MONA OFFSHORE WIND PROJECT

Environmental Statement

Volume 6, Annex 7.1: Navigational Risk Assessment (F02)

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Image of an offshore wind farm

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Errata

Document section	Description of errata
Paragraph 1.5.4.1	The local coastguard base for the region was incorrectly named as Holyhead Coastguard Operations Centre. The correct name is Holyhead Maritime Rescue Coordination Centre.
Paragraph 1.8.2.4	The relevant paragraph reference of NPS EN-3 is incorrectly given as 2.6.161. The correct paragraph reference is 2.8.187.
Paragraph 1.9.3.6	The text incorrectly states that 'Hazards are then defined as either Broadly Acceptable, with existing mitigation, or Unacceptable'. It should state that Hazards are then defined as either Broadly Acceptable, Tolerable if ALARP, or Unacceptable.
Paragraph 7.2.1.1.4 of Appendix E	The relevant paragraph reference of NPS EN-3 is incorrectly given as 2.6.161. The correct paragraph reference is 2.8.187.

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Glossary

Term	Meaning
Adverse Weather	Severe weather that creates potentially unsafe conditions for vessel transits.
Aid to Navigation (AtoN)	Any sort of signal or marker to support vessel navigation including buoys, beacons or lights.
Air Draught	The distance from the surface of the water to the highest point of the vessel.
Allision	Vessel makes contact with a fixed or floating object such as wind turbine.
Anchorage	A designated area where ships lower their anchors to remain in position.
As Low As Reasonably Practical (ALARP)	The principle that risk should be reduced as far as possible before further reduction is disproportionate to the costs of doing so.
Automatic Identification System (AIS)	An automatic tracking system carried by ships that broadcasts their position and identity to other nearby vessels.
Beam	Side or width of a vessel.
Berth	The specific location within a port or harbour where a vessel is moored, usually for the purposes of loading or unloading.
Bow	The front of a vessel.
Bridge	The principal control centre from a vessel where it is navigated.
Cargo Shift	The dangerous movement of goods aboard a vessel, typically resulting in damage.
Chart Datum	The water level surface shown on nautical charts, approximately the lowest level due to astronomical effects.
Closest Point of Approach (CPA)	The estimated point and distance at which two vessels or objects will reach their minimum value.
Collision	Coming together of two vessels underway.
Draught	The maximum depth of any part of a vessel.
Fog	Where visibility is less than 1,000 metres.
Gale	Winds in excess of 34 knots.
Grounding	Vessel makes contact with the seabed/shoreline or underwater assets.
Gust	A brief increase in wind speed.
Hydrography	The science and measurement of the physical features of the seabed.
Lee	The area of water downwind of an obstacle, such as a landmass.
Master	The designated person in charge of a ship, its crew, passengers and cargo.
Nautical Charts	A graphic representation of a sea area and adjacent coastal regions.
Overcarried	The act of a pilot not disembarking at a port’s pilot station and staying onboard the vessel until another destination.
Passage Plan	A detailed description of a vessel’s voyage from start to finish, including the route and hazards likely to be encountered along the way.
Pilot	Professional seafarers with detailed knowledge of a port or sea area and expertise in ship manoeuvring.
Port	The left side of a vessel when looking forward towards the bow.

Term	Meaning
Port or Harbour	A maritime facility compromising of one or more wharves or loading areas where ships load and discharge cargo or passengers.
Routeing	The path taken by a vessel.
Significant Wave Height (H_s)	The average wave height from trough to crest of the highest one-third of waves.
Snagging	Fishing Gear or anchors coming fast on subsurface infrastructure such as cables.
Starboard	The right side of a vessel when looking forward towards the bow.
Stern	The rear of a vessel.
Twenty Foot Equivalent Units	A measure of the cargo capacity of vessels, nominally those carrying containers.
Tonnage	The weight in tons of cargo or freight.
Traffic Separation Scheme (TSS)	A routeing measures aimed at the separation of opposing streams or traffic by appropriate means and by the establishment of traffic lanes.
Turnaround	The process and activities necessary between the arrival of a vessel in port and its departure, including unloading and loading of passengers or cargo.
Under Keel Clearance (UKC)	The vertical distance between the bottom of a ship and the seabed.
Vessel Monitoring System (VMS)	Satellite tracking system using a device on vessel which transmits the location, speed and course of the vessel.
Vessel Traffic Services (VTS)	A marine traffic monitoring system established by port authorities to manage vessel movements and safety.

Acronyms

Acronym	Description
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AtoN	Aids to Navigation
AtoNMP	Aids to Navigation Management Plan
BEIS	Department for Business, Energy and Industrial Strategy
CBRA	Cable Burial Risk Assessment
cd	Candela
CP	Construction Programme
CPA	Closest Point of Approach
CRNRA	Cumulative Regional Navigation Risk Assessment
CSIP	Cable Specification and Installation Plan
CTV	Crew Transfer Vessels
DCO	Development Consent Order
DfT	Department for Transport
DP	Design Plan

Acronym	Description
EIA	Environmental Impact Assessment
EnBW	Energie Baden-Wurttemberg AG
ERCOP	Emergency Response and Cooperation Plan
ETV	Emergency Towage Vessel
FLCP	Fisheries Liaison and Co-existance Plan
FSA	Formal Safety Assessment
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HAT	Highest Astronomical Tide
HMCG	His Majesty’s Coastguard
H_s	Significant Wave Height
IALA	International Association of Lighthouse Authorities
ICW	In Collision With
IMO	International Maritime Organisation
IoMSPC	Isle of Man Steampacket Company
IWRAP	IALA Waterway Risk Assessment Program
LAT	Lowest Astronomical Tide
LYC	Liverpool Yacht Club
MAIB	Marine Accident Investigation Branch
MARPOL	International Convention for the Prevention of Pollution from Ships
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
MGN	Marine Guidance Note
MMO	Marine Management Organisation
MNEF	Marine Navigation Engagement Forum
MPCP	Marine Pollution Contingency Plan
NFFO	National Federation of Fishermens Organisations
NPS	National Policy Statement
NRA	Navigation Risk Assessment
NRW	Natural Resources Wales
O&G	Oil and Gas
O&M	Operations and Maintenance
OCMS	Offshore Construction Method Statement
OEMP	Offshore Environmental Management Plan

Acronym	Description
OREI	Offshore Renewable Energy Installations
OSP	Offshore Substation Platform
PDE	Project Design Envelope
PEIR	Preliminary Environmental Impact Report
PEXA	Practice and Exercise Areas
RNLI	Royal National Lifeboat Institute
RYA	Royal Yachting Association
SAR	Search and Rescue
SIRA	Simplified IALA Risk Assessment
SOLAS	International Convention for the Safety of Life at Sea
SoS	Secretary of State
TSS	Traffic Separation Scheme
UKC	Under Keel Clearance
UKHO	UK Hydrographic Office
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
VHF	Very High Frequency
VMS	Vessel Monitoring System
VTMP	Vessel Traffic Management Plan
VTS	Vessel Traffic Services

Units

Unit	Description
%	Percentage
€	Euros
£	Pound sterling
cd	Candela
GT	Gross Tonnage
H_s	Significant wave height
k	Kilometres
km^2	Square kilometres
knot	Nautical miles per hour
m	Metres
m/s	Metres per Second
MW	Mega Watts

Unit	Description
nm	Nautical miles (1,852 meters)

1 Navigational risk assessment

1.1 Introduction

1.1.1 Background

1.1.1.1 Mona Offshore Wind Limited (the Applicant), a joint venture of bp Alternative Energy Investments Ltd (hereafter referred to as bp) and Energie Baden-Württemberg AG (hereafter referred to as EnBW) is developing the Mona Offshore Wind Project. The Applicant entered into Agreement for Lease for the Mona Offshore Wind Project in January 2023. The proposed capacity of the project is 1.5 GW, and the Mona Array Area consists of 300 km^2 located 15.7 nautical miles (nm) from Anglesey, 24.7 nm from northwest England and 24.9 nm from the Isle of Man. The Mona Offshore Wind Project is a Nationally Significant Infrastructure Project requiring a Development Consent Order (DCO) under the Planning Act 2008.

1.1.1.2 NASH Maritime Ltd (NASH) has been commissioned to undertake a Navigation Risk Assessment (NRA) for the Mona Offshore Wind Project, located in the Irish Sea. The scope of this NRA includes the wind turbines, offshore substation platforms (OSPs), cables and associated construction, maintenance and decommissioning activities. In addition, the assessment will summarise the outputs of a separate study into the cumulative impacts of the Mona Offshore Wind Project, in combination with other existing and proposed developments in the Irish Sea.

1.1.2 Description of NRA

1.1.2.1 Offshore developments have the potential to have negative impacts on the navigation and safety of maritime users. In order to understand the likelihood and magnitude of these impacts, an NRA is required. The Maritime and Coastguard Agency's (MCA) Marine Guidance Note (MGN) 654 (MCA, 2021a) describes the necessary input requirements and assessment methodology in order to properly assess these impacts. The legislation and guidance relevant to the methodological basis of this NRA are described in section 1.2.

1.1.2.2 The NRA has been developed to account for the impacts during construction, operation and decommissioning of the Mona Offshore Wind Project. The assessment is based on a Maximum Design Scenario (MDS), a conservative assumption on the design characteristics likely to have the greatest impact upon shipping and navigation receptors. Details of the MDS are presented in section 1.4.

1.1.2.3 This document describes the inputs, methodology and results of the NRA. The output of this assessment is used to inform the shipping and navigation assessment contained within the Environmental Statement (Volume 2, Chapter 7: Shipping and Navigation chapter of the Environmental Statement) and supersedes that published as part of the Preliminary Environmental Information Report (PEIR).

1.1.3 Summary of PEIR NRA

1.1.3.1 As part of the PEIR, an NRA was progressed on the Mona Potential Array Area for the Mona Offshore Wind Project and a cumulative assessment undertaken with the adjacent Morgan Offshore Wind Project Generation Assets (hereafter referred to as Morgan Generation Assets) and Morecambe Offshore Windfarm Generation Assets (hereafter referred to as Morecambe Generation Assets) projects. The NRA concluded that both individually and cumulatively, the Mona Offshore Wind Project would result in unacceptable risks to navigation and significant impacts to lifeline ferry services.

