commercial vessels.
Reduction of Under Keel Clearance as a Result of Cable Protection, Dynamic Cables, and Mooring Lines																							

All vessels	Isolation	All subsea cables	O	Development of and adherence to a CaP Compliance with MGN 654 Compliance with regulatory floating guidance Notification of damage or decay of cables Marking on Admiralty charts Cable Burial Risk Assessment	Presence of cable protection, dynamic cables, and mooring lines which reduces water depth Human/navigational error	Vessel transits over an area of reduced clearance but does not make contact	5	1	1	1	1	1.0	Tolerable with Mitigation	Interaction with dynamic cable, mooring line, or cable protection resulting in vessel damage, grounding (cable protection only) injury to person and/or pollution (including spillage of potential hazardous cargo	2	3	4	4	4	3.8	Broadly Acceptable		UK Chamber of Shipping noted that under keel risks are relevant for project vessels in addition to third-party vessels.
Anchor Interaction with Mooring Lines and Subsea Cables																							
All vessels	Isolation	All subsea cables	O	Development of and adherence to a CaP Development of and adherence to a VMNSP Compliance with regulatory floating guidance Guard vessel (s) via risk assessment Promulgation of information Notification of damage or decay of cables Marking on Admiralty charts Compliance with regulatory floating guidance	Presence of mooring lines Presence of subsea cables Mooring line design Insufficient cable burial/protection Human/navigational error Mechanical/technical failure	Vessel anchors on or drags anchor over a subsea cable or mooring line but no interaction occurs	3	1	1	1	1	1.0	Broadly Acceptable	Vessel anchors on or drags anchor over a subsea cable or mooring line with interaction occurring resulting in damage to the cable, protection, mooring line, and/or anchor	2	3	2	3	3	2.8	Broadly Acceptable		
Interference with Communications and Position Fixing Equipment from the Development																							
All vessels	Isolation	Array Area	O	Compliance with MGN 654 Lighting and marking Marking on Admiralty charts Cable Burial Risk Assessment	Human error relating to adjustment of Radar controls Presence of surface structures	Structures have no effect upon the Radar, communication and position fixing equipment on a vessel	4	1	1	1	1	1.0	Broadly Acceptable	Structures have minor but manageable levels of Radar interference on a vessel	3	1	1	1	1	1.0	Broadly Acceptable		UK Chamber of Shipping noted that an update to existing Radar assessments to consider floating foundations would be beneficial, potentially as a collective effort among developers.

All vessels	Isolation	Offshore export cable corridor	O	Compliance with MGN 654 Marking on Admiralty charts Cable Burial Risk Assessment	EMF from cables	Cables have no effect upon the Radar, communication and position fixing equipment on a vessel	4	1	1	1	1	1.0	Broadly Acceptable	Cables have minor but manageable levels of EMF interference on a vessel	3	1	1	1	1	1.0	Broadly Acceptable		
Reduction of Emergency Response Capability including SAR Access																							
Emergency responders	Isolation	Proposed Development	O	Development of and adherence to a DSLP Development of and adherence to an EMP Development of adherence to a VMNSP Compliance with MGN 654 Project vessel compliance with international marine regulations Lighting and marking	Array does not facilitate emergency responder access Adverse weather Limited resource capability	Delay to emergency response request	2	1	1	1	2	1.3	Broadly Acceptable	Delay to emergency response request leading to vessel damage, PLL and/or pollution	1	5	5	5	5	5.0	Tolerable with Mitigation		
	Cumulative	Proposed Development	O	Development of and adherence to a DSLP Development of and adherence to an EMP Development of adherence to a VMNSP Compliance with MGN 654 Project vessel compliance with international marine regulations Lighting and marking	Array does not facilitate emergency responder access Adverse weather Limited resource capability	Delay to emergency response request	3	1	1	1	2	1.3	Broadly Acceptable	Delay to emergency response request leading to vessel damage, PLL and/or pollution	2	5	5	5	5	5.0	Tolerable with Mitigation		
Loss of Station																							

All Vessels	Isolation	Array Area (WTGs)	C/D	Development of and adherence to an EMP Fisheries Liaison and Fishing Industry Representative Development of and adherence to a VMNSP Guard vessel (s) (via risk assessment) Promulgation of information Lighting and marking Compliance with regulatory floating guidance Minimum blade tip clearance	Damage to or failure of mooring line(s) Damage to or failure of tow during WTG towage operation	Failure of a single mooring line leads to temporary increase in the maximum excursion of the floating structure but not full loss of station	3	2	2	3	3	2.5	Broadly Acceptable	Total failure of mooring system leads to drifting of floating structure with risk of collision with vessels	2	4	4	5	5	4.5	Tolerable with Mitigation		MCA noted that emergency towage recovery is important to address as well as wreck status if the off station structure was to be sank. NLB noted the important of managing float offs. UK Chamber of Shipping confirmed that concerns for C/D phases are associated with loss of tow. Most likely and worst case consequence rankings for property and business increased following UK Chamber of Shipping feedback.
			O	Development of and adherence to an EMP Fisheries Liaison and Fishing Industry Representative Development of and adherence to a VMNSP Guard vessel (s) (via risk assessment) Promulgation of information Lighting and marking Compliance with regulatory floating guidance Minimum blade tip clearance	Damage to or failure of mooring line(s) Damage to or failure of tow during WTG towage operation	Failure of a single mooring line leads to temporary increase in the maximum excursion of the floating structure but not full loss of station	3	2	2	3	3	2.5	Broadly Acceptable	Total failure of mooring system leads to drifting of floating structure with risk of collision with vessels	2	4	4	5	5	4.5	Tolerable with Mitigation		MCA noted that emergency towage recovery is important to address as well as wreck status if the off station structure was to be sank. NLB noted the important of managing float offs. Most likely and worst case consequence rankings for property and business increased following UK Chamber of Shipping feedback.

Annex C Consequences

C.1 Introduction

710. This appendix presents an assessment of the consequences of collision and allision incidents, in terms of people and the environment, due to the presence of the Proposed Development.

711. The significance of the risk due to the presence of the Proposed Development is also assessed based on risk evaluation criteria and comparison with historical incident data in UK waters[6].

C.2 Risk Evaluation Criteria

C.2.1 Risk to People

712. Regarding the assessment of risk to people two measures are considered, namely:

- Individual risk; and
- Societal risk.

C.2.2 Individual Risk

713. Individual risk considers whether the risk from an incident to a particular individual changes significantly due to the presence of the Proposed Development. Individual risk considers not only the frequency of the incident and the consequences (e.g., likelihood of death), but also the individual's fractional exposure to that risk, i.e. the probability of the individual being in the given location at the time of the incident.

714. The purpose of estimating the individual risk is to ensure that individuals who may be affected by the presence of the Proposed Development are not exposed to excessive risks. This is achieved by considering the significance of the change in individual risk resulting from the presence of the Proposed Development relative to the UK background individual risk levels.

715. Annual risk levels to crew (the annual risk to an average crew member) for different vessel types are presented in Figure C-1, which also includes the upper and lower bounds for risk acceptance criteria as suggested in IMO Maritime Safety Committee 72/16 (IMO, 2001). The annual individual risk level to crew falls within the ALARP region for each of the vessel types presented.

[6] For the purposes of this assessment, UK waters is defined as the UK EEZ and UK territorial waters refers to the 12 nm limit from the British Isles, excluding the Republic of Ireland.

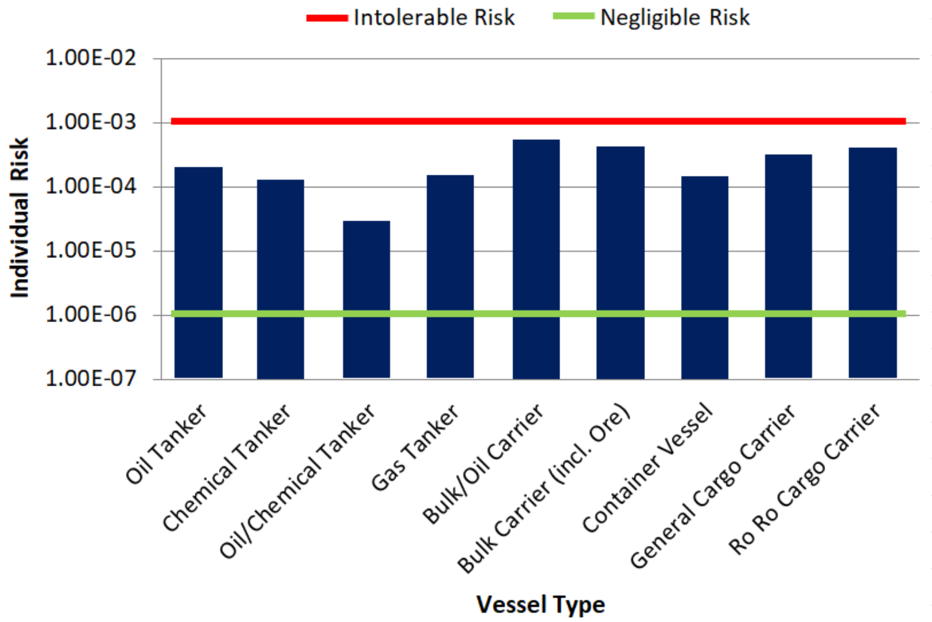

Figure C-1 Individual Risk Levels and Acceptance Criteria per Vessel Type

716. The typical bounds defining the ALARP regions for decision making within shipping are presented in 716. For a new vessel, the target upper bound for ALARP is set lower since new vessels are expected to benefit (in terms of design) from changes in legislation and improved maritime safety.

Table C-1 Individual Risk ALARP Criteria

Individual	Lower Bound for ALARP	Upper Bound for ALARP
To crew member	10^{-6}	10^{-3}
To passenger	10^{-6}	10^{-4}
Third-party	10^{-6}	10^{-4}
New vessel target	10^{-6}	Above values reduced by one order of magnitude

717. On a UK basis, the MCA have presented individual risks for various UK industries based on HSE data from 1987 to 1991. The risks for different industries are presented in Figure C-2.

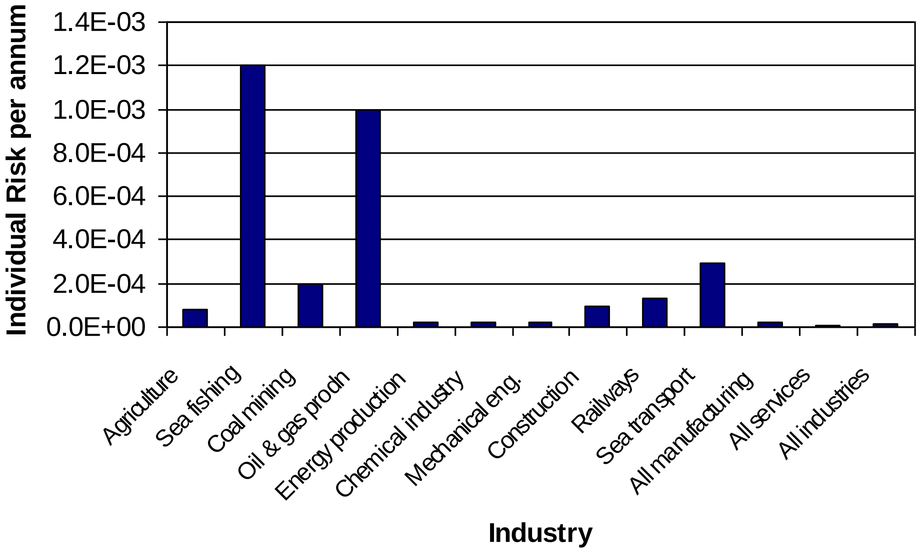

Figure C-2 Individual Risk per Year for Various UK Industries

718. The individual risk for sea transport of 2.9×10^{-4} per year is consistent with the worldwide data presented in Figure C-2, whilst the individual risk for sea fishing of 1.2×10^{-3} per year is the highest across all of the industries included.

C.2.3 Societal Risk

719. Societal risk is used to estimate risks of incidents affecting many persons (catastrophes) and acknowledging risk adverse or neutral attitudes. Societal risk includes the risk to every person, even if a person is only exposed to risk on one brief occasion. For assessing the risk to a large number of affected people, societal risk is desirable because individual risk is insufficient in evaluating risks imposed on large numbers of people.

720. Within this assessment, societal (navigation based) risk can be assessed for the Proposed Development, giving account to the change in risk associated with each incident scenario cause by the introduction of the wind farm structures. Societal risk may be expressed as:

- Annual fatality rate where frequency and fatality are combined into a convenient one-dimensional measure of societal risk (also known as PLL); and
- F-N diagrams showing explicitly the relationship between the cumulative frequency of an accident and the number of fatalities in a multi-dimensional diagram.

721. When assessing societal risk this study focuses on PLL, which accounts for the number of people likely to be involved in an incident (which is higher for certain vessel types) and assesses the significance of the change in risk compared to the UK background risk levels.

C.2.4 Risk to Environment

722. For risk to the environment the key criteria considered in terms of the risk due to the Proposed Development is the potential quantity of oil spilled from a vessel involved in an incident.

723. It is recognised that there will be other potential pollution, e.g., hazardous containerised cargoes; however, oil is considered the most likely pollutant, and the extent of predicted oil spills will provide an indication of the significance of pollution risk due to the Proposed Development compared to UK background pollution risk levels.

C.3 Marine Accident Investigation Branch Incident Data

C.3.1 All Incidents in UK Waters

724. All UK flagged commercial vessels are required to report incidents to the MAIB. Non-UK flagged vessels do not have to report an incident to the MAIB unless located at a UK port or within 12 nm (22.2 km) territorial waters and carrying passengers to a UK port. There are no requirements for non-commercial recreational craft to report incidents to the MAIB; however, a significant proportion of such incidents are reported to and investigated by the MAIB.

725. The MCA, harbour authorities and inland waterway authorities also have a duty to report incidents to the MAIB. Therefore, whilst there may be a degree of underreporting of incidents with minor consequences, those resulting in more serious consequences, such as fatalities, are likely to be reported.

726. Only incidents occurring in UK waters have been considered within this assessment for which the MAIB data is most comprehensive. It is also noted that incidents occurring in ports/harbours and rivers/canals have been excluded since the causes and consequences may differ considerably from an incident occurring offshore, which is the location of most relevance to the Proposed Development.

727. Accounting for these criteria, a total of 11,773 accidents, injuries and hazardous incidents were reported to the MAIB in the 20-year period between 2002 and 2021 involving 13,415 vessels (some incidents, such as collisions, involved more than one vessel).

728. The location of all incidents in proximity to the UK are presented in Figure C-3. The majority of incidents occur in coastal waters.

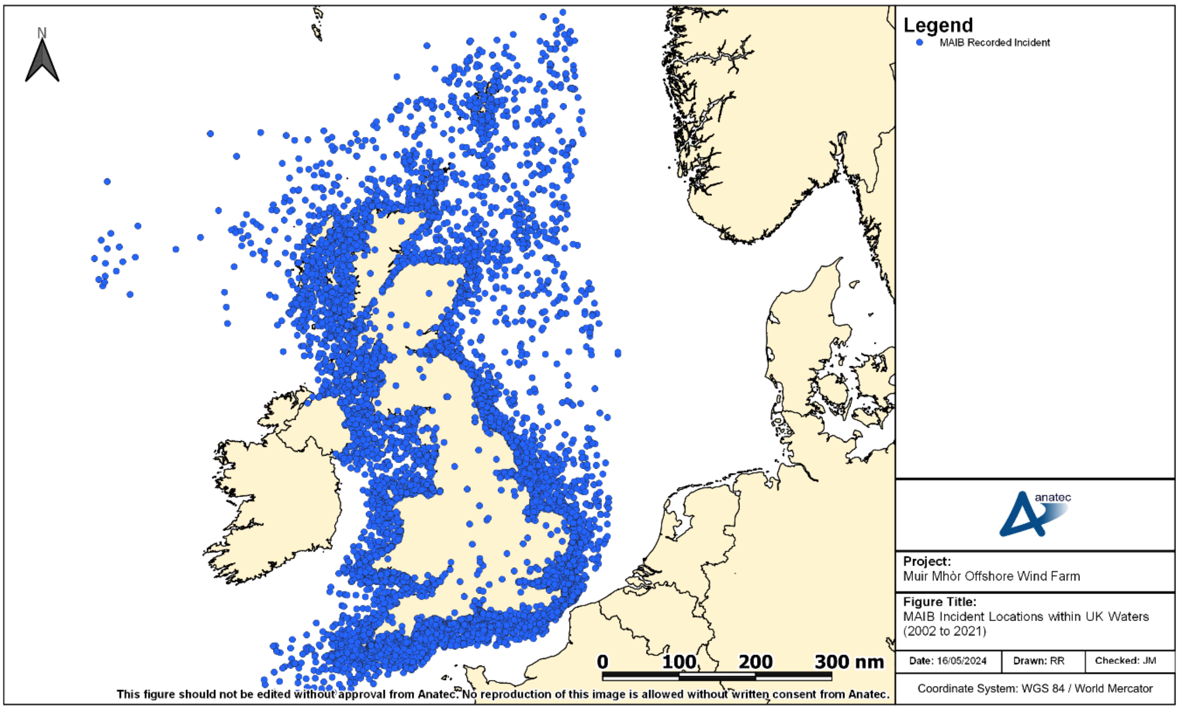

Figure C-3 MAIB Incident Locations within UK Waters (2002 to 2021)

729. The distribution of incidents by year in UK waters is presented in Figure C-4.

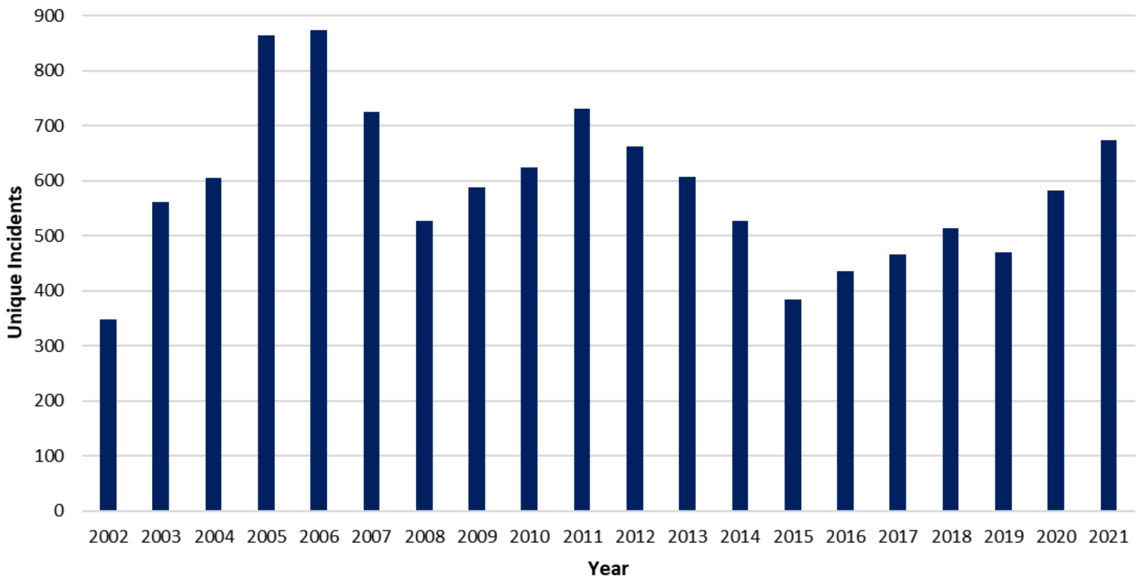

Figure C-4 MAIB Unique Incidents per Year within UK Waters (2002 to 2021)

730. The average number of unique incidents per year was 589. There has generally been a fluctuating trend in incidents over the 20-year period.

731. The distribution of incidents in UK waters by incident type is presented in Figure C-5.

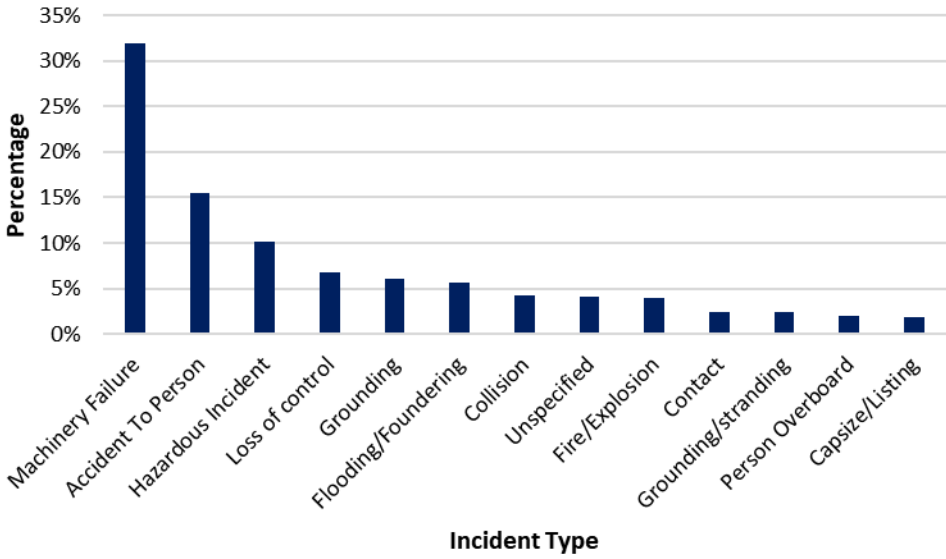

Figure C-5 MAIB Incident Types Breakdown within UK Waters (2002 to 2021)

732. The most frequent incident types were "*machinery failure*" (32%), "*accident to person*" (16%) and "*hazardous incident*" (10%). "*Collision*" and "*contact*" incidents represented 4% and 2% of total incidents, respectively.

733. The distribution of incidents in UK waters by vessel type is presented in Figure A.1.

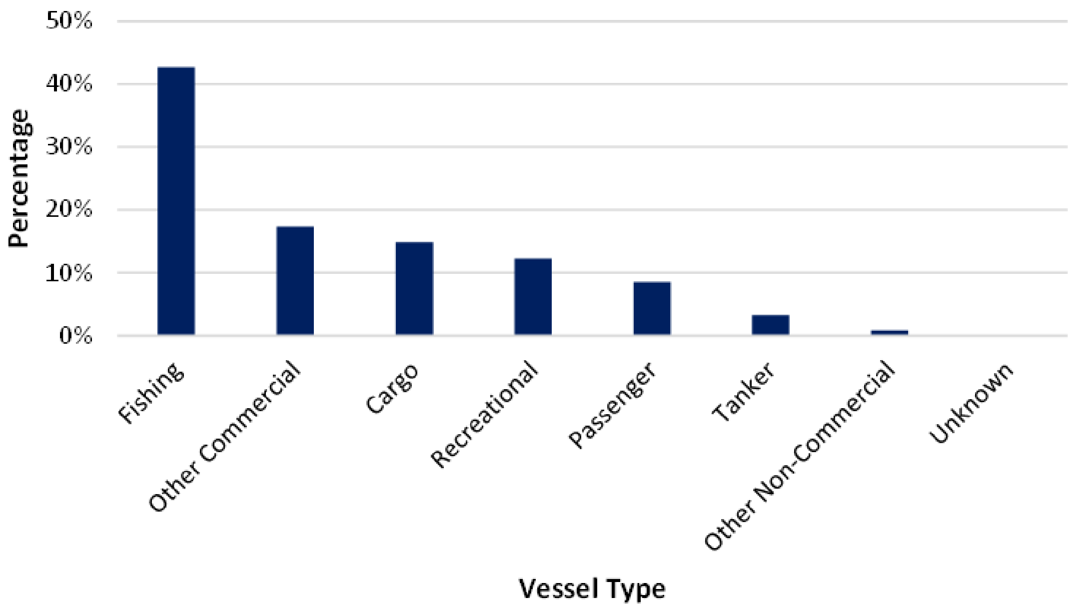

Figure A.1 MAIB Incident Types Breakdown within UK Waters (2002 to 2021)

734. The most frequent vessel types involved in incidents were fishing vessels (43%), other commercial vessels (17%) (including offshore industry vessels, tugs, workboats and pilot vessels) and cargo vessels (15%).

735. A total of 414 fatalities were reported in the MAIB incidents within UK waters between 2002 and 2021, corresponding to an average of 21 fatalities per year.

736. The distribution of fatalities in UK waters by vessel type and person category (crew, passenger and other) is presented in Figure C-6.

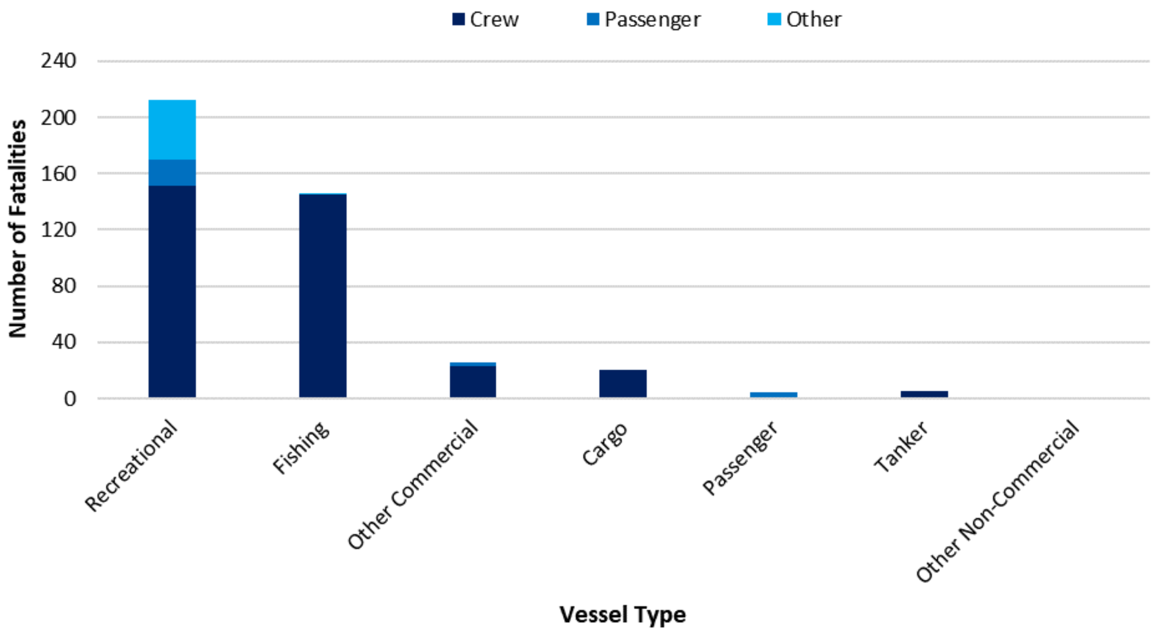

Figure C-6 MAIB Fatalities by Vessel Type within UK Waters (2002 to 2021)

737. The majority of fatalities occurred to recreational vessels (51%) and fishing vessels (35%), with crew members the main people involved (83%).

C.3.2 Collision Incidents

738. The MAIB define a collision incident as "*ships striking or being struck by another ship, regardless of whether the ships are underway, anchored or moored*" (MAIB, 2013).

739. A total of 481 collision incidents were reported to the MAIB in UK waters between 2002 and 2021 involving 1,068 vessels (in a small number of cases the other vessel involved was not logged).

740. The locations of collision incidents reported in proximity to the UK are presented in Figure C-7.

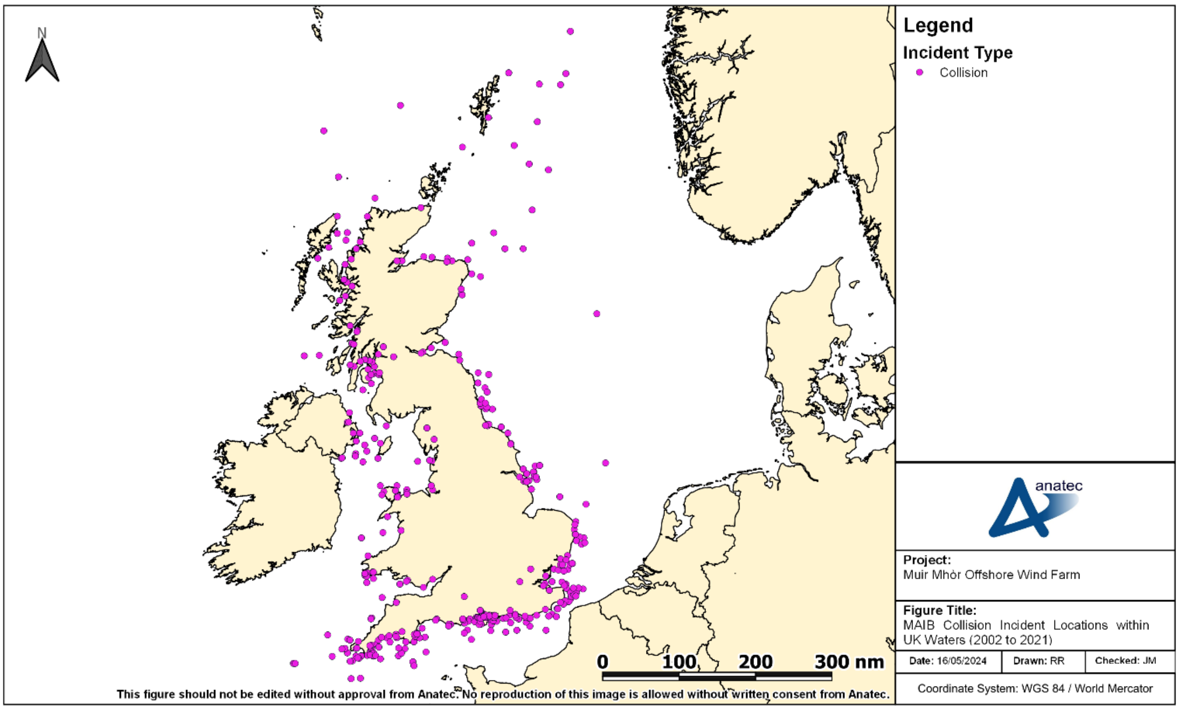

Figure C-7 MAIB Collision Incident Locations within UK Waters (2002 to 2021)

741. The distribution of collision incidents per year is presented in Figure C-8.

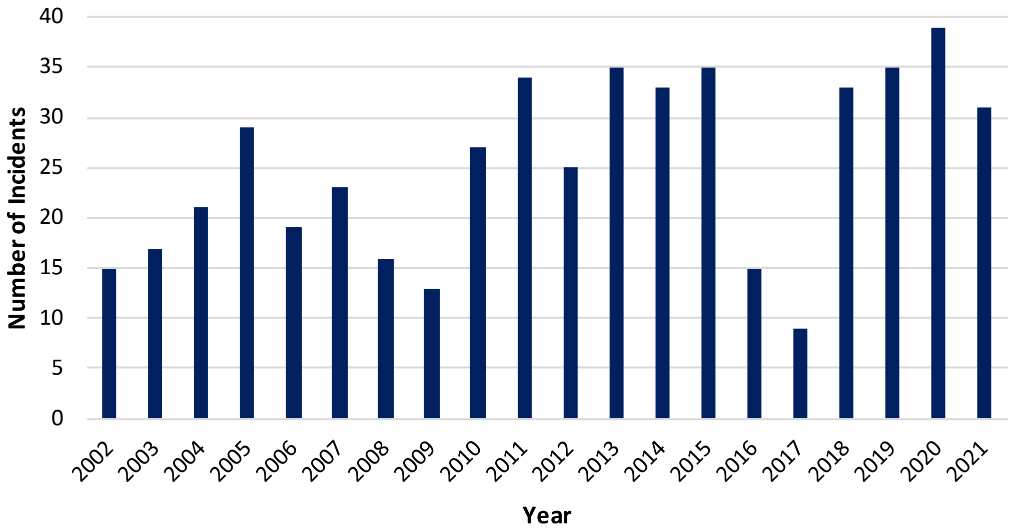

Figure C-8 MAIB Annual Collision Incidents within UK Water (2002 to 2021)

742. The average number of collision incidents per year was 25. There has been an overall slight increasing trend in collision incidents over the 20-year period, which may be due to better reporting of less serious incidents in recent years.