1.1.3.2 The Mona Offshore Wind Project subsequently committed to making a number of changes to reduce these impacts, namely:

- Reduction in the spatial extent of the Mona Array Area in the north, east and south
- Increase in separation between the Mona Potential Array Area and the Liverpool Bay Traffic Separation Scheme (TSS)
- Commitment to two lines of orientation in the arrangement of wind turbines and OSPs.

1.1.3.3 This document updates the NRA published as part of the PEIR to assess whether all risks have been reduced to either Broadly Acceptable or As Low as Reasonably Practicable (ALARP) (see section 1.9.3).

1.1.4 Document structure

1.1.4.1 This NRA consists of the following chapters and sections:

- Section 1.1: Introduction and background
- Section 1.2: Policy, guidance and legislation
- Section 1.3: NRA methodology
- Section 1.4: Project description and maximum design envelope
- Section 1.5: Description of marine environment
- Section 1.6: Description of existing marine activities
- Section 1.7: Future case traffic profile
- Section 1.8: Mona Offshore Wind Project impact assessment
- Section 1.9: Mona Offshore Wind Project NRA
- Section 1.10: Cumulative assessment
- Section 1.11: Conclusions and recommendations
- Appendix A: Hazard log
- Appendix B: Hazard workshop summary
- Appendix C: MGN654 checklist
- Appendix D: 2023 vessel traffic survey addendum
- Appendix E: Cumulative regional NRA.

1.2 Policy, guidance and legislation

1.2.1 Legislation and national policy

International obligations

1.2.1.1 The United Nations (UN) Convention on the Law of the Sea (UNCLOS) (UN, 1982) is an international agreement that establishes a legal framework for all marine and maritime activities. Article 60 concerns artificial islands, installations and structures in the exclusive economic zone. Article 60(7) states that '*Artificial islands, installations and structures and the safety zones around them may not be established where* *interference may be caused to the use of recognized sea lanes essential to international navigation*.' As per Article 22(4), '*The coastal state shall clearly indicate such sea lanes and TSS on charts to which due publicity shall be given'*.

1.2.1.2 Vessels navigating must also adhere to requirements under the Safety of Life at Sea (SOLAS), International Convention for the Prevention of Pollution from Ships (MARPOL) and Standards of Training, Certification and Watchkeeping for Seafarers conventions. Furthermore, vessels will navigate in accordance with the Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs).

National Policy Statement

1.2.1.3 This NRA has been undertaken in accordance with the instructions and guidance provided within the National Policy Statement (NPS) for Renewable Energy Infrastructure (EN-3) (Department for Energy Security & Net Zero, November 2024). Table 1.1 and Table 1.2 provides a summary of the guidance provided by NPS EN-3 that is relevant to shipping and navigation.

Table 1.1: Relevant shipping and navigation assessment requirements from NPS EN-3.

NPS Requirement	NRA Reference
Offshore wind farms and offshore transmission will occupy an area of the sea or seabed. For offshore wind farms in particular it is inevitable that there will be an impact on navigation in and around the area of the site. This is relevant to both commercial and recreational users of the sea who may be affected by disruption or economic loss because of the proposed offshore wind farm and/or offshore transmission. [Paragraph 2.8.178]	Impact on vessel routeing in section 1.8.3 and section 1.8.4 for ferries and other commercial shipping respectively. This includes routeing in typical and adverse weather conditions. Impacts on recreational craft are described throughout section 1.8, 1.9 and 1.10.
To ensure safety of shipping applicants should reduce risks to navigational safety to ALARP, as described in Section 2.8.331. [Paragraph 2.8.179]	Impacts to navigation are described in section 1.8 and the guidance and process for producing this NRA set out in section 1.9. The NRA for the Mona Offshore Wind Project concluded that there were no unacceptable risks and that all risks had been reduced to Broadly Acceptable or ALARP.
There is a public right of navigation over navigable tidal waters and International Law foreign vessels have the right of innocent passage through the UK's territorial waters. [Paragraph 2.8.180]	A summary of key legislation and policy is contained in section 1.2.
Beyond the seaward limit of the territorial sea, shipping has the freedom of navigation although offshore infrastructure and the imposition of safety zones can hinder this. [Paragraph 2.8.181]	A summary of key legislation and policy is contained in section 1.2. Applied risk controls, including safety zones, are described in section 1.4.8. Additional risk control options are identified in section 1.9.7.

NPS Requirement	NRA Reference
Impacts on navigation can arise from the wind farm or other infrastructure and equipment creating a physical barrier during construction and operation. [Paragraph 2.8.182]	Impact on vessel routeing in section 1.8.3 and section 1.8.4 for ferries and other commercial shipping respectively. This includes routeing in typical and adverse weather conditions. Impacts on recreational craft are described throughout section 1.8, 1.9 and 1.10.
There may be some situations where reorganisation of shipping traffic activity might be both possible and desirable when considered against the benefits of the wind farm and/or offshore transmission application and such circumstances should be discussed with the government officials, including Secretary of State (SoS) and MCA, and other stakeholders, including Trinity House, as The General Lighthouse Authority consultee, and the commercial shipping sector. It should be recognised that alterations might require national endorsement and international agreement and that the negotiations involved may take considerable time and do not have a guaranteed outcome. [Paragraph 2.8.183]	Significant consultation has been undertaken through the Marine Navigation Engagement Forum (MNEF), individual meetings, hazard workshops and written correspondence (section 1.3.5). Through this engagement feedback has been received on the impacts of the Mona Offshore Wind Project on different receptors, and as a result, substantial alterations were made to the Mona Offshore Wind Project design to minimise these impacts.
Applicants should engage with interested parties in the navigation sector early in the pre-application phase of the proposed offshore wind farm or offshore transmission to help identify mitigation measures to reduce navigational risk to ALARP, to facilitate proposed offshore wind development. This includes the Marine Management Organisation (MMO) or Natural Resources Wales (NRW) in Wales, MCA, the relevant General Lighthouse Authority, such as Trinity House, the relevant industry bodies (both national and local) and any representatives of recreational users of the sea, such as the Royal Yachting Association (RYA), who may be affected. This should continue throughout the life of the development including during the construction, operation and decommissioning phases. [Paragraph 2.8.184]	
Engagement should seek solutions that allow offshore wind farms, offshore transmission and navigation and shipping users of the sea to co-exist successfully. [Paragraph 2.8.185]	
The presence of the wind turbines can also have impacts on communication and shipborne and shore-based radar systems. See section 5.5 in EN-1 for further guidance. [Paragraph 2.8.186]	Impacts on shipborne and shorebased navigation, communications and positioning systems are described in section 1.8.11.
Prior to undertaking assessments applicants should consider information on internationally recognised sea lanes, which is publicly available. [Paragraph 2.8.187]	Location of sea lanes are presented in section 1.5.1 and impact on vessel routeing measures in section 1.8.2.
Applicants should refer in assessments to any relevant, publicly available data available on the Maritime Database. [Paragraph 2.8.188]	Datasets used to undertake this assessment are described in section 1.3.5.
Applicants must undertake a Navigational Risk Assessment (NRA) in accordance with relevant government guidance prepared in consultation with the MCA and the other navigation stakeholders listed above. [Paragraph 2.8.189]	The guidance and process followed in producing this NRA is described in section 1.9.

NPS Requirement	NRA Reference
The NRA will for example necessitate: • A survey of vessel traffic in the vicinity of the proposed wind farm • A full NRA of the likely impact of the wind farm on navigation in the immediate area of the wind farm in accordance with the relevant marine guidance • Cumulative and in-combination risks associated with the development and other developments (including other wind farms) in the same area of sea. [Paragraph 2.8.190]	Three 14 day vessel traffic surveys were conducted in compliance with the requirements under MGN654, survey findings are presented in section 1.6. This included a summer, winter and top-up survey (see Appendix D). The NRA is presented in section 1.9 and has been produced in accordance with MGN654. The cumulative impacts of the Mona Offshore Wind Project on vessel routeing, collision and contact, in combination with multiple developments, are examined in section 1.10 and Appendix E.
In some circumstances applicants may seek declaration of a safety zone around wind turbines and other infrastructure. Although these might not be applied until after consent to the wind farm has been granted. [Paragraph 2.8.191]	Applied risk controls, including safety zones, are described in section 1.4.8. Additional risk control options are identified in section 1.9.7.
The declaration of a safety zone excludes or restricts activities within the defined sea areas including navigation and shipping. [Paragraph 2.8.192]	
Where there is a possibility that safety zones will be sought, applicant assessments should include potential effects on navigation and shipping. [Paragraph 2.8.193]	
Where the precise extents of potential safety zones are unknown, a realistic worst-case scenario should be assessed. Applicants should consult the MCA for advice on maritime and safety and refer to the government guidance on safety zones as a part of this process. [Paragraph 2.8.194]	
Applicants should undertake a detailed NRA, which includes Search and Rescue (SAR) Response Assessment and emergency response assessment prior to applying for consent. The specific SAR requirements will then be discussed and agreed post-consent. [Paragraph 2.8.195]	Impacts on SAR are described in section 1.8.9.

Table 1.2: Relevant shipping and navigation Secretary of State decision making requirements from NPS EN-3.