743. The most frequent vessel types involved in collision incidents were recreational vessels (29%), fishing vessels (26%), other commercial vessels (24%) and cargo vessels (13%).

744. A total of five fatalities were reported in MAIB collision incidents within UK waters between 2002 and 2021. Details of each of these fatal incidents reported by the MAIB are presented in Table C-2.

Table C-2 Description of Fatal MAIB Collision Incidents (2002 to 2021)

Date	Description	Fatalities
July 2005	Collision between two powerboats at night. Both vessels were unlit and both helmsmen had consumed alcohol. One of the helmsmen died.	1
October 2007	Collision between fishing vessel and coastal general cargo vessel following failure to keep an effective lookout. Fishing vessel sank with three of the four crew members abandoning ship into a life raft, but the fourth crew member was not recovered.	1
August 2010	Collision between passenger ferry and fishing vessel. Fishing vessel sank with one of the two crew members recovered from the sea, but the other member was not recovered despite an extensive search.	1
June 2015	Collision between Rigid-hulled Inflatable Boat (RIB) and yacht. Believed that around a dozen persons were onboard the motorboat with the majority taken ashore by lifeboat. One person seriously injured and airlifted to hospital before being pronounced dead later.	1
June 2018	Collision between power boats during a race. One of the vessels overturned with the pilot pronounced dead at the scene.	1

C.3.3 Allision Incidents

745. The MAIB define a contact incident as "*ships striking or being struck by an external object. The objects can be: floating object (cargo, ice, other or unknown); fixed object, but not the sea bottom; or flying object*" (MAIB, 2013). In line with the NRA as a whole, an allision is considered to involve a moving object and a stationary object at sea, with port infrastructure excluded from consideration; the MAIB contact incidents have been individually inspected and filtered in line with the NRA definition.

746. A total of 119 allision incidents were reported to the MAIB within UK waters between 2002 and 2021 involving 119 vessels.

747. The locations of allision incidents reported in proximity to the UK are presented in Figure C-9.

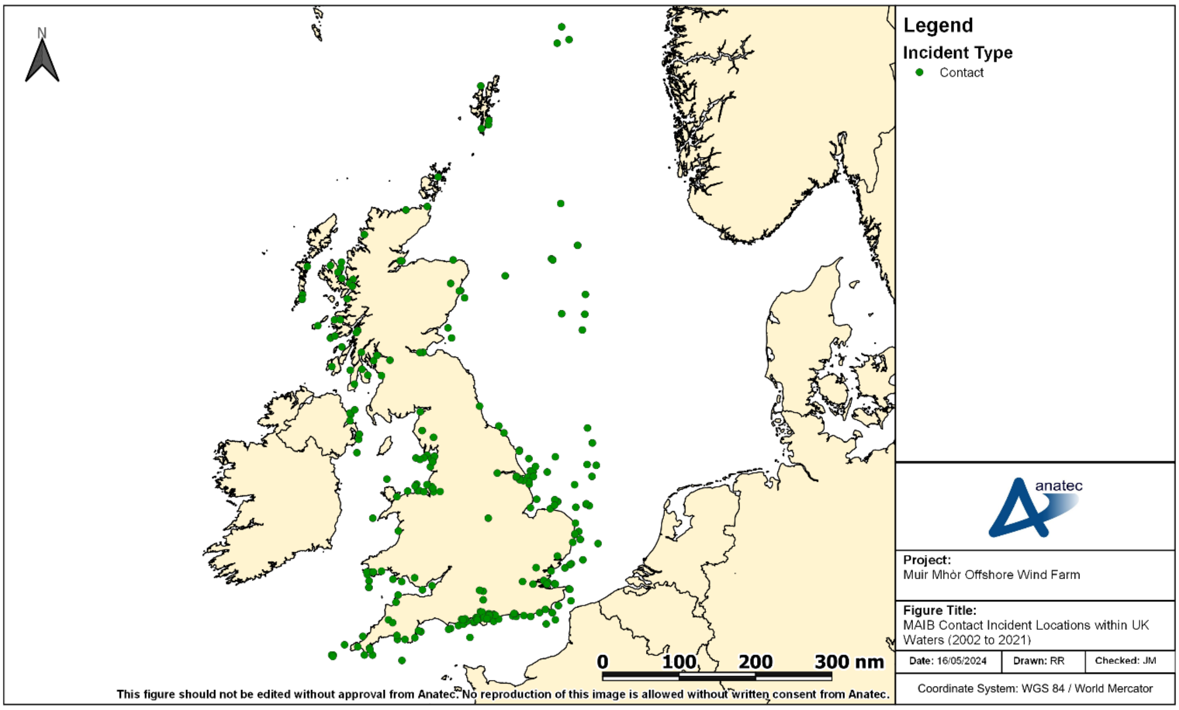

Figure C-9 MAIB Allision Incident Locations within UK waters (2002 to 2021)

748. The distribution of allision Incidents per year is presented in Figure C-10.

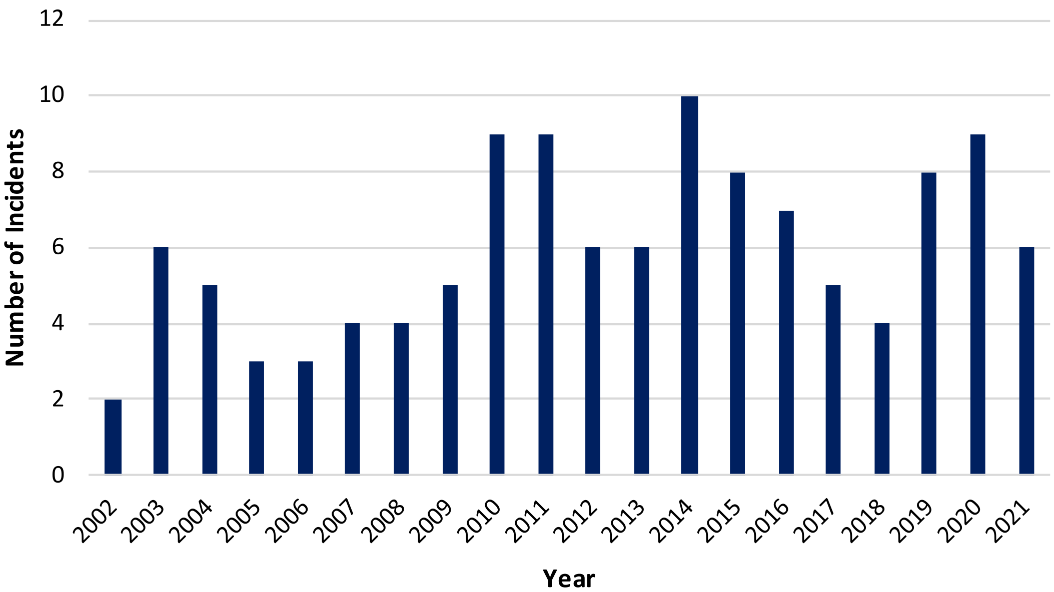

Figure C-10 MAIB Contact Incidents per Year within UK Waters (2000 to 2019)

749. The average number of allision incidents per year was six. As with collision incidents, there has been an overall slight increasing trend in allision incidents over the 20-year period, which may be due to better reporting of less serious incidents in recent years.

750. The distribution of vessel types involved in allision incidents is presented in Figure C-11.

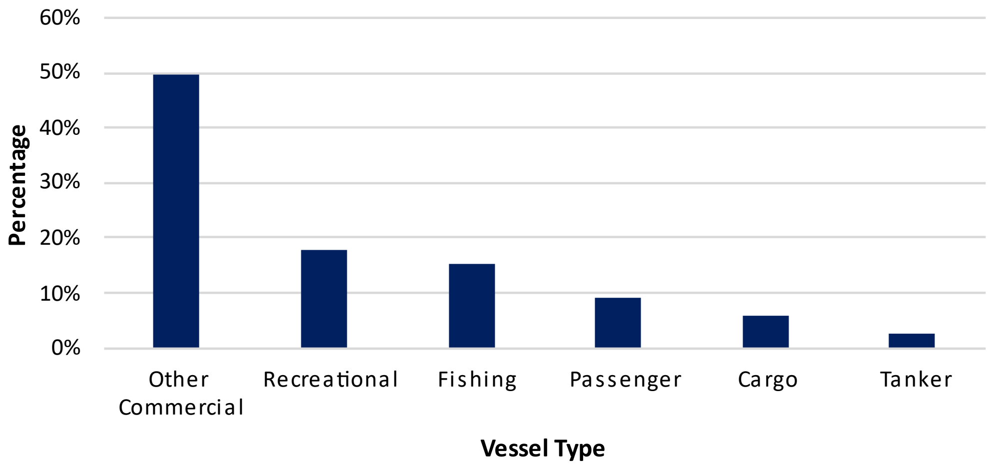

Figure C-11 MAIB Allision Incidents by Vessel Type within UK Waters (2002 to 2021)

751. The most frequent vessel types involved in allision incidents were other commercial vessels (50%), recreational vessels (18%) and fishing vessels (15%).

752. No fatalities were reported in MAIB allision incidents within offshore UK waters between 2002 and 2021.

C.4 Fatality Risk

C.4.1 Incident Data

753. This section uses the MAIB incident data along with information on average manning levels per vessel type to estimate the probability of a fatality in a maritime incident associated with the Proposed Development.

754. The Proposed Development is assessed to have the potential to affect the following incidents:

- Vessel to vessel collision;
- Powered vessel to structure allision;
- Drifting vessel to structure allision; and
- Fishing vessel to structure allision.

755. Of these incident types, only vessel to vessel collisions match the MAIB definition of collisions and hence the fatality analysis presented in Section C.4.2 is considered directly applicable to these types of incidents.

756. The other scenarios of powered vessel to structure allision, drifting vessel to structure allision and fishing vessel to structure allision are not clearly represented

by the MAIB data (as discussed in Section 9.4). Additionally, none of the allision incidents reported by the MAIB between 2002 and 2021 resulted in a fatality.

757. Therefore, the MAIB collision fatality risk rate has also been conservatively applied for the allision incident types.

C.4.2 Fatality Probability

758. Five of the 504 collision incidents reported by the MAIB within UK waters between 2002 and 2021 resulted in one or more fatalities. This gives a 0.99% probability that a collision incident will lead to a fatal accident.

759. To assess the fatality risk for personnel onboard a vessel (crew, passenger or other) the number of persons involved in the incidents needs to be estimated. Table C-3 presents the average number of person on board (POB) estimated for each category of vessel navigating in proximity to the Proposed Development. For passenger vessels this is based upon information available for the specific vessels recorded in the vessel traffic survey data. For other vessel categories, this is based upon information available from the MAIB incident data.

Table C-3 Estimated Average POB by Vessel Category

Vessel Category	Sub Categories	Source of Estimated Average POB	Estimated Average POB
Cargo/freight	Dry cargo, other commercial, service ship, etc.	MAIB incident data	15
Tanker	Tanker/combination carrier	MAIB incident data	23
Passenger	Ro-Ro passenger, cruise liner, etc.	Vessel traffic survey data/online information	3,034
Fishing	Trawler, potter, dredger, etc.	MAIB incident data	3.3

760. It is recognised that these average POB numbers can be substantially higher or lower on an individual vessel basis depending upon the size, subtype, etc. but applying reasonable averages is considered sufficient for this analysis, particularly when noting that the average POB for the dominant vessel category (passenger) is based upon the vessel traffic survey data where possible.

761. Using the average POB, along with the vessel type information involved in collision incidents reported by the MAIB there was an estimated 132,194 POB the vessels involved in the collision incidents.

762. Based upon five fatalities during the period 2002 to 2021, the overall fatality probability in a collision for any individual onboard is approximately 3.78×10^{-5} per collision.

763. It is considered inappropriate to apply this rate uniformly as the statistics indicate that the fatality probability associated with smaller craft, such as fishing vessels and recreational vessels, is higher. Therefore, the fatality probability has been subdivided into three categories of vessel as presented in Table C-4. In addition, due to zero fatalities resulting from commercial vessel collisions between 2002 and 2021, the time period used to assess the fatality probability for commercial vessels has been extended by five years to ensure a meaningful probability is captured.

Table C-4 Collision Incident Fatality Probability by Vessel Category

Vessel Category	Sub Categories	Fatalities	People Involved	Fatality Probability	Time Period
Commercial	Dry cargo, passenger, tanker, etc.	1	40,646	2.46×10^{-5}	1997 to 2021 (25 years)
Fishing	Trawler, potter, dredger, etc.	2	927	2.2×10^{-3}	2002 to 2021 (20 years)
Recreational	Yacht, small commercial motor yacht, etc.	3	1,023	2.9×10^{-3}	2002 to 2021 (20 years)

C.4.3 Fatality Risk Due to the Proposed Development

764. The base case and future case annual collision frequency levels pre and post wind farm for the Proposed Development are summarised in Table C-5.