NPS Requirement	NRA Reference
The SoS should not grant development consent in relation to the construction or extension of an offshore wind farm if it considers that interference with the use of recognised sea lanes essential to international navigation is likely to be caused by the development. [Paragraph 2.8.326]	Relevant International Maritime Organisation (IMO) routeing measures, including the Liverpool Bay TSS, are considered in relation to the Mona Array Area are presented in section 1.5.1 and section 1.8.2 shows that there would be no significant adverse impact on this route.
The use of recognised sea lanes essential to international navigation means: a. Anything that constitutes the use of such a sea lane for the purposes of article 60(7) of the UN Convention on the Law of the Sea 1982	

NPS Requirement	NRA Reference
b. Any use of waters in the territorial sea adjacent to Great Britain that would fall within paragraph (a) if the waters were in a REZ. [Paragraph 2.8.327]	
The SoS should be satisfied that the site selection has been made with a view to avoiding or minimising disruption or economic loss to the shipping and navigation industries, with particular regard to approaches to ports and to strategic routes essential to regional, national and international trade, lifeline ferries and recreational users of the sea. [Paragraph 2.8.328]	Impact on vessel routeing in section 1.8.3 and section 1.8.4 for ferries and other commercial shipping respectively. This includes routeing in typical and adverse weather conditions. These sections show that the Mona Array Area is clear of the majority of key shipping routes.
Where after carrying out a site selection, a proposed development is likely adversely to affect major commercial navigation routes, for instance by causing appreciably longer transit times, the SoS should give these adverse effects substantial weight in its decision making. [Paragraph 2.8.329]	
Where a proposed offshore wind farm is likely to affect less strategically important shipping routes, the SoS should take a pragmatic approach to considering proposals to minimise negative impacts. [Paragraph 2.8.330]	
The SoS should be satisfied that risk to navigational safety is ALARP. It is government policy that wind farms and all types of offshore transmission should not be consented where they would pose unacceptable risks to navigational safety after mitigation measures have been adopted. [Paragraph 2.8.331]	Impacts to navigation are described in section 1.8 and the guidance and process for producing this NRA set out in section 1.9. It is demonstrated that there are no unacceptable risks to navigation and all hazards have been reduced to ALARP.
The SoS should be satisfied that the scheme has been designed to minimise the effects on recreational craft and that appropriate mitigation measures, such as buffer areas, are built into applications to allow for recreational use outside of commercial shipping routes. [Paragraph 2.8.332]	Impacts on recreational craft are described throughout section 1.8, 1.9 and 1.10.
In view of the level of need for energy infrastructure, where an adverse effect on the users of recreational craft has been identified, and where no reasonable mitigation is feasible, the SoS should weigh the harm caused with the benefits of the scheme. [Paragraph 2.8.333]	
The SoS should make use of advice from the MCA, who will use the NRA described in paragraphs 2.8.189 and 2.8.190 above. [Paragraph 2.8.334]	Relevant stakeholders have been consulted throughout, including the MCA. A summary of the key issues raised during consultation activities, the consultee and the consultation activity undertaken is provided in section 1.3.5. An MNEF was established for project (see section 1.3.5). A hazard workshop was undertaken and is described in section 1.9.4. Impacts to navigation are described in section 1.8 and the guidance and process for producing this NRA set out in section 1.9. Stakeholder consultation is summarised in section 1.3.5.

NPS Requirement	NRA Reference
	An MNEF was established for project (see section 1.3.5). A hazard workshop was undertaken and is described in section 1.9.4.
The SoS should have regard to the extent and nature of any obstruction of or danger to navigation which (without amounting to interference with the use of such sea lanes) is likely to be caused by the development in determining whether to grant consent for the construction, or extension, of an offshore wind farm, and what requirements to include in such a consent. [Paragraph 2.8.335]	Impacts to navigation are described in section 1.8 and the guidance and process for producing this NRA set out in section 1.9.
The SoS may include provisions, compliant with national maritime legislation and UNCLOS, within the terms of a development consent as respects rights of navigation so far as they pass through waters in or adjacent to Great Britain which are between the mean low water mark and the seaward limits of the territorial sea. [Paragraph 2.8.336]	Applied risk controls, including safety zones, are described in section 1.4.8. Additional risk control options are identified in section 1.9.7.
The provisions may specify or describe rights of navigation which: • Are extinguished • Are suspended for the period that is specified in the DCO • Are suspended until such time as may be determined in accordance with provisions contained in the DCO • Are exercisable subject to such restrictions or conditions, or both, as are set out in the DCO. [Paragraph 2.8.337]	
The SoS should specify the date on which any such provisions are to come into force, or how that date is to be determined. [Paragraph 2.8.338]	
The SoS should require the applicant to publish any provisions that are included within the terms of the DCO, in such a manner as appears to the SoS to be appropriate for bringing them, as soon as is reasonably practicable, to the attention of persons likely to be affected by them. [Paragraph 2.8.339]	
The SoS should include provisions as respects rights of navigation within the terms of a DCO only if the applicant has requested such provision be made as part of their application for development consent. [Paragraph 2.8.340]	

Marine Plans and Marine Policy Statements

1.2.1.4 The 2009 Marine and Coastal Access Act (MCAA) requires all public authorities taking authorisation or enforcement decisions that affect or might affect the UK marine area, to do so in accordance with the 2011 UK Marine Policy Statement and the relevant marine plans (HMG, 2011).

1.2.1.5 The Welsh National Marine Plan was published in 2019. The Plan recognises the importance of shipping and ports to the Welsh economy.

Table 1.3: Welsh National Marine Policies relevant to shipping and navigation.

Policy	MPS Reference	NRA Reference
Proposals should demonstrate how they have considered opportunities for coexistence with other compatible sectors in order to optimise the value and use of the marine area and marine natural resources	ECON_02	N/A
Proposals should demonstrate that they have assessed potential cumulative effects and should, in order of preference: a. Avoid adverse effects; and/or b. Minimise effects where they cannot be avoided; and/or c. Mitigate effects where they cannot be minimised. If significant adverse effects cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding.	GOV_01	Impacts on navigational safety are presented in section 1.8 and section 1.9. Applied risk controls, including safety zones, are described in section 1.4.8. Additional risk control options are identified in section 1.9.7. A cumulative assessment has been undertaken and is summarised in section 1.10.
a. Proposals likely to have significant adverse impacts upon an established activity covered by a formal application or authorisation must demonstrate how they will address compatibility issues with that activity. Proposals unable to demonstrate adequate compatibility must present a clear and convincing case for the proposal to progress under exceptional circumstances. b. Proposals likely to have significant adverse impacts upon an established activity not subject to a formal authorisation must demonstrate how they will address compatibility issues with that activity. Proposals unable to demonstrate adequate compatibility must present a clear and convincing case for proceeding. Under SAF 01 a and b, compatibility should be demonstrated through, in order of preference: • Avoiding significant adverse impacts on those activities, and/or • Minimising significant adverse impacts where these cannot be avoided; and/or • Mitigating significant adverse impacts where they cannot be minimised.	SAF_01	
a. Proposals for ports, harbours and shipping activities will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations. b. Relevant public authorities and the sector are encouraged, in liaison with other interested parties, to collaborate to understand opportunities to support the sustainable development of the ports and shipping sector through marine planning.	P&S_01	Impacts on ports and harbours are described throughout section 1.8, 1.9 and 1.10.
Proposals that maintain or enhance access to the marine environment are encouraged.	SOC_01	Impacts on recreational craft are described throughout section 1.8, 1.9 and 1.10.

1.2.1.6 The North West Marine Plan has been prepared for the purposes of section 51 of the MCAA 2009. Relevant policies of this plan for shipping and navigation are described in Table 1.4.

Table 1.4: Northwest Marine Policies relevant to shipping and navigation.

Policy	MPS Reference	NRA Reference
Only proposals demonstrating compatibility with current port and harbour activities will be supported. Proposals within statutory harbour authority areas or their approaches that detrimentally and materially affect safety of navigation, or the compliance by statutory harbour authorities with the Open Port Duty or the Port Marine Safety Code, will not be authorised unless there are exceptional circumstances. Proposals that may have a significant adverse impact upon future opportunity for sustainable expansion of port and harbour activities, must demonstrate that they will, in order of preference: a. Avoid, b. Minimise c. Mitigate adverse impacts so they are no longer significant. If it is not possible to mitigate significant adverse impacts, proposals should state the case for proceeding.	NW-PS-1	Impacts on navigational safety are presented in section 1.8 and section 1.9. In particular, the impacts on commercial shipping routes and the approaches to ports/harbours are given in sections 1.8.2, 1.8.3 and 1.8.4.
Proposals that require static sea surface infrastructure or that significantly reduce under-keel clearance must not be authorised within or encroaching upon International Maritime Organization routeing systems unless there are exceptional circumstances.	NW-PS-2	Location of sea lanes are presented in section 1.5.1 and impact on vessel routeing measures in section 1.8.2. The assessment demonstrates that the Mona Offshore Wind Project does not encroach upon routeing schemes such as TSS.
Proposals that require static sea surface infrastructure or that significantly reduce under-keel clearance which encroaches upon high density navigation routes, strategically important navigation routes, or that pose a risk to the viability of passenger services, must not be authorised unless there are exceptional circumstances.	NW-PS-3	Impacts on Under Keel Clearance (UKC) are presented in section 1.8.13 and the NRA contained within section 1.9 considers these impacts. The assessment demonstrates that the Mona Offshore Wind Project does not significantly reduce UKC.
Proposals promoting or facilitating sustainable coastal and/or short sea shipping as an alternative to road, rail or air transport will be supported where appropriate.	NW-PS-4	N/A

1.2.2 Primary guidance

MGN654

1.2.2.1 The principal guidance document for NRAs is the MCA's MGN654 (2021a). MGN654 describes the potential shipping and navigation issues which should be considered by developers when proposing offshore renewable energy installations (OREIs). Annex 1 (2021b) of the MGN provides a detailed methodology for assessing the marine navigational safety risks of OREIs. In particular, by following the methodology, the NRAs:

- Are proportionate to the scale of the development and magnitude of risks
- Are based on the risk assessment approach of the Formal Safety Assessment (FSA)

- Are capable of utilising techniques and methods which produce results which are acceptable to the Government
- Compare the base case and future case risks in the study area before predicting the impacts of the OREIs on that risk through a hazard log
- Determine which risk controls should be put in place to minimise the risks to ALARP.

1.2.2.2 MGN654 Annex 1 provides a standardised format of submission which is described in Table 1.5. Annex 2 provides guidance on wind farm shipping route interactions. Annex 3 provides guidance on UKC. Annex 4 provides hydrography guidelines. Annex 5 contains guidance on requirements, guidance and operational considerations for SAR and emergency response (MCA, 2021c).

1.2.2.3 A checklist is provided in Annex 6 of the MGN654, which has been completed for this NRA within Appendix C.

Table 1.5: MGN654 Annex 1 Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of OREI.

The following content is included:	Compliant Yes/No	NRA Reference
A risk claim is included supported by a reasoned argument and evidence	Yes	The risk assessment conducted in section 1.9 and is supported by data analysis (section 1.6), consultation (section 1.3.5) and a review and discussion of impacts (section 1.8). Therefore, a risk claim is made in section 1.11.
Description of the marine environment	Yes	A description of the baseline marine environment is provided in section 1.5.
Description of the OREI development and how it changes the marine environment	Yes	A description of the OREI development is provided in section 1.4. Potential impacts are described in section 1.8.
Analysis of the Marine Traffic	Yes	A detailed analysis of the baseline vessel traffic is provided in section 1.6. Section 1.7 presents the future baseline traffic profile. The impacts of the OREIs on that traffic is contained within section 1.8.
Status of the hazard log	Yes	The navigational risk assessment is provided in section 1.9. The hazard log is provided in Appendix A.
NRA	Yes	The NRA is provided in section 1.9.
Search and Rescue overview and assessment	Yes	Existing SAR provision is described in section 1.5.4. An assessment of impacts of the Mona Offshore Wind Project to SAR is provided in section 1.8.8.6.
Emergency Response Overview and Assessment	Yes	
Status of Risk control log	Yes	Applied risk controls, including safety zones, are described in section 1.4.8. Additional risk control options are identified in section 1.9.7.
Major Hazards Summary	Yes	A summary of the principal impacts of the Mona Offshore Wind Project are contained within section 1.8 and an NRA reported in section 1.9.
Statement of Limitation	Yes	Any limitations or assumptions of this assessment are reported in their relevant sections.

The following content is included:	Compliant Yes/No	NRA Reference
Through Life Safety Management	Yes	Applied risk controls, including safety zones, are described in section 1.4.8. Additional risk control options are identified in section 1.9.7.

Formal Safety Assessment

1.2.2.4 The IMO FSA process has been applied within this NRA. The guidelines for FSA were approved in 2002 and were most recently amended in 2018 by MSC-MEPC.2/Circ.12/Rev.2. This NRA has been conducted utilising this methodology, as per recommendations from MGN654.

1.2.2.5 The FSA is a structured and systematic methodology, aimed at enhancing maritime safety, including protection of life, health, the marine environment and property, by using risk analysis and, if appropriate, cost-benefit assessment. The IMO FSA guidance define a hazard as "*a potential to threaten human life, health, property or the environment*", the realisation of which results in an incident or accident. The potential for a hazard to be realised (i.e. likelihood) can be combined with an estimated or known consequence of outcome and this combination is termed 'risk'. There are five steps within the FSA process.

- Step 1: Identification of hazards
- Step 2: Risk analysis
- Step 3: Risk control options
- Step 4: Cost-benefit assessment (if applicable)
- Step 5: Recommendations for decision making.

1.2.3 Additional guidance and lessons learnt

1.2.3.1 Significant additional guidance is available which has been used to inform this NRA, which are described in Table 1.6 and Table 1.7.

Table 1.6: Summary of additional relevant guidance.

Guidance	Description
MGN372: OREIs: Guidance to Mariners Operating in the Vicinity of UK OREIs (MCA, 2022).	Issues to be taken into account when planning and undertaking voyages near OREI off the UK coast.
International Association of Lighthouse Authorities (IALA) G1162 The Marking of Offshore Man-Made Structures (IALA, 2021).	Guidance on the lighting and marking arrangements for Offshore Wind Farms.
RYA Position of Offshore Renewable Energy Developments: Wind Energy (RYA, 2019).	Describes key impacts of offshore wind farms on recreational activities.
PIANC WG161 Interaction Between Offshore Wind Farms and Maritime Navigation (PIANC, 2018).	Provides guidelines and recommendations on impacts on mitigations for shipping routes near offshore wind farms.
Nautical Institute (2013) The Shipping Industry and Marine Spatial Planning.	Guidance on benefits and risks of marine spatial planning for shipping and navigation.
G+ IOER (2019) Good practice guidelines for offshore renewable energy developments.	Guidance on emergency response for offshore wind farms.

Table 1.7: Lessons learnt and supporting studies.

Guidance	Description
MCA and QinetiQ (2004) Results of the electromagnetic investigations and assessments of marine radar, communications and positioning systems undertaken at the North Hoyle wind farm by QinetiQ and the MCA.	Reporting of trial on impacts of offshore wind farm on shipboard equipment.
MCA (2005) Offshore Wind Farm Helicopter SAR Trials Undertaken at the North Hoyle Wind Farm.	Reporting of trial on impacts of offshore wind farm on SAR equipment and activities.
BWEA (2007). Investigation of Technical and Operational Effects on Marine Radar Close to Kentish Flats Offshore Wind Farm.	Reporting of trial on impacts of offshore wind farm on shipboard equipment.
MCA (2019) MCA report following aviation trials and exercises in relation to offshore windfarms.	Reporting of trial on impacts of offshore wind farm on SAR equipment and activities and the implications on offshore wind farm design.
Rawson and Brito (2022) Assessing the validity of navigation risk assessments: a study of offshore wind farms in the UK.	Analysis of historical incidents in UK offshore wind farms.
Walney Extension offshore wind farm Application (c.2013).	Documents associated with application for Walney Extension offshore wind farm.
Rhiannon offshore wind farm Scoping Report (2012).	Documents associated with application for Rhiannon offshore wind farm.
Awel y Môr offshore wind farm Application (2021 to 2023).	Documents associated with application for Awel y Môr offshore wind farm.
Anatec (2016). Influence of UK Offshore Wind Farm Installation on Commercial Vessel Navigation.	Analysis of impact of offshore wind farms on ship routes from historical data.

1.3 NRA methodology

1.3.1 Overview

1.3.1.1 The NRA has been produced in accordance with MGN654 and follows the IMO's FSA (see section 1.2.2). This assessment considers all identified impacts of the Mona Offshore Wind Project on shipping and navigation receptors. The FSA defines a risk as "*the combination of frequency and the severity of the consequence*" (IMO, 2018). Therefore, the likelihood and consequence of these impacts are assessed through the collection of significant datasets and consultation. Details on the risk criteria and matrix methodology are contained within section 1.9.

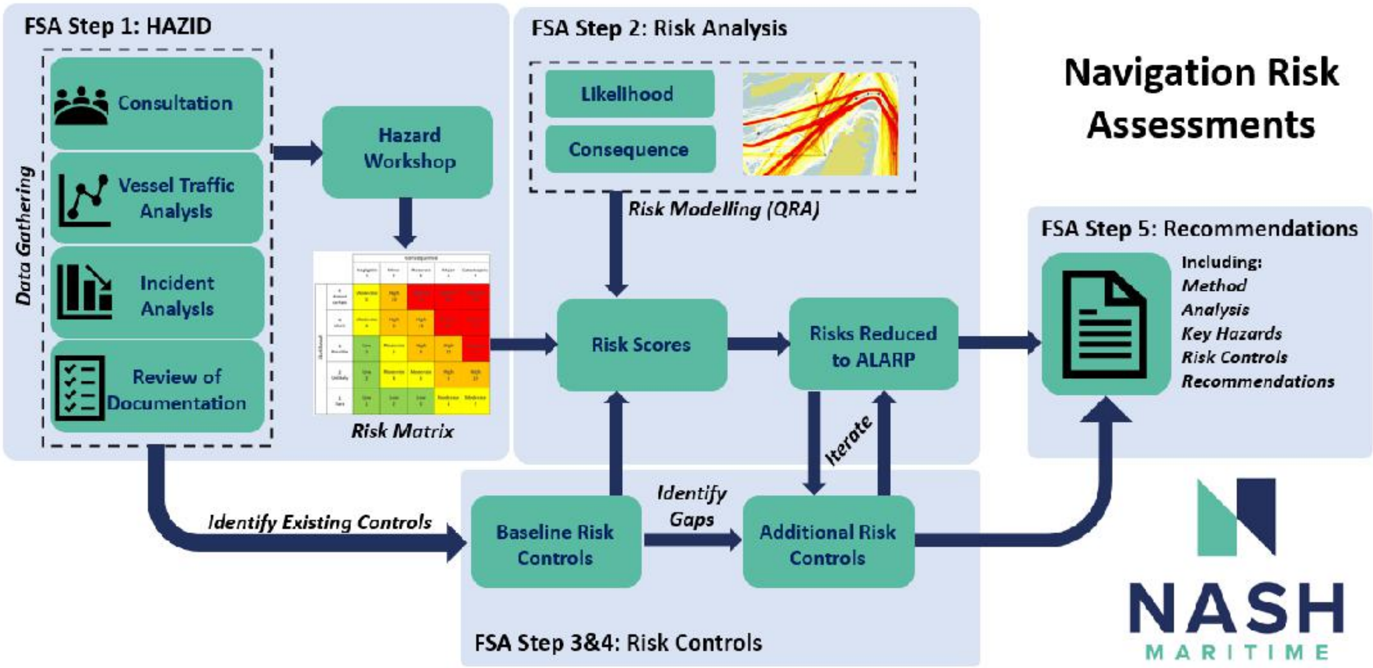


Figure 1.1: NRA methodology.

1.3.2 Definition of shipping and navigation study area

1.3.2.1 The shipping and navigation study area for the Environmental Statement is defined as an area 10 nm from the Mona Array Area and 3 nm from the Mona Offshore Cable Route Corridor (see Figure 1.2).

1.3.2.2 This shipping and navigation study area has been agreed with consultees and is consistent with industry best practice for NRAs. The proposed shipping and navigation study area exceeds the MGN654 interactive boundaries distance of “Very Low” risk of 5 nm and it can therefore be concluded that impacts to shipping and navigation receptors more than 10 nm from the Mona Array Area are negligible.

1.3.3 IALA risk management tools

Qualitative risk assessment – SIRA

1.3.3.1 The Simplified IALA Risk Assessment method (SIRA) follows the FSA process and allows organisations to assess maritime and navigation risk in their waters so that they can meet their obligations for the management of navigation safety (e.g. obligations under international conventions such as SOLAS, national domestic legislation, etc.). The principles of the SIRA approach have been used to conduct the risk assessment.

1.3.3.2 Details of the overarching methodology are provided in the following IALA Guidance:

- IALA (2022) Guideline 1018 - Risk Management
- IALA (2017) Guideline 1138 - The Use of the SIRA.

Quantitative risk modelling – IWRAP

1.3.3.3 The IALA Waterway Risk Assessment Program (IWRAP Mk II) is a quantitative tool for calculating the frequency of collisions, groundings and allisions for navigating vessels in a given waterway. The tool was developed by IALA to support coastal states in conducting risk assessments to address obligations under SOLAS Chapter V. The tool has been presented at the IMO (e.g. NAV 52/17/2 and SN.1/Circ.296) and used by Coastal States (including UK, Denmark and Sweden) to support the assessment of new routeing measures (e.g. NCSR 5/INF.3). The tool has also had widespread use in assessing risk, both in the UK, Norway and elsewhere.