Table C-5 Summary of Annual Collision and Allision Risk Results

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base case	2.32×10^{-4} (1 in 4,318 years)	2.98×10^{-4} (1 in 3,359 years)	6.57×10^{-5} (1 in 15,222 years)
	Future case (10%)	2.79×10^{-4} (1 in 3,581 years)	3.59×10^{-4} (1 in 2,788 years)	7.94×10^{-5} (1 in 12,600 years)
	Future case (20%)	3.27×10^{-4} (1 in 3,054 years)	4.20×10^{-4} (1 in 2,379 years)	9.28×10^{-5} (1 in 10,777 years)
Powered vessel to structure allision	Base case	N/A	2.29×10^{-4} (1 in 4,376years)	2.29×10^{-4} (1 in 4,376years)
	Future case (10%)	N/A	2.51×10^{-4} (1 in 3,990 years)	2.51×10^{-4} (1 in 3,990 years)
	Future case (20%)	N/A	2.66×10^{-4} (1 in 3,755 years)	2.66×10^{-4} (1 in 3,755 years)
Drifting vessel to structure allision	Base case	N/A	2.98×10^{-5} (1 in 33,517 years)	2.98×10^{-5} (1 in 33,517 years)
	Future case (10%)	N/A	3.29×10^{-5}	3.29×10^{-5}

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
			(1 in 30,356 years)	(1 in 30,356 years)
	Future case (20%)	N/A	3.56×10^{-5} (1 in 28,107 years)	3.56×10^{-5} (1 in 28,107 years)
Fishing vessel to structure allision	Base case	N/A	2.87×10^{-2} (1 in 34 years)	2.87×10^{-2} (1 in 34 years)
	Future case (10%)	N/A	3.16×10^{-2} (1 in 31 years)	3.16×10^{-2} (1 in 31 years)
	Future case (20%)	N/A	3.44×10^{-2} (1 in 28 years)	3.44×10^{-2} (1 in 28 years)
Total	**Base case**	**2.32×10^{-4} (1 in 4,318 years)**	**2.93×10^{-2} (1 in 34 years)**	**2.90×10^{-2} (1 in 34 years)**
	Future case (10%)	**2.79×10^{-4} (1 in 3,581 years)**	**3.22×10^{-2} (1 in 31 years)**	**3.19×10^{-2} (1 in 31 years)**
	Future case (20%)	**3.27×10^{-4} (1 in 3,054 years)**	**3.52×10^{-2} (1 in 28 years)**	**3.48×10^{-2} (1 in 29 years)**

765. From the detailed results of the collision and allision risk modelling, the distribution of the predicted change in annual collision and allision frequency by vessel type due to the Proposed Development for the base case and future case are presented in Figure C-12. For clarity, the same distribution is presented in Figure C-13 with fishing vessels excluded.

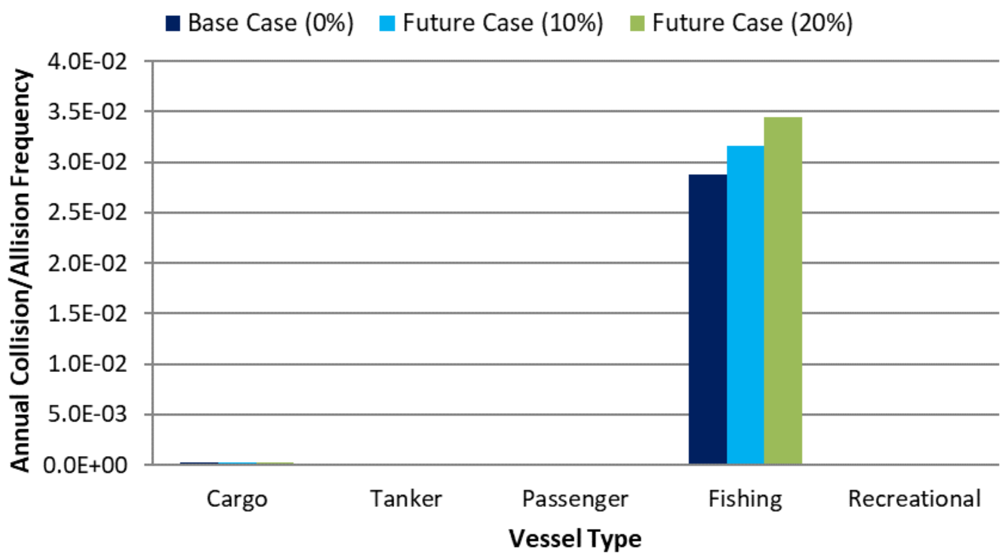

Figure C-12 Estimated Change in Annual Collision and Allision Frequency by Vessel Type

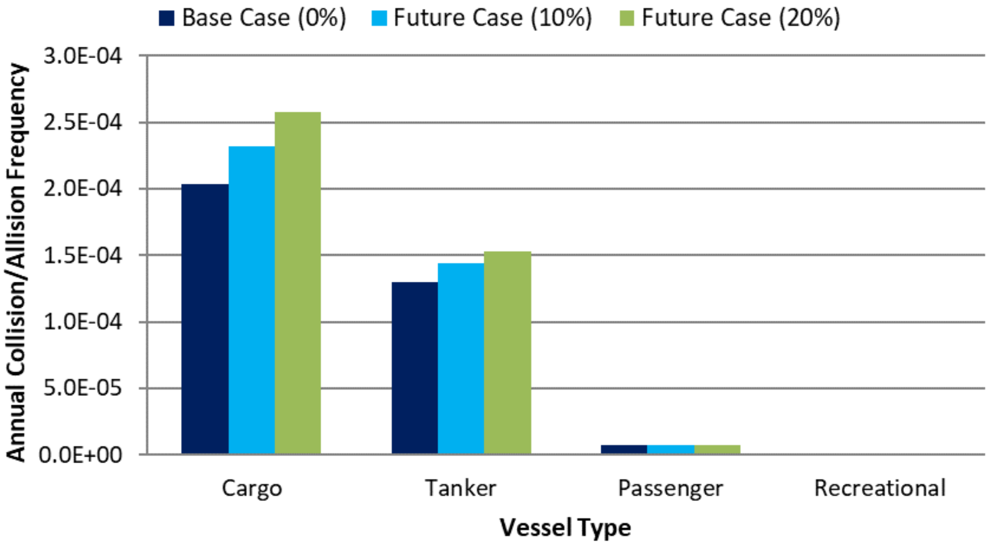

Figure C-13 Estimated Change in Annual Collision and Allision Frequency by Vessel Type (Excluding Fishing Vessels)

766. The change in collision and allision frequency is dominated by fishing vessels due to their active presence within and in proximity to the Array Area and the conservative nature of Anatec's COLLRISK model for fishing vessel allisions.

767. The second greatest collision and allision frequency change was associated with cargo vessels but was significantly lower than fishing vessels.

768. Combining the annual collision and allision frequency (Table C-5), estimated number of POB for each vessel type (Table C-3) and the estimated fatality probability for each vessel type category (Table C-4), the annual increase in PLL due to the presence of the Proposed Development for the base case is estimated to be 1.93×10^{-4}, equating to one additional fatality every 5,177 years. The estimated incremental increases in PLL due to the Proposed Development, distributed by vessel type and for the base case and future case, are presented in Figure C-14. For clarity, the same distribution is presented in Figure C-15 with fishing vessels excluded.

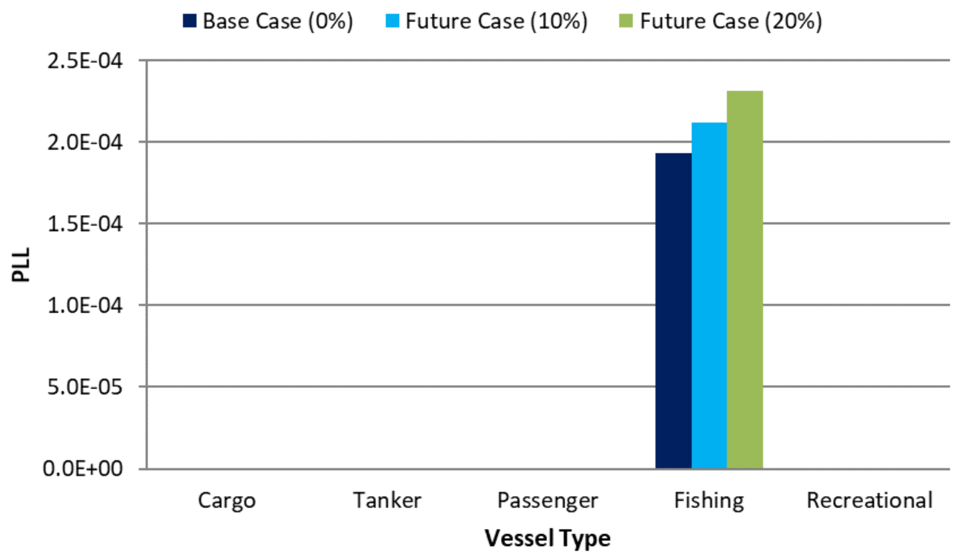

Figure C-14 Estimated Change in Annual PLL by Vessel Type

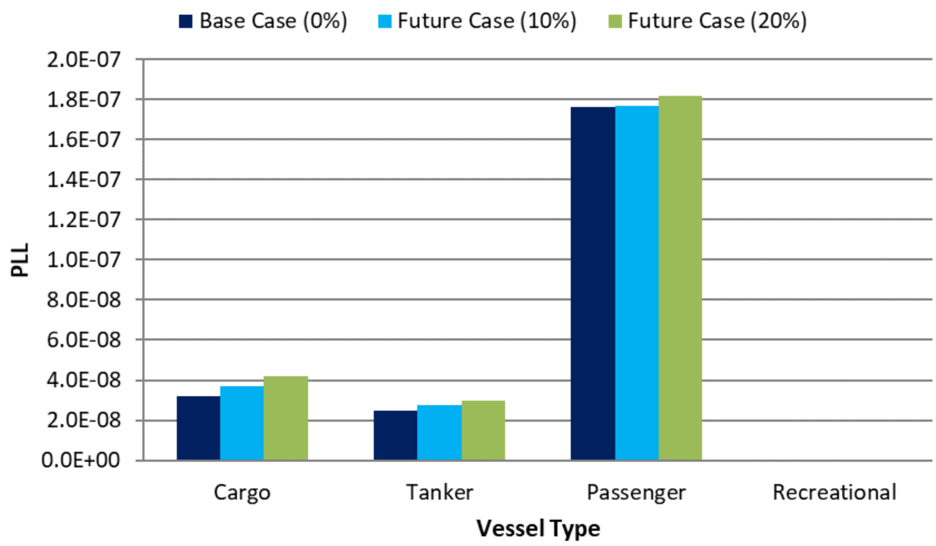

Figure C-15 Estimated Change in Annual PLL by Vessel Type (Excluding Fishing Vessels)

769. As with the change in collision and allision frequency, the change in annual PLL is dominated by fishing vessels which historically have a higher fatality probability than commercial vessels.

770. The second greatest annual PLL change was associated with passenger vessels due to much greater numbers of POB associated with this vessel type compared to others.

771. Converting the PLL to individual risk based upon the average number of people exposed by vessel type, the results are presented in Figure C-16. For clarity, the same distribution is presented in Figure C-17 with fishing vessels excluded.

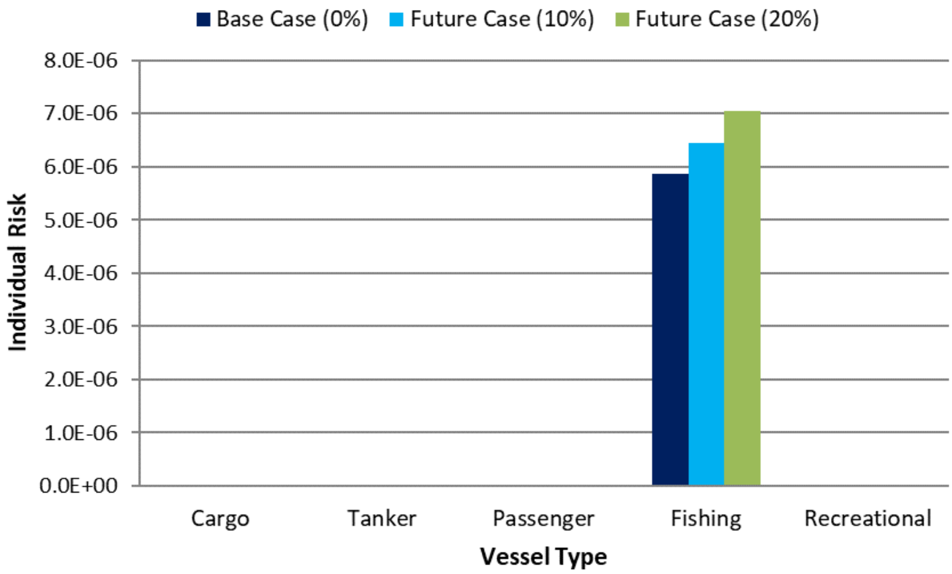

Figure C-16 Estimated Change in Individual Risk by Vessel Type

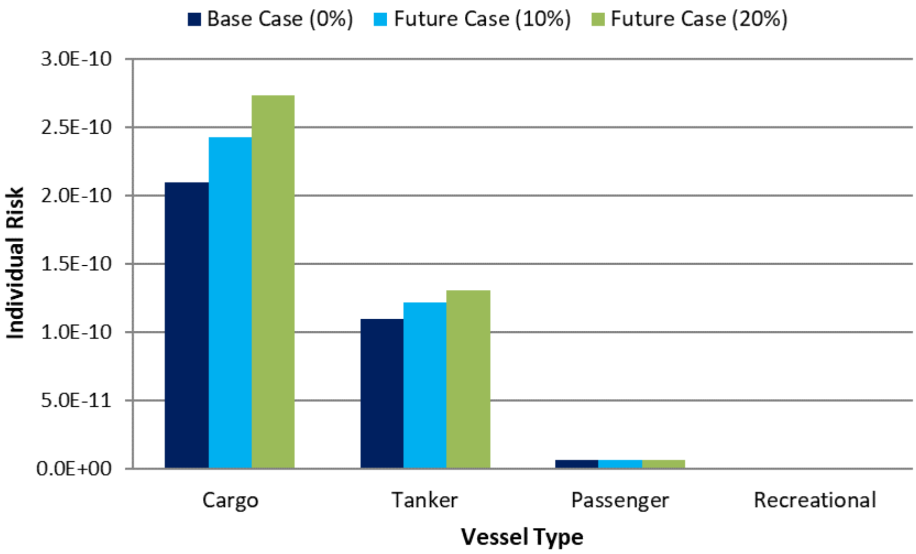

Figure C-17 Estimated Change in Individual Risk by Vessel Type (Excluding Fishing Vessels)

772. The change in individual risk to people is dominated by fishing vessels, again reflecting the higher probability of a fatality occurring in the event of an incident involving a fishing vessel compared to other vessel types.

C.4.4 Significance of Increase in Fatality Risk

773. In comparison to MAIB statistics, which indicate an average of 18 to 19 fatalities per year in UK territorial waters during the 20-year period between 2002 and 2021, the overall increase for the base case in PLL of one additional fatality per 5,177 years represents a very small change.

774. In terms of individual risk to people, the change for commercial vessels attributed to the Proposed Development (approximately 3.24×10^{-10} for the base case) is very low compared to the background risk level for the UK sea transport industry of 2.9×10^{-4} per year.

775. For fishing vessels, the change in individual risk attributed to the Proposed Development (approximately 5.87×10^{-6} for the base case) is very low compared to the background risk level for the UK sea fishing industry of 1.2×10^{-3} per year.

C.5 Pollution Risk

C.5.1 Historical Analysis

776. The pollution consequences of a collision in terms of oil spill depend upon the following criteria:

- Spill probability (i.e., the likelihood of outflow following an incident); and
- Spill size (quantity of oil).

777. Two types of oil spill are considered in this assessment:

- Fuel oil spills from bunkers (all vessel types);
- Cargo oil spills (laden tankers).

778. The research undertaken as part of the DfT’s Marine Environmental High Risk Areas (MEHRAs) Project (DfT, 2001) has been used it was comprehensive and based upon worldwide marine oil spill data analysis. From this research, the overall probability of a spill per incident was calculated based upon historical incident data for each incident type as presented in Figure C-18.