1.3.3.4 IALA (2017) Guideline G1123 contains guidance on implementing the tool and the underlying mechanics are presented in Friis-Hansen (2008).

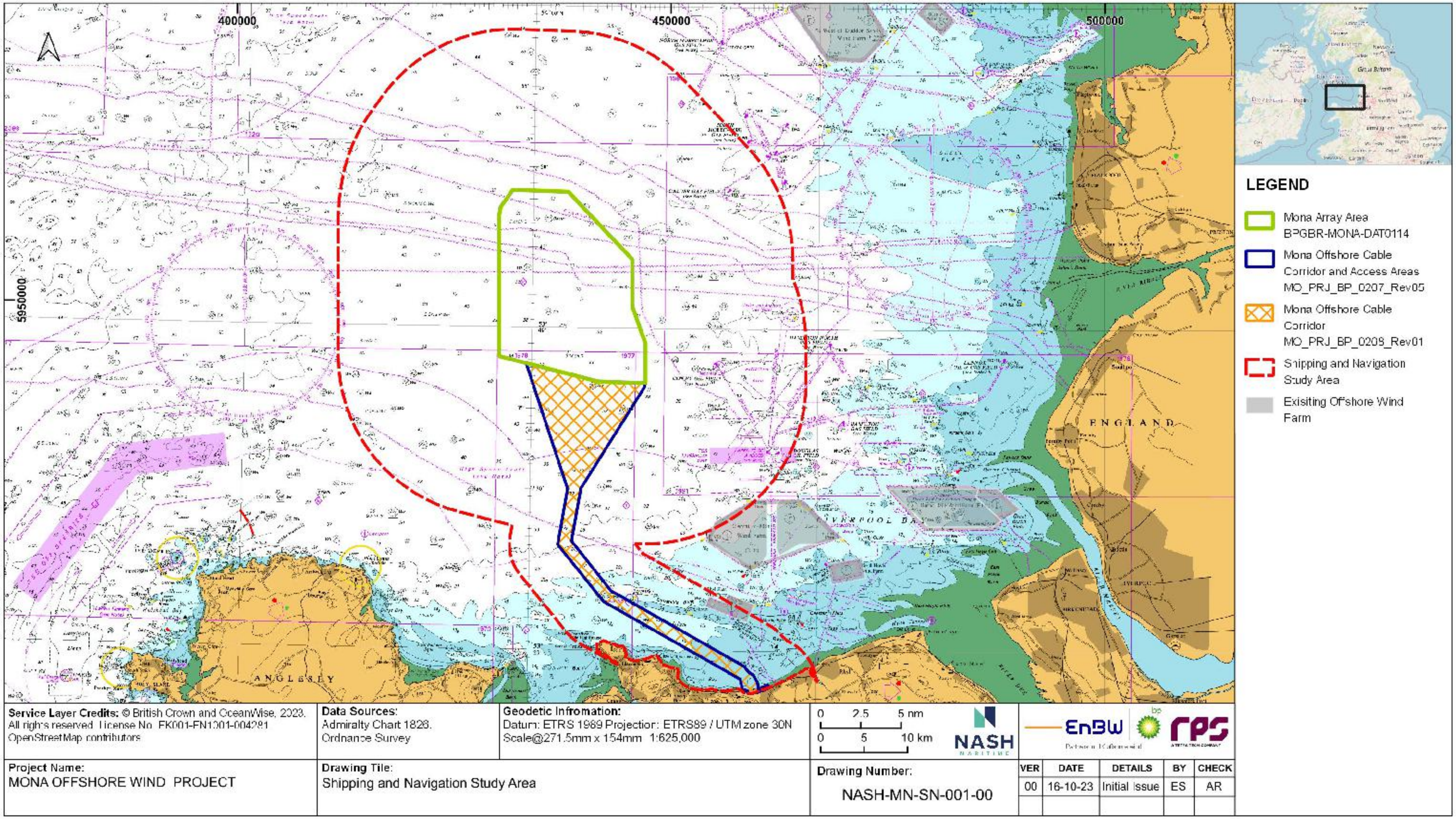


Figure 1.2: Shipping and navigation study area.

1.3.4 Cumulative NRA approach

1.3.4.1 A separate cumulative regional NRA (CRNRA) has been produced in collaboration between the developers of the Morgan Generation Assets, the Mona Offshore Wind Project and the Morecambe Offshore Windfarm Generation Assets (Generation Assets) (Appendix E). The objective of the CRNRA is to enable stakeholders to engage with and understand the potential cumulative effects of the three proposed projects. A regional (collaborative) approach to assessment was adopted to enable individual projects to quantify and manage the cumulative impacts in a coordinated, consistent and efficient manner. This assessment dovetails with the individual NRAs undertaken for each of the three offshore windfarm projects.

1.3.4.2 The CRNRA primarily assesses the impacts of the operations and maintenance (O&M) phase of the three project array areas on vessel navigation and safety. The focus of the CRNRA was to enable a detailed assessment of the key concerns of stakeholders, principally the formation of routes between the three project array areas and existing offshore wind farms. For this reason, the transmission assets for each project (such as the export cables) have not been included within the CRNRA. Export cables have minimal impact on surface navigation, impacts are highly localised to the specific cable routes and rarely have significant cumulative effects on shipping and navigation receptors. The potential impact of transmission assets on shipping and navigation is considered separately within the assessment chapters for the individual projects. For the Mona Offshore Wind Project this can be found in Volume 2, Chapter 7, Shipping and navigation, of the Environmental Statement.

1.3.4.3 The findings of this CRNRA are summarised in section 1.10 and the full report available in Appendix E.

1.3.5 Summary of data sources and information gathering

Consultation and engagement

1.3.5.1 Consultation has been undertaken with stakeholders prior to and during the NRA to interface with various regulators and stakeholders at an early stage and as part of assessing risk. Table 1.8 describes the engagement which has included a range of forums:

- MNEF (2021 to 2024), a shipping and navigation engagement forum was established in 2021. The purpose was to enable the Applicant to regularly update stakeholders on plans and progress of the Mona Offshore Wind Project and Morgan Generation Assets, and for stakeholders to express views or concern on the impacts of the Projects for discussion and, where possible, resolution. The MNEF is also a forum for engagement by the applicants of the Morecambe Generation Assets and the three projects have worked collaboratively to ensure there has been ongoing engagement on the cumulative impacts associated with these three projects
- Specific meetings with stakeholders through 2021 to 2023 (see Table 1.8 for summary)
- Visit aboard the Isle of Man Steam Packet Company's (IoMSPC) Ben-my-Chree between Douglas and Heysham (05 April 2022) to experience navigation through the shipping and navigation study area from the master's perspective
- Hazard workshops held in Liverpool on 11 October 2022 and 29 September 2023 (details of which are summarised in section 1.9.4 and Appendix B)

- Full bridge simulator sessions conducted with ferry operators at HR Wallingford throughout 2022 and 2023 (details of which are contained in Appendix E)
- Scoping Report submission (05 May 2022)
- Scoping Opinion responses (15 June 2022)
- PEIR submission (April 2023)
- Section 42 consultation responses (June 2023).