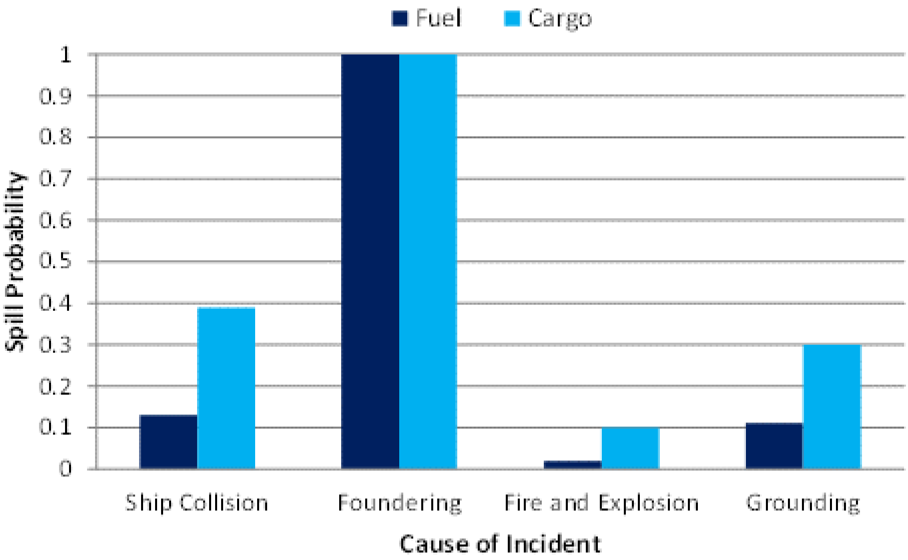

Figure C-18 Probability of an Oil Spill Resulting from an Accident

779. Therefore, it was estimated that 13% of vessel collisions result in a fuel oil spill and 39% of collisions involving a laden tanker result in a cargo oil spill.

780. In the event of a bunker spill, the potential outflow of oil depends upon the bunker capacity of the vessel. Historical bunker spills from vessels have generally been limited to a size below 50% of bunker capacity, and in most incidents much lower.

781. For the types and sizes of vessels exposed to the Proposed Development, an average spill size of 100 tonnes of fuel oil is considered a conservative assumption.

782. For cargo spills from laden tankers, the spill size can vary significantly. The ITOPF reported the following spill size distribution for tanker collisions between 1974 and 2004:

- 31% of spills below seven tonnes;
- 52% of spills between seven and 700 tonnes; and
- 17% of spills greater than 700 tonnes.

783. Based upon this data and the tankers transiting in proximity to the Proposed Development, an average spill size of 400 tonnes is considered a conservative assumption.

784. For fishing vessel collisions, comprehensive statistical data is not available. Consequently, it is conservatively assumed that 50% of all collisions involving fishing vessels will lead to oil spill with the quantity spilled being on average five tonnes. Similarly for recreational vessels, due to a lack of data 50% of collisions are conservatively assumed to lead to a spill with an average size of one tonne.

C.5.2 Pollution Risk due to the Proposed Development

785. Applying the above probabilities to the annual collision and allision frequency by vessel type presented in Table C-5 and the average spill size per vessel, the amount of oil spilled per year due to the impact of the Proposed Development is estimated to be 0.09 tonnes for the base case, rising to 0.11 tonnes per year for the 20% future case.

786. The estimated increase in tonnes of oil spilled, distributed by vessel type, for the base case and future case are presented in Figure C-19.

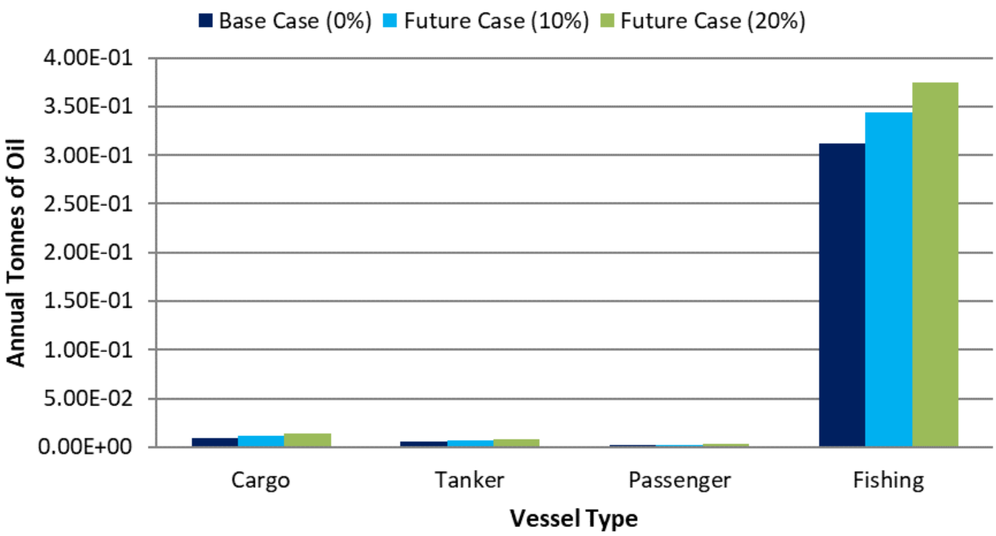

Figure C-19 Estimated Change in Pollution by Vessel Type

787. The annual oil spill results are dominated by fishing vessels due to their high associated annual collision and allision frequency. The second greatest contributor was tankers, reflecting the greater oil spill volume per incident associated with tankers.

C.5.3 Significant of Increase in Pollution Risk

788. To assess the significance of the increased pollution risk from vessels caused by the Proposed Development, historical oil spill data for the UK has been used as a benchmark.

789. From the MEHRAs research, the annual average tonnes of oil spilled in UK waters due to maritime incidents in the 10-year period from 1989 to 1998 was 16,111. This is based upon a total of 146 reported oil pollution incidents of greater than one tonne (smaller spills are excluded as are incidents which occurred within port or harbour areas or resulting from operational errors or equipment failure). Commercial vessel spills accounted for approximately 99% of the total while fishing vessel incidents accounted for less than 1%.

790. The overall increase in pollution estimated due to the Proposed Development of 0.09 tonnes per year for the base case represents a 0.0006% increase compared to the historical average pollution quantities from maritime incidents in UK waters.

C.6 Conclusion

791. This appendix has quantitively assessed the fatality and pollution risk associated with the Proposed Development in the event of a collision or allision incident occurring. The assessment indicates that the fatality and pollution risk associated with fishing vessels is greatest.

792. Overall, the impact of the Proposed Development on people and the environment is relatively low compared to the existing background risk levels in UK waters. However, this is the localised impact of a single OWF development and there will be additional maritime risks associated with other OWF developments in the Irish Sea and the UK as a whole.

793. Discussion of relevant mitigation measures and monitoring is provided in Section 23 of the NRA.

Annex D Regular Operator Consultation

794. As part of the consultation process for the Proposed Development, Regular Operators identified (from the vessel traffic survey data) in proximity to the Array Area were consulted via email. An example of the correspondence sent to the Regular Operators is presented below.

Anatec Ltd.
Cain House
10 Exchange Street
Aberdeen AB11 6PH
Tel: 01224 253700
Email: aberdeen@anatec.com
Web: www.anatec.com

Date: 23rd November 2023

Opportunity to Participate in Consultation Relating to Shipping and Navigation for the Proposed Muir Mhòr Offshore Wind Farm

Dear Sir/Madam,

As you may be aware, the Muir Mhòr Offshore Wind Farm ('the Project') is being developed by a Joint Venture between Fred. Olsen Seawind and Vattenfall ('the Developer') in the North Sea, off the east coast of Scotland. Following a Scoping Report published in July 2023 (see here), a Navigational Risk Assessment (NRA) is being undertaken to inform the Environmental Impact Assessment Report (EIAR).

An overview of the Muir Mhòr array area is provided in Figure 1. The array area is located approximately 33 nautical miles (nm) off the Scottish east coast, east of Peterhead. The array area covers an area of approximately 58 square nautical miles (nm^2) within which up to 67 floating wind turbine generators (WTG) and up to three fixed offshore electrical platforms (OEP) will be installed.

An offshore export cable corridor (ECC) will be located between the wind farm array and a landfall location on the Scottish east coast. Figure 1 also illustrates the Offshore ECC for reference, which splits into two sections to avoid the Hywind Scotland Offshore Wind Farm.

Further information about the Project can be found here.

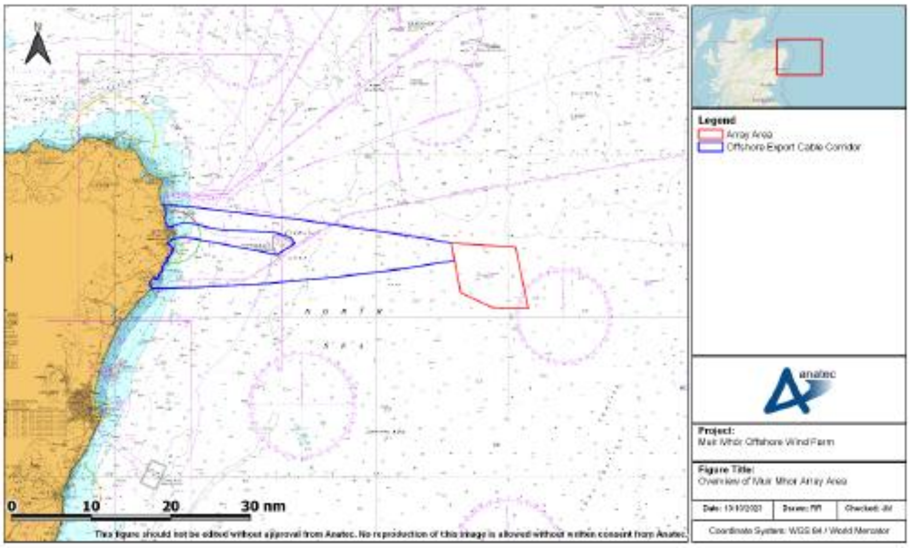

Figure 1 Overview of the Project

The Project is one of various offshore wind farm developments being developed as part of the ScotWind leasing round. A cumulative overview of other offshore wind farm developments is presented in Figure 2, including developments which are operational, under construction, and in planning (Forth Zone, ScotWind and Innovation and Targeted Oil & Gas (INTOG)).

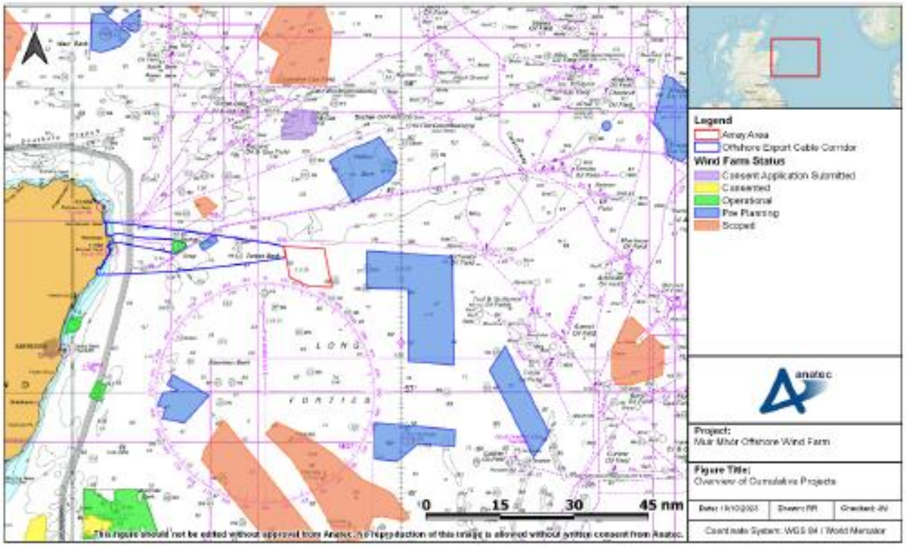

Figure 2 Overview of Cumulative Projects

Page 2

Anatec has been contracted by the the Project to provide technical support on shipping and navigation during the EIAR process, and to coordinate consultation with relevant stakeholders. As part of this support, Anatec has undertaken an assessment of 28 days of Automatic Identification System (AIS), Radar and visual observations data in compliance with the Maritime and Coastguard Agency's (MCA) Marine Guidance Note (MGN) 654 (14 days in February 2023 and 14 days in July and August 2023), as well as a long-term AIS assessment for the entirety of 2022. This allowed the identification of regular commercial operators. This exercise has identified your organisation as a regular operator within or in proximity to the array area.

We therefore invite your feedback on the Project, including any impact it may have upon the navigation of vessels. Whilst we welcome all feedback we are particularly interested in any comments or feedback relating to the following:

1. Whether the presence of the Project is likely to impact the routeing of any specific vessels and/or routes, including the nature of any change in regular passage.
2. Whether the presence of the Project poses any safety concerns to your vessels, including in relation to adverse weather routeing.
3. Whether your responses to the previous questions are affected by the additional presence of cumulative offshore wind farm developments.
4. Whether you would choose to make passage internally through the array area containing floating WTGs and fixed OEPs.
5. Whether you wish to be retained on our list of marine stakeholders and consulted throughout the NRA process.

Additionally, we wish to invite you to attend a Hazard Workshop which is anticipated to take place in early 2024 (further details will follow).

We would appreciate that any responses are provided via email to [redacted] by **Friday 22nd December**, as well as an indication of whether you are interested in attending the Hazard Workshop noted above.

Yours sincerely,

[redacted]
Risk Analyst
Anatec Ltd.

Annex E Long-Term Vessel Traffic Movements

795. This appendix assesses additional long-term vessel traffic data for the Proposed Development. As required under MGN 654 (MCA, 2021), the NRA considers 28 days of AIS, Radar and visual observation data as the primary vessel traffic data source. However, it should be considered that studying a 28-day period in isolation may exclude certain activities or periods of pertinence to Shipping and Navigation. Therefore, in line with good practice assessment procedures, this NRA has also considered a longer term dataset covering all of 2022 to ensure a comprehensive characterisation of vessel traffic movements can be established, including the capture of any seasonal variation.

796. The key aims of this appendix are to identify seasonal variations and any other movements or activities not represented by the vessel traffic survey data.

E.1 Methodology

E.1.1 Study Area

797. This appendix has assessed the long-term vessel traffic data within the same 10 nm (18.5 km) buffer study area as introduced in Section 3.5.

E.1.2 Data Period and Temporary Vessel Traffic

798. The long-term vessel traffic data was collected from coastal AIS receivers for the entirety of 2022 (1 January to 31 December). Overall, there was good coverage of the study area during the data period.

799. As per the vessel traffic surveys, a number of vessel tracks recorded during the data period were classified as temporary (non-routine) and have been excluded from the characterisation of the vessel traffic baseline; this was typically vessels carrying out survey operations, attending offshore wind developments which at the time of data collection were under construction, or attending temporary jack-up platforms.

800. Overall, temporary traffic which was removed from the dataset equated to approximately 6% of all traffic recorded across the data period.

E.1.3 AIS Carriage

801. General limitations associated with the use of AIS data (for example, carriage requirements) are discussed in full within Section 5.4.1.

E.2 Long-Term Vessel Traffic Movements

802. A plot of the vessel tracks recorded within the study area during the data period, colour-coded by vessel type and excluding temporary traffic, is presented in Figure E-1. Following this, the same data is illustrated in a density heat map in Figure E-2.

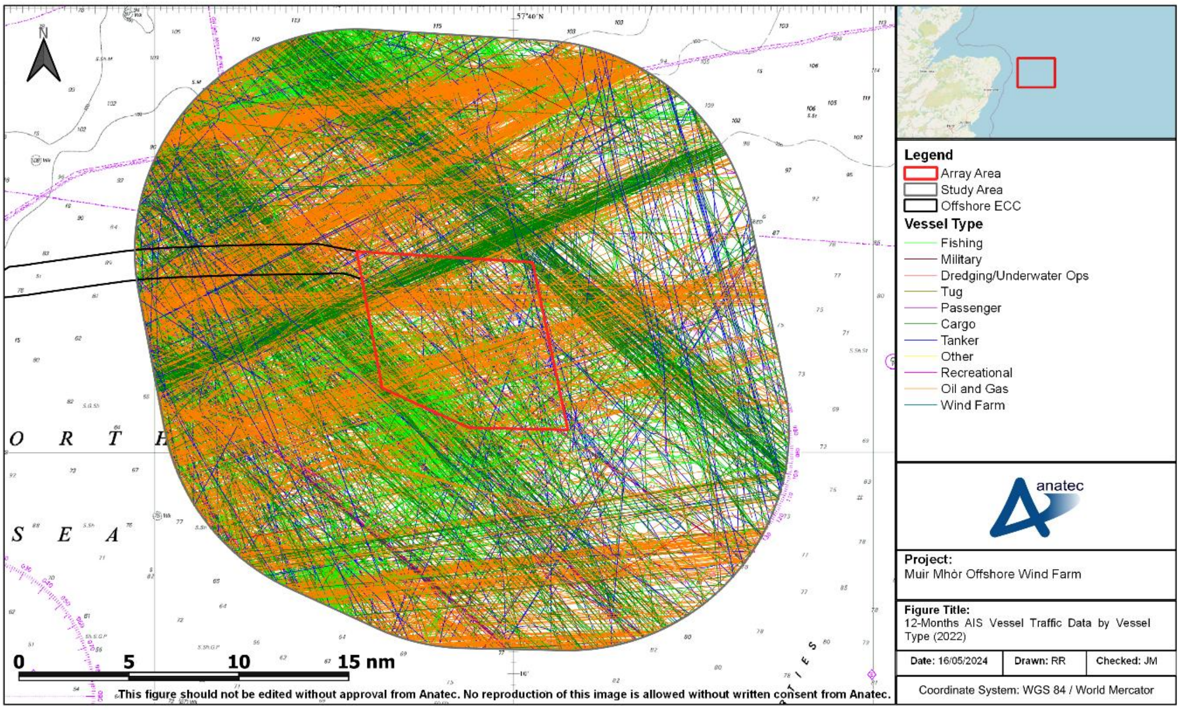

Figure E-1 12-Months AIS Vessel Traffic Data by Vessel Type (2022)

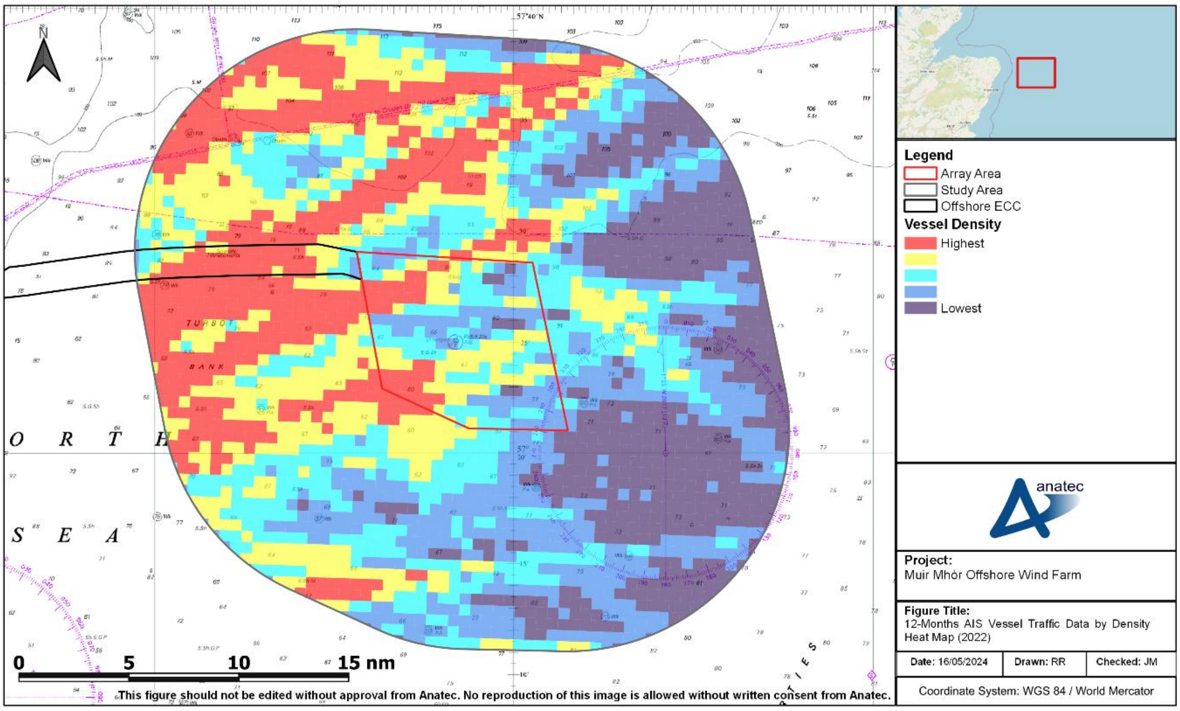

Figure E-2 12-Months AIS Vessel Traffic Data by Density Heat Map (2022)

E.2.2 Vessel Counts

803. The average number of unique vessels recorded per day for each month of the data period withing the study area and intersecting the Array Area is presented in Figure E-3.

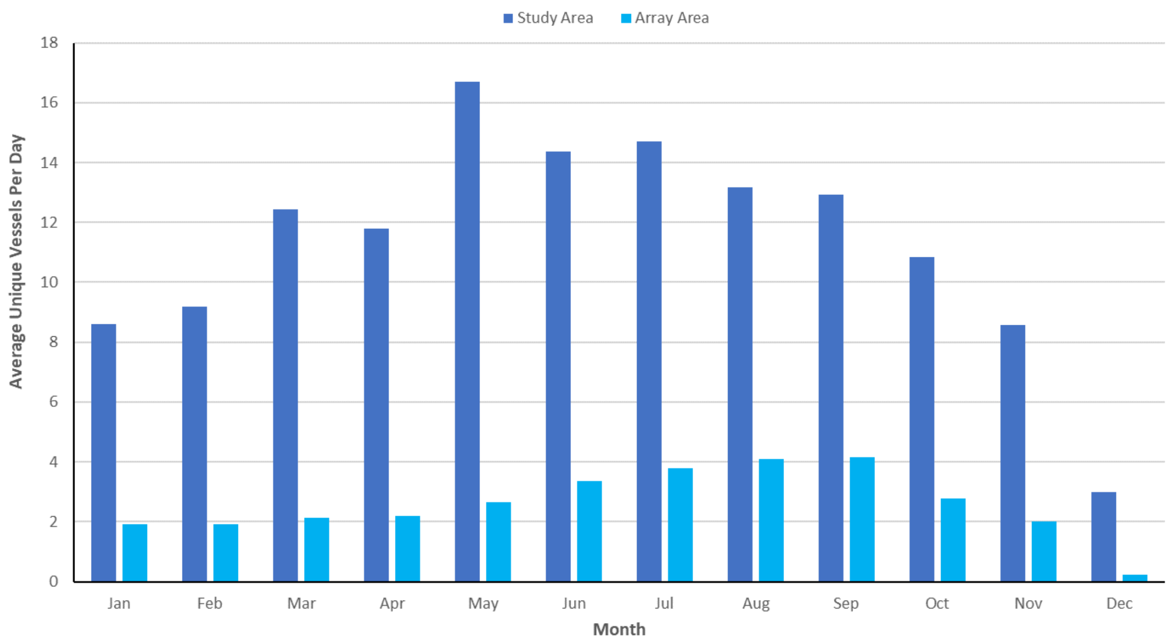

Figure E-3 Average Unique Vessel Counts per Day per Month (2022)

804. The busiest month during the long-term vessel traffic dataset was May with an average of 17 unique vessels per day recorded within the study area. September was the busiest month for vessels intersecting the Array Area with an average of four unique vessels per day recorded.

805. The quietest month during the long-term vessel traffic dataset was December with an average of three unique vessels per day recorded within the study area. December was also the quietest month for vessels intersecting the Array Area with an average of one unique vessel recorded every four to five days.

E.2.3 Vessel Type

806. The distribution of the main vessel types recorded during the long-term vessel traffic dataset are presented in Figure E-4 for vessels within the study area and in Figure E-5 for vessels intersecting the Array Area.

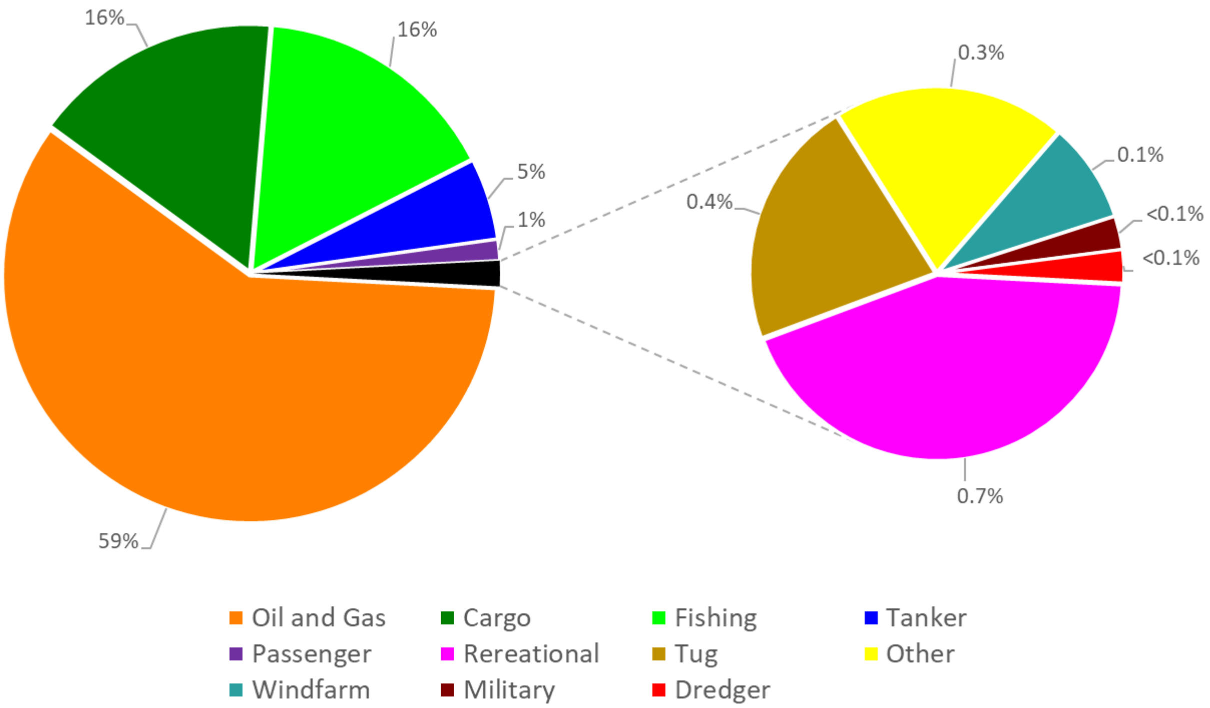

Figure E-4 Vessel Type Distribution within the Study Area (2022)

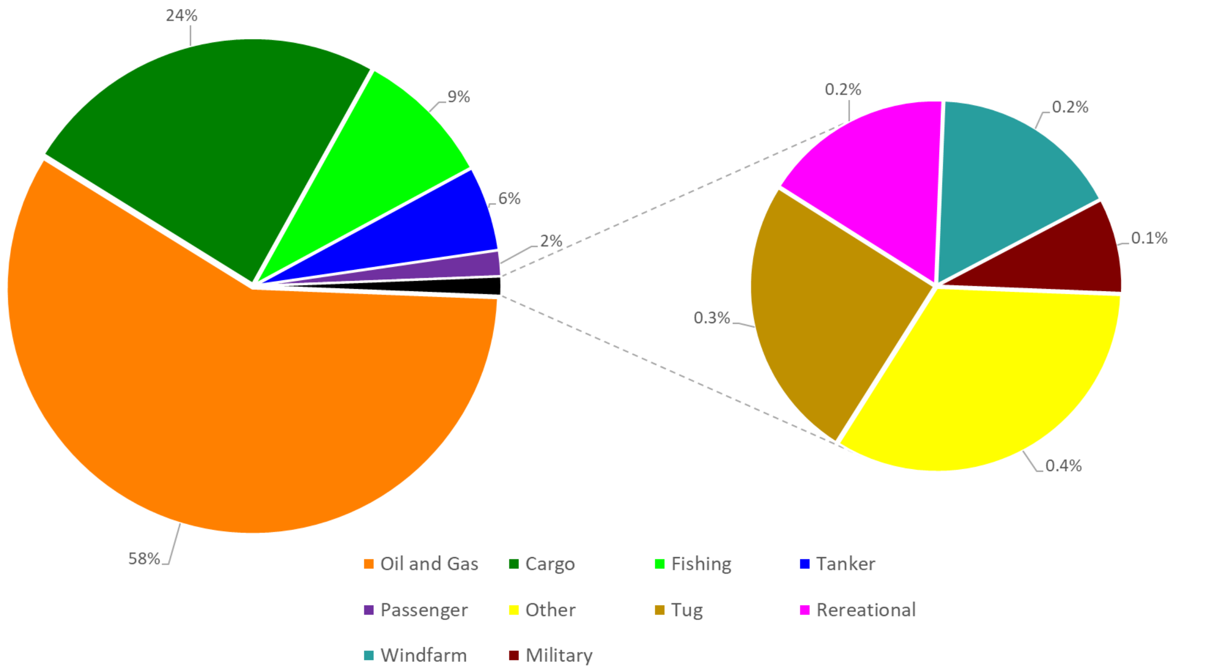

Figure E-5 Vessel Type Distribution within the Array Area (2022)

807. The most common vessel type recorded within the study area during the data period was oil and gas vessels, accounting for 59% of all traffic recorded. Other common

vessel types included cargo vessels (16%), fishing vessels (16%), and tankers (5%). No other vessel type equating to more than 5% of all vessel types recorded.

808. This was the same trend for vessels intersecting the Array Area with oil and gas vessels (58%), cargo vessels (24%) and fishing vessels (9%) being the most commonly recorded vessel types.

809. These trends correlate with the vessel traffic survey data analysed in Section 10.1.2.

E.2.3.2 Oil and Gas Vessels

810. Figure E-6 presents the oil and gas vessels recorded within the study area during the data period. Following this, Figure E-7 illustrates the unique average counts per day per month for oil and gas vessels are presented.