Table 1.8: Summary of key consultation issues raised during consultation activities undertaken for the Mona Offshore Wind Project relevant to Shipping and Navigation.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this NRA
14 October 2021	MCA Consultation Meeting	Project introduction and proposed approach. Data collection strategy (incl. survey timings).	Survey details contained within section 1.6.2.
10 November 2021	MNEF Members MNEF Meeting	Project introduction and proposed approach. Site selection in relation to shipping and navigation constraints. Impacts of COVID-19 on data collection. Impacts to Ferry Operators (Safety and Commercial). Relation of impacts on ferry routes with regulation and guidance. Sensitivity of ferry operator schedules.	Data collection strategy is provided in section 1.3.5 and section 1.6.1. Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
01 February 2022	MCA & Trinity House Consultation Meeting	Methodological Engagement. Update on proposed approach for assessment. Status of NPS updates. Requirement for cumulative assessment. Adverse ship routeing assessment. Consenting of Walney Extension and assessment of gap with the North East Potential Development Area. Modelling to reflect local navigational conditions.	Relevant methodology and guidance is given in section 1.2 and section 1.3. Cumulative impacts are described in a separate NRA but are summarised in section 1.10. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
09 February 2022	Department for Business, Energy and Industrial Strategy (BEIS) Consultation Meeting	Methodological Engagement. Introduction to the project and proposed approach for assessment. Status of NPS updates and role of BEIS. Engagement with wider stakeholders.	Relevant methodology and guidance is given in section 1.2 and section 1.3. Consultation strategy is described in section 1.3.5.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this NRA
14 February 2022	Chamber of Shipping Seatruck Ferries Stena Line IoMSPC MCA Consultation Meeting	Methodological Engagement. Relation of impacts on ferry routes with regulation and guidance. Site selection in relation to shipping and navigation constraints. Impacts to Ferry Operators (Safety and Commercial). Need for a cumulative assessment. Adverse weather routeing decision making. Need for collaborative engagement in assessment.	Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9. Cumulative impacts are described in a separate NRA but are summarised in section 1.10. Adverse weather routeing impacts are described in section 1.8.3.
15 March 2022	Seatruck Ferries Stena Line IoMSPC P&O Questionnaire	Request for Info Letter. Questionnaire issued to operators requesting details of existing operational details and constraints in normal and adverse weather.	Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
04 April 2022	IoMSPC Consultation Meeting	Baseline Data Gathering. Review of current operations and constraints. Review of impacts and decision making in adverse weather. Review of future changes to operations. Significance and potential impacts to IoMSPC and Isle of Man.	Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
05 April 2022	IoMSPC Consultation Meeting	Crossing from Douglas to Heysham aboard Ben-my-Chree. Discussions with master on navigational decision making and passage planning.	N/A.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this NRA
05 April 2022	Seatruck Ferries Consultation Meeting	Baseline Data Gathering. Site selection and shipping and navigation constraints. Potential impacts of projects on safety and commercial operations for Seatruck. Review of current operations and constraints. Review of impacts and decision making in adverse weather. Review of future changes to operations.	Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9. Future case scenario development is described in section 1.7.
14 April 2022	Stena Consultation Meeting	Baseline Data Gathering. Potential impacts of projects on safety and commercial operations for Stena. Review of current operations and constraints. Review of impacts and decision making in adverse weather. Review of future changes to operations.	Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9. Future case scenario development is described in section 1.7.
20 April 2022	Spirit Energy Consultation Meeting	Impacts to Spirit Energy. Impacts to marine and aviation movements to offshore platforms and rigs. Requirement for safe passing distances and exclusion areas. Increased traffic flow and collision risk.	Oil and gas (O&G) activities are described in section 1.5.2 and section 1.6.3. Safety impacts to O&G operations are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
21 April 2022	RYA Consultation Meeting	RYA Consultation and Survey Strategy. Introduction to project and assessment approach. Availability of RYA Recreational Atlas. Summer survey strategy. Further engagement opportunities.	Data collection strategy is provided in section 1.3.5 and section 1.6.1. Impacts to recreational users are considered throughout section 1.8 and section 1.9.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this NRA
05 May 2022	Harbour Energy Consultation Meeting	Impacts to Harbour Energy. Decommissioning Plan for Millom West. Impacts to marine and aviation movements to offshore platforms and rigs. Requirement for safe passing distances and exclusion areas. Increased traffic flow and collision risk.	O&G activities are described in section 1.5.2 and section 1.6.3. Safety impacts to O&G operations are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
06 May 2022	MNEF Members MNEF Meeting	Project update. Cumulative impacts of multiple projects on ferry operations. How the cumulative impacts will be assessed or examined. Impacts of projects on Isle of Man economy/society. Extent of incident data. Safety of navigating in gaps. Consequences of allisions with wind turbines.	Cumulative impacts are described in a separate NRA but are summarised in section 1.10. Data collection strategy is provided in section 1.3.5 and section . Impacts of project, including consequences, are described in section 1.8 and the risk assessment within section 1.9.
23 May 2022	Trinity House Scoping Opinion	Assessment Approach MGN654 Compliance. Cumulative Impacts to be Assessed. Additional and impacts to existing Aids to Navigation (AtoN). Decommissioning Plan. Export Cable corridor marking and protection.	Relevant methodology and guidance is given in section 1.2 and section 1.3. Cumulative impacts are described in a separate NRA but are summarised in section 1.10. Applied risk controls are described in section 1.4.8.
30 May 2022	MCA Scoping Opinion	Assessment Approach MGN654 Compliance. Impacts on vessel routeing and adverse weather routeing. Cumulative Impacts to be Assessed. Turbine layouts to comply with MGN654. Export Cable corridor marking and protection.	Relevant methodology and guidance is given in section 1.2 and section 1.3. Cumulative impacts are described in a separate NRA but are summarised in section 1.10. Impacts on vessel routeing are described in section 1.8.2/1.8.3/1.8.4. Applied risk controls are described in section 1.4.8.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this NRA
31 May 2022	Isle of Man Government Scoping Opinion	Cumulative impacts of multiple developments. Inclusion of Isle of Man Orsted offshore wind farm proposal. Impacts on IoMSPC routes into Douglas. Impacts to adverse weather routeing and safe shelter. Impacts to SAR capabilities.	Cumulative impacts are described in a separate NRA but are summarised in section 1.10. Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9. Impacts to SAR are described in section 1.8.8.
15 June 2022	Planning Inspectorate Scoping Opinion	Assessment Approach and shipping and navigation study area.	Relevant methodology and guidance is given in section 1.2 and section 1.3. The shipping and navigation study area is described in section 1.3.2.
30 June 2022	Seatruck Consultation Meeting	Bridge Simulations Preparations for the Mona Potential Array Area to inform PEIR. Determination of routes for assessment. Review of weather conditions and constraints. Definition of traffic and emergency scenarios. Assessment criteria and run order.	Section 1.3.5 provides a high-level summary of the navigational simulations with the technical report contained in Appendix E.
20 July 2022 21 July 2022	IoMSPC Bridge Simulations	Bridge Simulations Preparations for the Mona Potential Array Area to inform PEIR. Determination of routes for assessment. Review of weather conditions and constraints. Definition of traffic and emergency scenarios. Assessment criteria and run order.	Section 1.3.5 provides a high-level summary of the navigational simulations with the technical report contained in Appendix E.
11 August 2022 12 August 2022	Stena Line Bridge Simulations	Bridge Simulations Preparations for the Mona Potential Array Area to inform PEIR. Determination of routes for assessment. Review of weather conditions and constraints. Definition of traffic and emergency scenarios. Assessment criteria and run order.	Section 1.3.5 provides a high-level summary of the navigational simulations with the technical report contained in Appendix E.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this NRA
17 August 2022 18 August 2022 19 August 2022	IoMSPC Bridge Simulations	Bridge Simulations for the Mona Potential Array Area to inform PEIR. Safety of transits in adverse weather and traffic through Morgan-Walney.	Section 1.3.5 provides a high-level summary of the navigational simulations with the technical report contained in Appendix E. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
23 Aug 2022 24 Aug 2022 25 Aug 2022	Stena Line Bridge Simulations	Bridge Simulations for the Mona Potential Array Area to inform PEIR. Safety of transits in adverse weather and traffic through the Mona-Morgan/Mona-Morecambe Offshore Cable Corridors.	Section 1.3.5 provides a high-level summary of the navigational simulations with the technical report contained in Appendix E. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
08 September 2022 09 September 2022	Seatruck Bridge Simulations	Bridge Simulations for the Mona Potential Array Area to inform PEIR. Safety of transits in adverse weather and traffic through Mona-Morgan.	Section 1.3.5 provides a high-level summary of the navigational simulations with the technical report contained in Appendix E. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
03 October 2022	Various Consultation Meeting	Webinar to prepare for hazard workshops of the Mona Potential Array Area to inform PEIR.	Section 1.9 describes the findings of the hazard workshop.
10 October 2022	MNEF Members MNEF Meeting	Project update. Application process. Approach to cumulative assessment. Introduction to Morgan and Morecambe Offshore Wind Farms: Transmission Assets.	Section 1.2 describes the relevant legislation and policies.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this NRA
10 October 2022	Shipping and navigation stakeholders including, statutory consultees, commercial operators, fishing industry, other sea users etc. Hazard Workshop	Cumulative Hazard Workshop of the Mona Potential Array Area to inform PEIR.	Section 1.9 describes the findings of the hazard workshop.
11 October 2022	Shipping and navigation stakeholders including, statutory consultees, commercial operators, fishing industry, other sea users etc. Hazard Workshop	Hazard Workshops of the Mona Potential Array Area to inform PEIR.	Section 1.9 describes the findings of the hazard workshop.
19 October 2022	Isle of Man Government Consultation Meeting	Impacts on Isle of Man economy. Status of future Isle of Man offshore developments.	Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9. Cumulative impacts are described in a separate NRA but are summarised in section 1.10.
20 October 2022	Orsted Consultation Meeting	Update on Isle of Man Offshore Wind Farm.	Cumulative impacts are described in a separate NRA but are summarised in section 1.10.
18 January 2023	MNEF members MNEF Meeting	Project update on boundary amendments and commitments post PEIR.	A summary of the NRA results following boundary amendments are contained in section 1.9.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this NRA
April – June 2023	Shipping and navigation stakeholders including, statutory consultees, commercial operators, fishing industry, other sea users and members of the public Section 42 Responses	Cumulative impacts on Isle of Man's ferry and freight services and important sectors on the Isle of Man. Increase in navigation risk. Concerns over safety of ferries in adverse weather. Concern over additional fuel and carbon emissions.	This NRA has been updated to reflect comments received during the Section 42 consultation on the Mona PEIR. The consultation responses are listed in full within the Consultation report (Document reference E3)
23 May 2023 24 May 2023 25 May 2023	Stena Line Bridge Navigation Simulations	Update to navigation bridge simulations of the Mona Array Area to inform the Environmental Statement.	A summary of the navigation simulations is provided in section 1.3.5.
22 June 2023 23 June 2023	Seatruck Bridge Navigation Simulations	Update to navigation bridge simulations of the Mona Array Area to inform the Environmental Statement.	A summary of the navigation simulations is provided in section 1.3.5.
13 September 2023 14 September 2023 15 September 2023	IoMSPC Bridge Navigation Simulations	Update to navigation bridge simulations of the Mona Array Area to inform the Environmental Statement.	A summary of the navigation simulations is provided in section 1.3.5.
21 September 2023	MNEF Members MNEF Meeting	Project update and review of boundary changes.	Project details for assessment in the Environmental Statement are defined in section 1.4.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this NRA
28 September 2023	Shipping and navigation stakeholders including, statutory consultees, commercial operators, fishing industry and other sea users. Hazard Workshop	Cumulative NRA hazard workshop of the Mona Array Area to inform the Environmental Statement.	Section 1.9 describes the findings of the hazard workshop.
29 September 2023	Shipping and navigation stakeholders including, statutory consultees, commercial operators, fishing industry and other sea users. Hazard Workshop	Mona Offshore Wind Project hazard workshop to inform the Environmental Statement.	Section 1.9 describes the findings of the hazard workshop.
07 December 2023	Seatruck Consultation Meeting	Review of engagements and assessments to date. Identification of potential increases in risk to vessels. Identification of residual impacts on commercial operations. Cumulative impacts associated with Mooir Vannin.	A summary of engagement is included in section 1.3.5. Impacts to navigational safety are described in section 1.8 and an NRA is undertaken within section 1.9. Impacts to ferry routes are described in section 1.8.3. Cumulative impacts are assessed within the CRNRA in Appendix E and summarised in section 1.10.
11 December 2023	IoMSPC Isle of Man Government Consultation Meeting	Review of engagements and assessments to date. Identification of potential increases in risk to vessels. Identification of residual impacts on commercial operations. Cumulative impacts associated with Mooir Vannin.	A summary of engagement is included in section 1.3.5. Impacts to navigational safety are described in section 1.8 and an NRA is undertaken within section 1.9. Impacts to ferry routes are described in section 1.8.3. Cumulative impacts are assessed within the CRNRA in Appendix E and summarised in section 1.10.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this NRA
14 December 2023	Stena Line Consultation Meeting	Review of engagements and assessments to date. Identification of potential increases in risk to vessels. Identification of residual impacts on commercial operations. Cumulative impacts associated with Mooir Vannin.	A summary of engagement is included in section 1.3.5. Impacts to navigational safety are described in section 1.8 and an NRA is undertaken within section 1.9. Impacts to ferry routes are described in section 1.8.3. Cumulative impacts are assessed within the CRNRA in Appendix E and summarised in section 1.10.
18 December 2023	Trinity House Consultation Meeting	Review of engagements and assessments to date. Review of findings of shipping and navigation assessments. Review of Mona Offshore Wind Project mitigation measures. Cumulative impacts associated with Mooir Vannin Offshore Wind Farm.	A summary of engagement is included in section 1.3.5. Impacts to navigational safety are described in section 1.8 and an NRA is undertaken within section 1.9. Applied risk controls are described within section 1.4.8. Cumulative impacts are assessed within the CRNRA in Appendix E and summarised in section 1.10.
19 December 2023	MCA Consultation Meeting	Review of engagements and assessments to date. Review of findings of shipping and navigation assessments. Cumulative impacts associated with Mooir Vannin Offshore Wind Farm.	A summary of engagement is included in section 1.3.5. Impacts to navigational safety are described in section 1.8 and an NRA is undertaken within section 1.9. Applied risk controls are described within section 1.4.8. Cumulative impacts are assessed within the CRNRA in Appendix E and summarised in section 1.10.