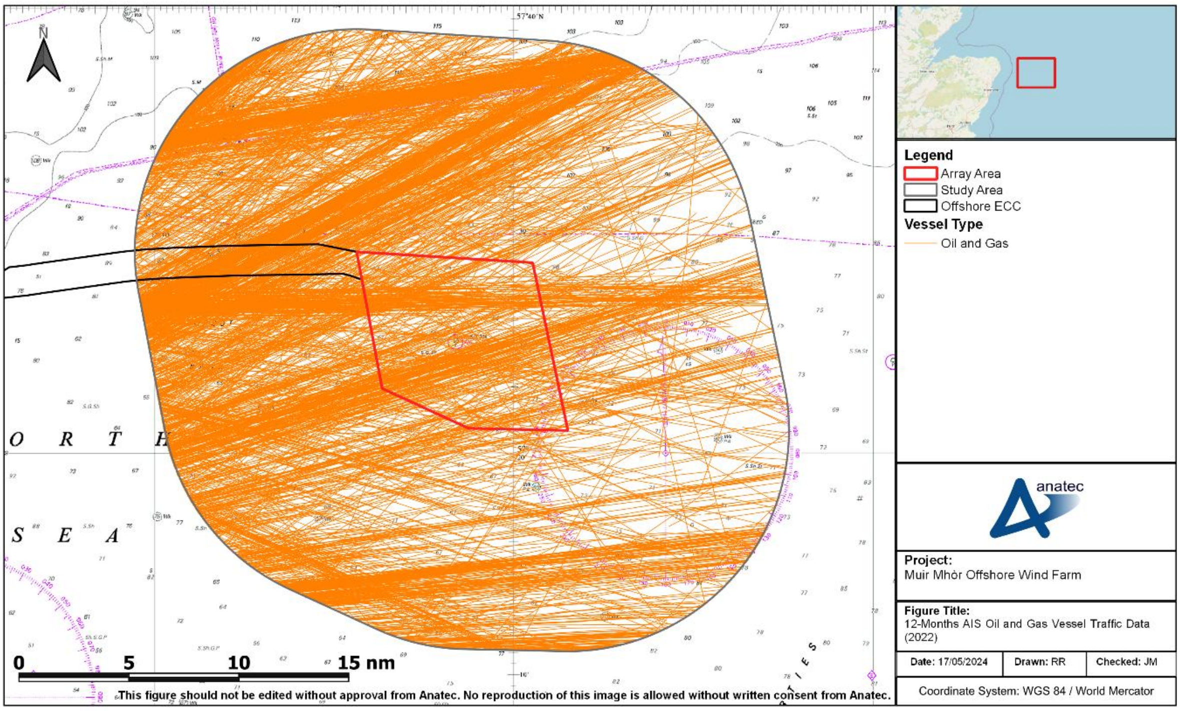

Figure E-6 12-Months AIS Oil and Gas Vessel Traffic Data (2022)

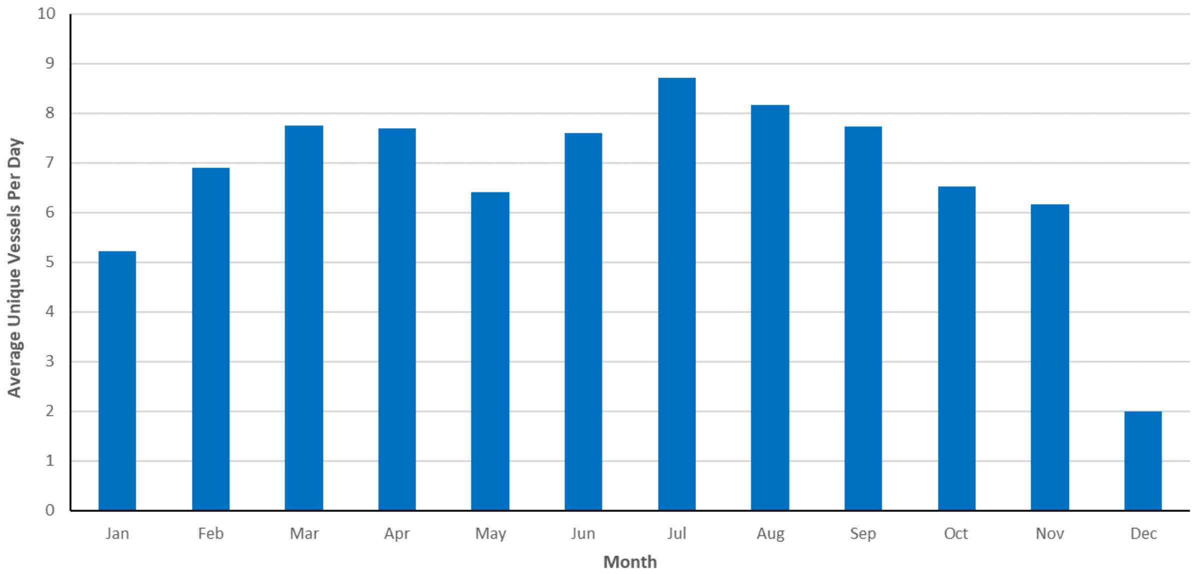

Figure E-7 Unique Oil and Gas Vessel Counts per Day per Month (2022)

811. Oil and gas vessels showed slight seasonal variation with higher average numbers recorded in spring and summer months with fewer vessels recorded in the winter months in comparison. On average, there were seven unique cargo vessels recorded per day within the study area across the data period. July was the busiest month for oil and gas vessels when vessel activity peaked with an average nine unique vessels recorded each day. December was the quietest month with an average of two unique vessels recorded each day.

812. An average of one to two unique oil and gas vessels intersected the Array Area per day or approximately 22% of all oil and gas vessels recorded.

813. The majority of oil and gas vessels were observed transiting east west across the study area with slightly higher volumes to the north. Of all oil and gas vessels with a valid destination broadcast via AIS, 34% of vessels were routeing to Aberdeen. Peterhead (13%), Forties Field (11%), and Kittiwake Field (5%) were also common destinations.

814. Several defined oil and gas routes recorded within the study area across the data period, these included:

- Aberdeen/Arbroath – Mungo, ETAP and Seagull fields at the south of the study area;
- Aberdeen – Nelson and Everest Fields through the centre and south of the Array Area;
- Peterhead – Kittiwake Field directly east west at the north of the Array Area;
- Aberdeen – Britannia, Alba, and the Andrew Fields directly adjacent to the north-west corner of the Array Area;
- Peterhead – Forties field at the northern extent of the study area; and

- Aberdeen – Tiffany Field and the Global Producer FPSO at the far north-west of the study area.

E.2.3.3 Commercial Vessels

815. Figure E-8 presents the commercial vessels recorded within the study area during the data period, colour-coded by vessel type. Following this, Figure E-9 illustrates the unique average counts per day per month for commercial vessels are presented.

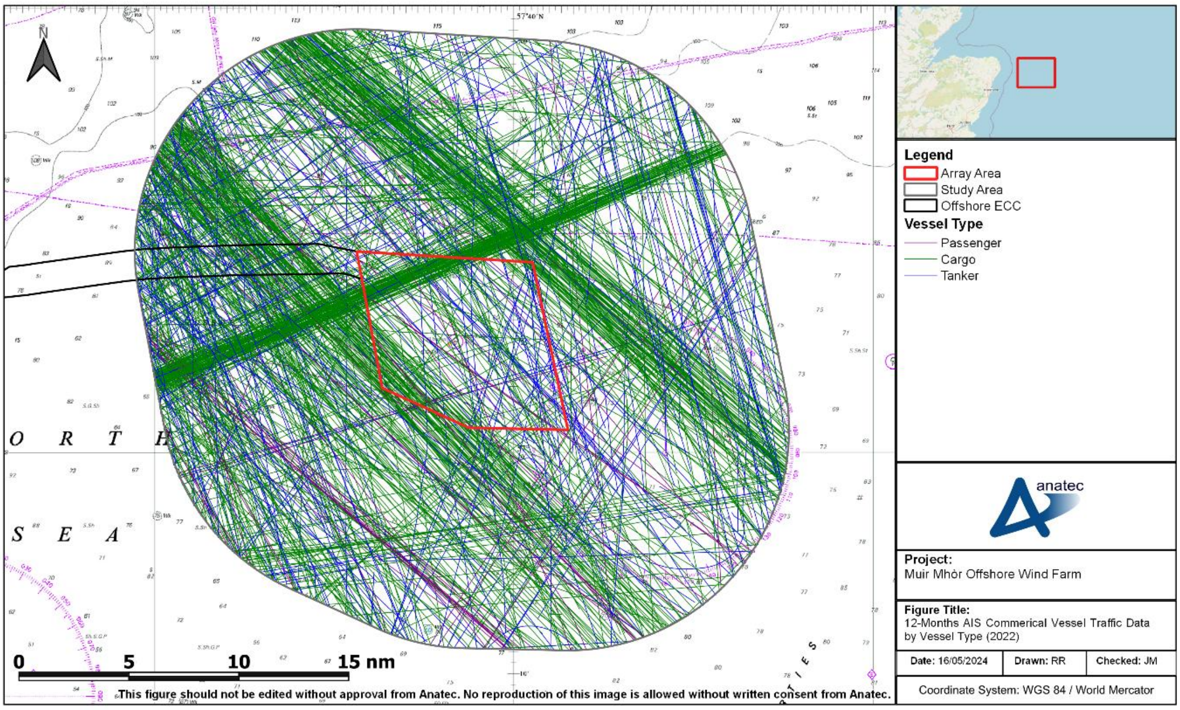

Figure E-8 12-Months AIS Commercial Vessel Traffic Data by Vessel Type (2022)

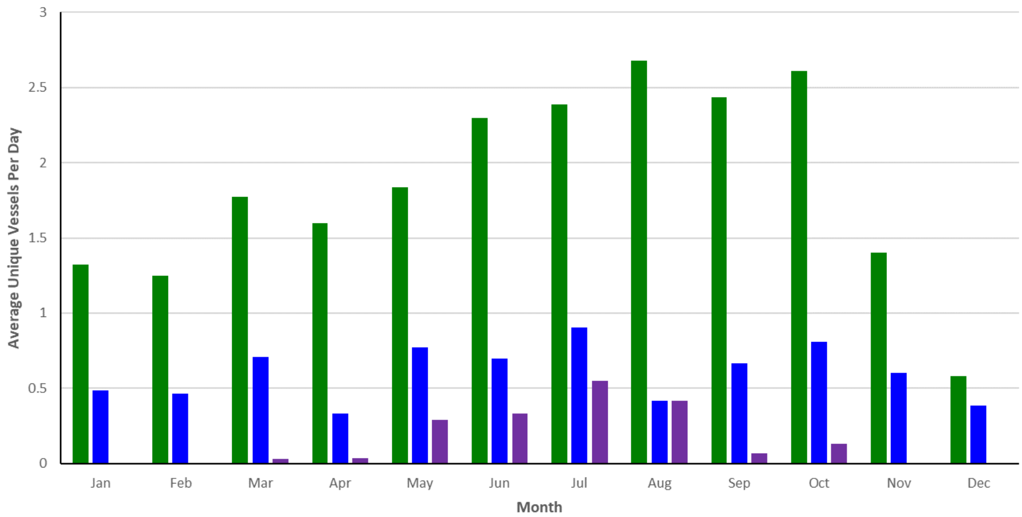

Figure E-9 Unique Commercial Counts per Day per Month by Vessel Type (2022)

816. Cargo vessels were the main commercial vessel type recorded and showed moderate seasonal variation with higher average numbers recorded in the summer months and fewer vessels recorded in the winter months in comparison. On average there was two unique cargo vessels per day recorded within the study area during the data period. August was the busiest month for cargo vessels with an average of three unique vessels recorded per day. December was the quietest month with an average of one unique cargo vessel recorded every two days.

817. The main cargo sub-type recorded was general cargo (31% of all cargo vessels recorded). Bulk carriers (23%), container vessels (16%), Ro-Ro (13%) were also common.

818. Cargo vessels were observed on four main commercial routes. These routes include:

- European ports – United States/Canada intersecting the west of the Array Area;
- Denmark – United States/Canada to the immediate east of the Array Area;
- Aberdeen – Risavika through the north of the Array Area; and
- Aberdeen – Norway ports to the south of the study area, noting this route is less defined.

819. Cargo vessels were also noted across the study area on less frequent and less defined routes which also intersected the Array Area. Overall, 34% of all cargo vessels recorded in the study area intersect the Array Area, or an average of one cargo vessels every one to two days.

820. Ro-Ro vessels, which are a particularly sensitive user given their timetabled services, were mainly on the Aberdeen – Risavika route previously mentioned. A vessel on this route was recorded on average once every 5 days within the study area across the data period, with this route intersecting the north-west corner of the Array Area. Other Ro-Ro vessels were infrequent and not on defined routes, however, the majority of these other Ro-Ro vessels were also routeing to ports in Denmark.

821. Commercial ferries including Ro-Ro and Roll-On/Roll-Off Passenger (Ro-Pax) vessels are illustrated in Figure E-10 by vessel operator. As illustrated, the Aberdeen – Risavika route operated by Sea Cargo is the only main commercial ferry route in the study area. Six transits were recorded by Smyril Line routeing between Rotterdam and Tórshavn (Faroe Islands) in the winter months which may be related to adverse weather conditions and is highlighted in the adverse weather section of the NRA (Section 12).

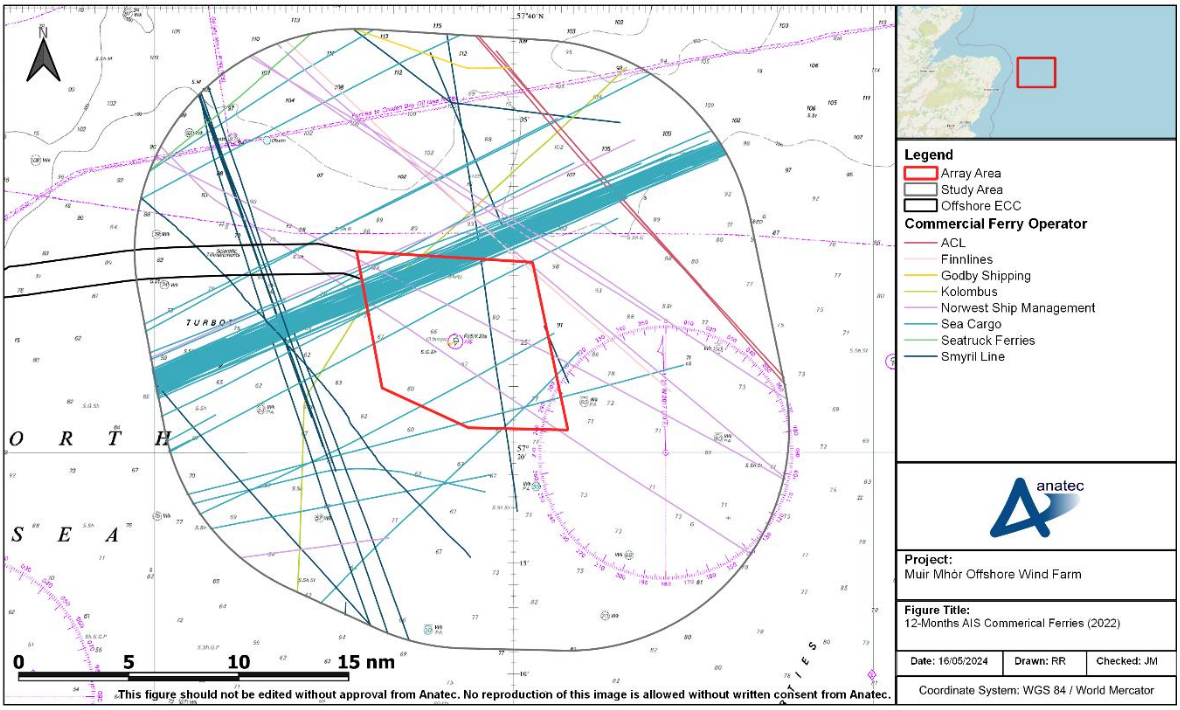

Figure E-10 12-Months AIS Commercial Ferries by Operator (2022)

822. Tankers were not as prominent in the study area, but vessels were consistent throughout the data period with an average of one unique vessel recorded every one to two days. July was the busiest month for tankers with an average of one unique tanker recorded per day within the study area. December was the quietest month with an average of one unique tanker recorded every two to three days. An average of one unique tanker was recorded within the Array Area every seven days, or approximately 24% of all tankers recorded.

823. The most common tanker sub types recorded during the data period was crude oil tankers (46%), combined oil/chemical tankers (17%), and product tankers (12%).

824. Tankers were recorded transiting in various directions across the study area with defined north-west south-east routeing noted through the full extent of the Array Area and to the west. This traffic was routeing between Scapa Flow (UK)/the BW Catcher FPSO and Wilhelmshaven (Denmark), as well as other ports in Denmark. Tankers were also recorded routeing between ports and harbours in Shetland and Orkney and Rotterdam.

825. Passenger vessels were highly seasonal with vessels only being recorded within the study area during the months March to October. It is noted that September recorded only two unique vessels, and the months March, April, and October only recorded one unique vessel across each month, this highlighting the main passenger vessels were recorded during the summer months of June, July, and August. There was an average of one unique passenger vessel recorded per week (every seven days) during

the data period. June was the busiest month for passenger vessels with an average of one unique vessel every one to two days. Winter months (January, February, November, and December) recorded no passenger vessels within the study area. An average of one to two passenger vessels per month were recorded intersecting the Array Area, or approximately 30% of all passenger vessels recorded.

826. Passenger vessels were noted mainly routeing north-west south-east across the study area. These vessels were all cruise liners and were routeing between Bremerhaven (Germany) and Invergordon. Several other passenger vessels, including cruise liners and yachts, routeing in other directions were also recorded within the study area.

E.2.3.4 Fishing Vessels

827. Figure E-11 presents the fishing vessels recorded within the study area during the data period. Following this, Figure E-12 illustrates the unique average counts per day per month for fishing vessels are presented.

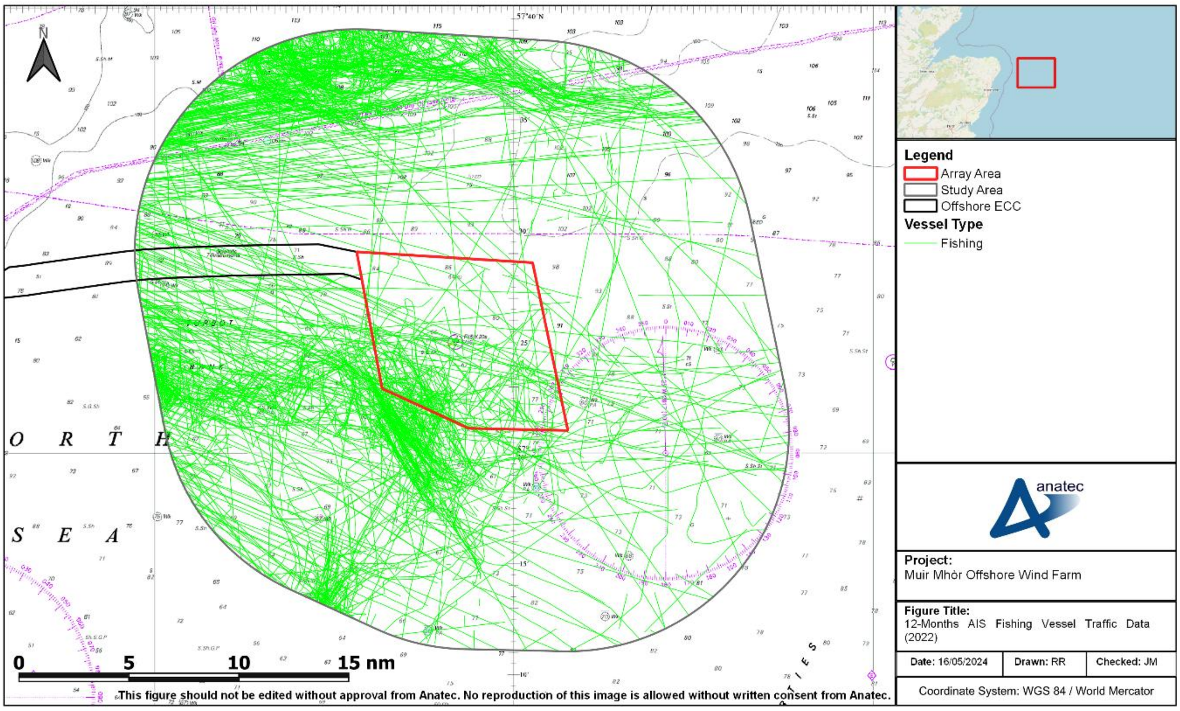

Figure E-11 12-Months AIS Fishing Vessel Traffic Data (2022)

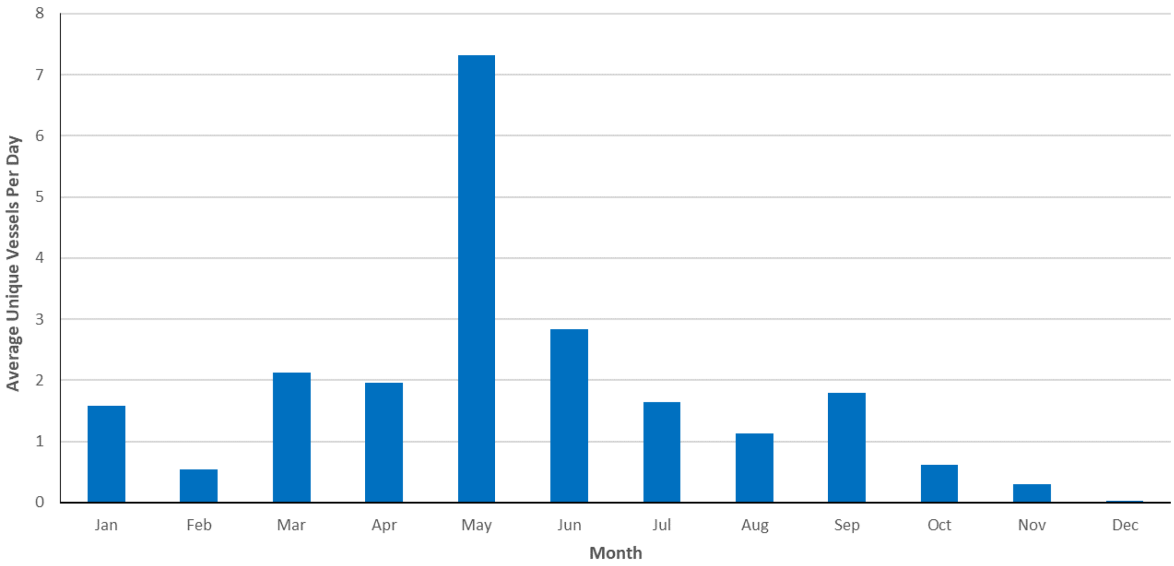

Figure E-12 Unique Fishing Vessel Counts per Day per Month (2022)

828. Fishing was moderate in the study area across the data period with more vessels in transit to/from fishing grounds (61% of all commercial fishing vessels) as opposed to engaged in fishing activity (39%). On average there was two unique fishing vessels per day recorded within the study area during the data period. May was considerably the busiest month for fishing vessels with seven unique vessels recorded per day. December was the quietest month with only of one unique fishing vessel recorded within the entire month. An average of one unique fishing vessel intersected the Array Area every four days across the data period, or approximately 13% of all fishing vessels recorded.

829. As for vessels which were considered to be engaged in likely fishing activity, several were noted to the northern extent of the study area and were primarily bottom otter trawls and mainly present in the months of April and May. Other vessels engaged in likely fishing activity were noted in the south-west of the study area, intersecting the Array Area. These vessels were primarily potters and seiners, with fishing dredgers, and both pelagic and demersal trawlers also present with activity in this area consistent across the spring and summer months. Several potters were also present during the winter in this area.

E.2.3.5 Recreational Vessels

830. Figure E-13 presents the recreational vessels recorded within the study area during the data period. Following this, Figure E-14 illustrates the unique average counts per day per month for recreational vessels are presented.

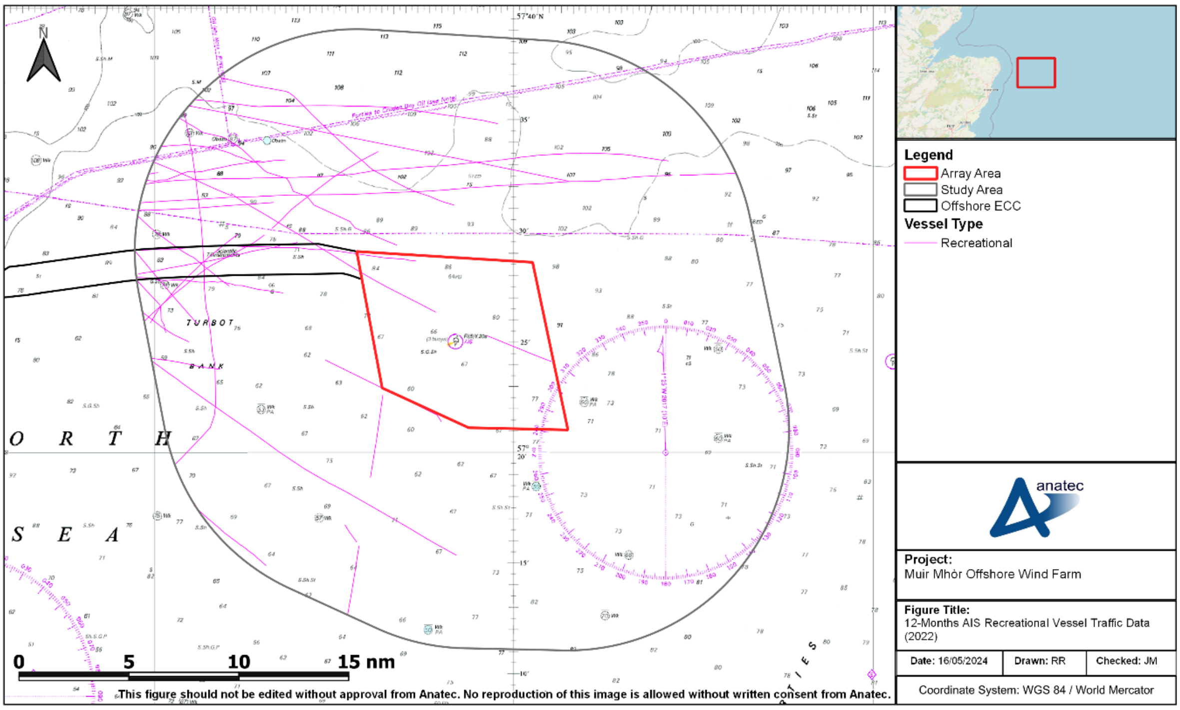

Figure E-13 12-Months AIS Recreational Vessel Traffic Data (2022)

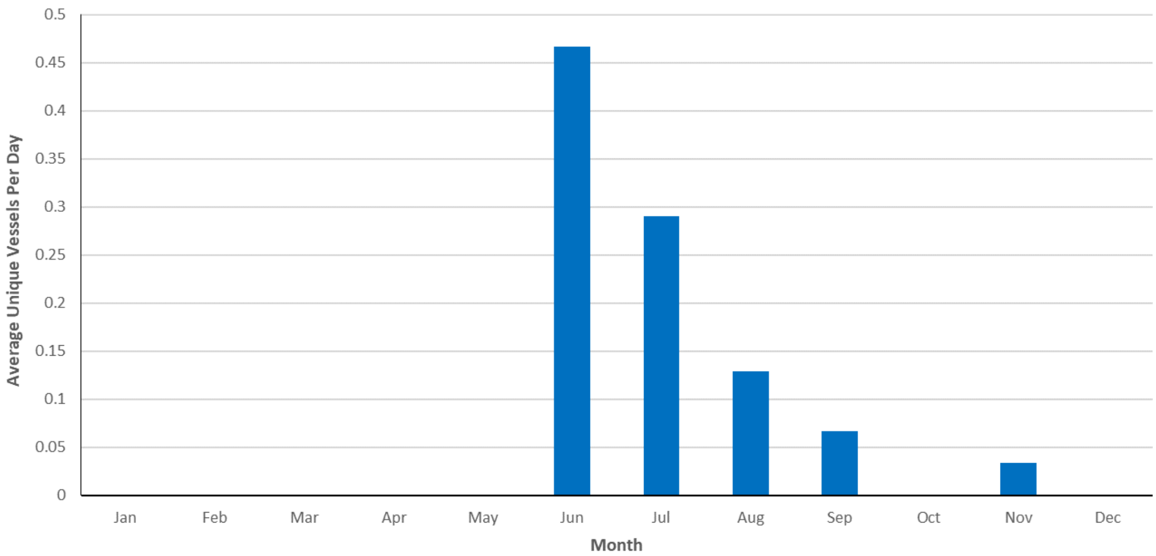

Figure E-14 Unique Recreational Vessel Counts per Day per Month (2022)

831. Recreational vessels were mostly on transits east west at the northern extent of the study area and were highly seasonal with vessels only recorded from June to September, with one vessel also being recorded in November. This would be expected given recreational activity would generally tend to be most prevalent during summer conditions, particularly far offshore.

832. An average of one recreational vessel was recorded within the study area every 12 days. June was the busiest month for recreational vessels with an average of one unique vessel being recorded every two days. Seven of the 12 months in the data period recorded no recreational vessels. Only two recreational vessels intersected the Array Area across the data period.

E.3 Vessel Traffic Survey Data Comparison

833. Table E-1 compares traffic volumes by vessel type between the long-term vessel traffic data and vessel traffic survey data recorded within the study area.

Table E-1 Comparison of Vessel Type Counts Between Long-Term Vessel Traffic Data and Vessel Traffic Survey Data

Vessel Type	Long-Term Vessel Traffic Data (2022)			Winter Survey (2023)	Summer Survey (2023)
	Busiest Month	Quietest Month	Average Vessels per Week	Average Vessels per Week	Average Vessels per Week
Oil and Gas	July	December	47	62	62
Cargo	August	December	13	12	24
Fishing	May	December	13	6	23
Tanker	July	April	4	5	4
Passenger	July	Jan/Feb/Nov/Dec	1	0	4
Recreational	June	Jan to May and Oct to Dec	0-1	0	6

834. In the case of fishing vessels, passenger vessels, and recreational vessels, the higher counts during the summer months in the long-term vessel traffic data is reflected in the vessel traffic survey data. For these vessel types there is substantial seasonal variation in counts such that the average values presented in Table E-1 give limited context. However, the seasonality was similar between the long-term vessel traffic data and vessel traffic survey data.

835. Seasonality was also recorded for cargo vessels during the long-term vessel traffic data which was also reflected in the.

836. Greater volumes of oil and gas vessels were recorded during the vessel traffic survey data in comparison to the long-term vessel traffic data. Oil and gas vessels can be inconsistent with transits depending on what operations are currently ongoing. There is an abundance of oil and gas infrastructure in the wider area surrounding the Proposed Development and so any change in in requirements and activity of oil and gas vessels will be reflected.

837. Overall, there is good agreement and understanding between the counts for the long-term vessel traffic data and the vessel traffic surveys.