Vessel traffic datasets

1.3.5.2 Vessel traffic data from several sources was utilised to determine baseline conditions:

- High fidelity Automatic Identification System (AIS) data for 2019 and 2022 for whole Irish Sea procured on behalf of the Mona Offshore Wind Project
- Vessel traffic surveys:
  - 14 day winter vessel traffic survey (05 December 2021 to 19 December 2021) collecting AIS, radar and visual observations
  - 14 day summer vessel traffic survey (30 June 2022 to 14 July 2022) collecting AIS, radar and visual observations
  - A top-up vessel traffic survey was undertaken in October and November 2023 to ensure compliance with MGN654 survey data recency requirements (see Appendix D).
- MMO 2019 anonymised AIS data
- EMODNet 2021 vessel density grids
- RYA Coastal Atlas
- UK Vessel Monitoring System (VMS) 2019 data
- OISPAR EU VMS 2017 data
- Department for Transport (DfT) shipping statistics (2022).

Incident data

1.3.5.3 Four accident datasets were utilised to support this assessment:

- Marine Accident Investigation Branch (MAIB) accidents database (1992 to 2021)
- Royal National Lifeboat Institute (RNLI) incident data (2008 to 2022)
- DfT SAR helicopter taskings (2021)
- G+ Accident Data (2013 to 2021).

Other data sources

1.3.5.4 Other datasets were utilised to support this assessment:

- Marine aggregate dredging licences (Crown Estate 2022)
- Offshore renewables (Crown Estate 2022)
- Industrial infrastructure (turbines, O&G, cables etc.) (Oceanwise, 2022)
- O&G activity (Oil and Gas Authority, 2022)
- Admiralty charts (2022)
- Admiralty Sailing Directions (2022)
- Passage plans and vessel information provided by ferry operators (2022)
- Tidal data (Admiralty Total Tide)
- MetOcean data (provided by Applicant).

Full bridge simulations

1.3.5.5 Full bridge simulations of ferry passages through the Irish Sea were commissioned by bp/EnBW. The aim of the simulations was to understand, in more detail, potential navigation impacts of the Mona, Morgan and Morecambe Offshore Wind Projects on existing commercial ferries and to test the viability and safety of commercial ferry transits between the offshore wind farms in normal and adverse weather conditions. A series of simulations were undertaken during 2022 on the Potential Array Areas of the Mona, Morgan Generation Assets and Morecambe Generation Assets and used to inform the PEIR. A second series of simulations were undertaken in 2023 to review the effects that changes to the array areas made post-PEIR would have on navigation safety. A detailed report of the findings of the simulations undertaken to inform the ES has been produced (Appendix E).

1.3.5.6 The simulations were administered by HR Wallingford at their UK Ship Simulation Centre following initial engagement in which the scope of the simulations, simulation scenarios and assessment criteria were agreed together with verification of the ship models being tested. Each simulation session was attended by ferry masters and officers and is summarised in Table 1.9.

1.3.5.7 The assessment criteria and simulation scenarios used within the simulations were developed and agreed with the ferry companies prior to each simulator run. Realistic traffic scenarios, emergency situations and normal/adverse weather conditions were determined based off the analysis contained within this NRA, and consultation with ferry operators.

Table 1.9: Simulation sessions.

Operator	Model Verification Session	PEIR Session	Environmental Statement Session
IoMSPC	21 to 22 July 2022	16 to 19 August 2022	12 to 4 June 2023 (Project team only) 13 to15 September 2023
Stena Line	11 to12 August 2022	23 to 25 August 2022	23 to 25 May 2023
Seatruck Ferries	Previously agreed with HRW	08 to 09 September 2022	22 to 23 June 2023
P&O (Applicant's project team only)	N/A	26 August 2022	N/A

1.3.5.8 The navigation simulations undertaken on the Mona Potential Array Area for the PEIR resulted in numerous failed runs, particularly during adverse weather and with complex traffic situations. As part of the CRNRA with the amended project boundaries post-PEIR, including the Mona Array Area, the navigation simulations were repeated between May and September 2023 with a total of 35 additional runs carried out. The key findings of the updated navigation simulations are as follows (see Appendix E):

- The changes to the Mona Array Area significantly improved navigation over the Mona Potential Array Area which was assessed at PEIR
- Collision risk whilst navigating between and around the array areas for the three projects was manageable with existing operational procedures in complex, worst credible traffic situations. These were in full compliance with COLREGs and the practice of good seamanship

- Routes remain susceptible to adverse weather which necessitate longer deviations with three projects in place
- Vessels operating near or within the offshore wind farms were apparent by radar and visual means and any collision risk situation could be determined by the passing ferries
- During emergency situations there remained some optionality for Masters to best position their vessel to respond
- None of the simulated scenarios were appreciably more challenging at night than during the day.

1.3.5.9 The full findings of the Environmental Statement simulations are reported in Appendix E.

1.4 Project description and maximum design scenario

1.4.1 Introduction

1.4.1.1 The Project Design Envelope (PDE) approach has been adopted for the Environmental Impact Assessment (EIA) of the Mona Offshore Wind Project, in accordance with industry good practice. Volume 1, Chapter 3: Project description of the Environmental Statement sets out the design assumptions and parameters from which the realistic MDS is drawn for the Mona Offshore Wind Project EIA.

1.4.1.2 When undertaking assessments on projects a number of years ahead of the time of construction, the assessment can consider what impacts might be significant based on the maximum design principals and assumptions.

1.4.1.3 The MDS relevant to shipping and navigation receptors is described within this section. This considers:

- The largest extent of the development
- The longest duration of activities
- The most vessel movements undertaken by the Mona Offshore Wind Project
- The maximum number of structures
- The minimum spacing between structures
- The longest lengths of cables
- The minimum cable burial
- The maximum height and length of cable protection.

1.4.2 Project boundaries and location

1.4.2.1 The Mona Array Area is 300 km^2 in area and is located in the east Irish Sea, 28.8 km (15.6 nm) from the Anglesey coastline, 46.9 km (25.3 nm) from the northwest coast of England, and 46.6 km (25.2 nm) from the Isle of Man (when measured from Mean High Water Springs (MHWS).

1.4.2.2 The water depths within the Mona Array Area are between 45 m and 31 m below Lowest Astronomical Tide (LAT).

1.4.2.3 The Mona Offshore Cable Corridor extends from the Mona Array Area to the selected landfall location on the north coast of Wales.

1.4.2.4 An indicative layout of wind turbines and OSPs is presented in Figure 1.3. The final layout of the Mona Offshore Wind Project is subject to assessment of all constraints and engineering/design determination. The final design will be subject to approval by NRW in consultation with the MCA and Trinity House and secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.

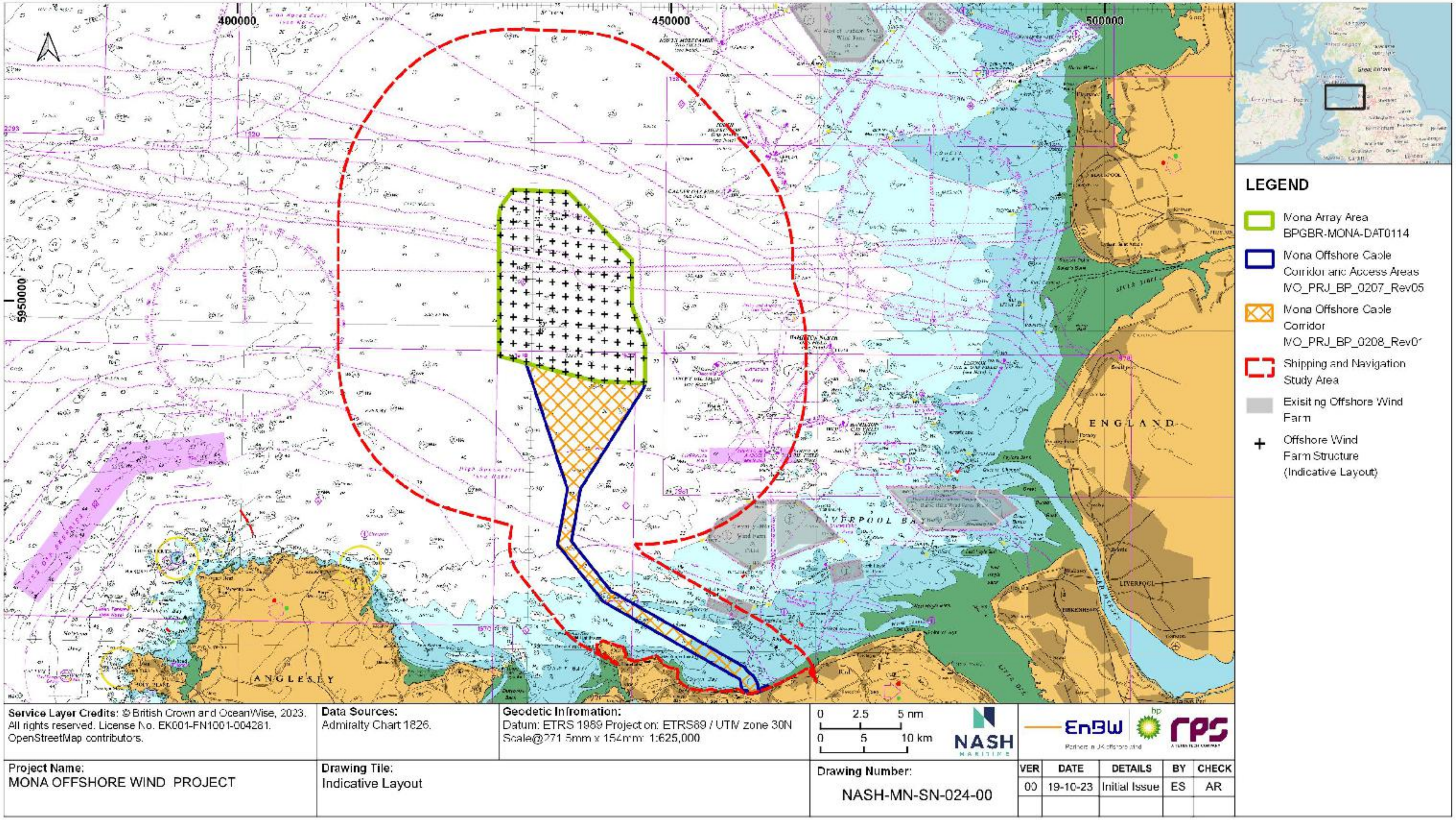


Figure 1.3: Indicative layout.

1.4.3 Generation infrastructure

1.4.3.1 The Mona Offshore Wind Project generation infrastructure could consist of:

- Up to 96 wind turbines
- Up to four offshore substations platforms.

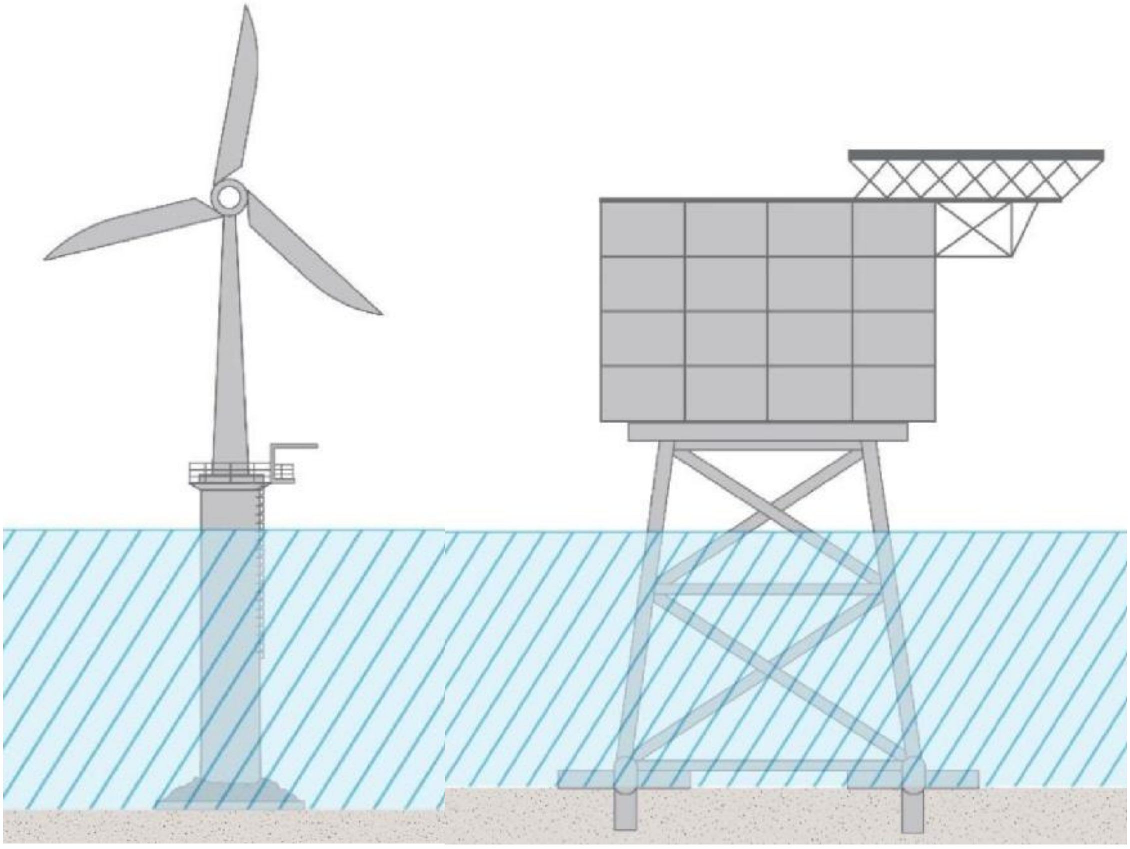


Figure 1.4: Illustrative wind turbine and substation design.

Wind turbines

1.4.3.2 Up to 96 wind turbines will be installed within the Mona Array Area. The hub height will be 168 m or more above LAT.

1.4.3.3 The minimum and maximum blade tip height above LAT will be 34 m and 364 m respectively. The maximum rotor diameter will be 320 m.

1.4.3.4 The minimum spacing between wind turbines will be 1,400 m.

1.4.3.5 Various foundation options are under investigation; however, all options are for fixed rather than floating structures. These include gravity base foundations, jackets on pin-piles or jackets on suction buckets. The largest wind turbine structure would be a three leg jacket with 40 m spacing between jacket legs at the water surface level.

1.4.3.6 Scour protection may be required for up to 13.8 m from each pile to a height of 2.6 m.

Offshore substation platforms

1.4.3.7 Up to four OSPs may be required to transform electricity generated by the wind turbines to a higher voltage to allow power to be more efficiently transmitted to shore.

1.4.3.8 The maximum dimensions of the substations will be 80 m x 60 m up to a height of 95 m to the top of the antenna structure.

1.4.4 Transmission infrastructure

1.4.4.1 Inter-array cables will be installed to carry electrical current produced by the wind turbines to the offshore substations. These will be up to 325 km in length with a minimum burial depth of 0.5 m. Cable protection may be required over a maximum of 32.5 km of the cable with a height of up to 3 m. Up to 67 cable crossings, each cable crossing has a length of up to 80 m and a height of up to 4 m.

1.4.4.2 Interconnector cables connect the offshore substations to each other in order to provide redundancy in the case of cable failure. Up to three cables will be installed with a maximum total length of 50 km and a minimum burial depth of 0.5 m. Cable protection will be laid over a maximum of 10 km with a height of up to 3 m. Up to ten cable crossings may be required, each crossing has a length of up to 50 m and a height of up to 3 m.

1.4.4.3 Export cables are used to transfer power from the OSPs to the landfall. Up to four cables will be installed with a maximum length of 90 km each (360 km in total) and minimum burial of 0.5 m. Cable protection will be laid over a maximum of 72 km of the cables with a height of up to 3 m. Up to 24 cable crossings may be required, each crossing has a length of up to 50 m and a height of up to 3 m.

1.4.4.4 Cable protection if required would consist of steel armour wire, rock or mattresses.

1.4.5 Construction and decommissioning activities

1.4.5.1 Construction is anticipated to take up to four years in duration. Foundation structures, offshore substation topsides, cabling and wind turbines will be transported to the installation site by vessel from the preassembly harbour or from the fabrication yard. Each individual wind turbine tower, nacelle and blades will be installed on top of the wind turbine foundations. The blades are likely to be installed one at a time, or alternatively may be transported and installed as pre-assembled rotor stars (hub with blades attached). Offshore substation foundations will be installed and then a pre-commissioned OSP top side will be transported to site and installed on top of the foundations. Cable installation could be achieved through burial using prelay plough, plough, trenching or jetting.

1.4.5.2 At the landfall, the offshore export cables will be installed through the intertidal zone using either trenchless methods or open cut trenching. The offshore export cables will be jointed to the onshore export cables at a transition joint bay, located on the landward side of the landfall. Following installation of the wind turbines and connection to the necessary cabling, a process of testing and commissioning will be undertaken.

1.4.5.3 Construction will require additional vessel movements undertaking work in either the Mona Array Area or export cable corridor. The maximum construction vessel movements will be 2,055 per year. This may include a variety of different vessel types, including:

- Main Installation/Support Vessels
- Tug/Anchor Handlers
- Cable Lay Vessels
- Guard Vessels

- Survey Vessels
- Seabed Preparation Vessels
- Crew Transfer Vessels (CTVs)
- Scour Protection Installation Vessels
- Cable Protection Installation Vessels.

1.4.5.4 Following the operational lifetime of the Mona Offshore Wind Project, the Mona Offshore Wind Project will be decommissioned or repowered in line with the regulations, requirements, guidance and best practices relevant at the time. It is anticipated that all structures above the seabed will be completed removed, but that offshore cables may be left in situ. A decommissioning plan will be prepared prior to construction.

1.4.5.5 The duration of the decommissioning programme is anticipated to be the same as for construction. During the decommissioning phase the changes would gradually decrease from the operational MDS as the need for project-related vessels is reduced and structures are removed and cut below the seabed.

1.4.6 Operations and maintenance activities

1.4.6.1 The operational lifetime of the Mona Offshore Wind Project is anticipated to be up to 35 years.

1.4.6.2 O&M will require additional vessel movements undertaking work in either the Mona Array Area or export cable corridor. The maximum number of O&M vessel movements will be 849 per year. This may include a variety of different vessel types, including:

- CTVs
- Jack-Ups
- Cable Repair Vessels
- Service Operation Vessels
- Excavators/Backhoe Dredgers.

1.4.6.3 Routine maintenance activities offshore may include inspections, removal of marine growth build up, minor repairs, cleaning activities, and replacement of consumables and corrosion protection systems. Non-routine major maintenance activities may include component exchanges (e.g. wind turbine blades, gearboxes), cable reburial and cable repair activities.

1.4.6.4 Routine O&M activities may be carried out from CTVs or Service Operation Vessels, with major maintenance activities (such as component exchanges) requiring jack-up vessels, heavy lift vessels or specialist vessels such as cable repair and cable laying vessels. Occasionally, helicopters may also be used to transport personnel and equipment.

1.4.7 Marking and lighting

1.4.7.1 The Mona Offshore Wind Project will be designed and constructed in accordance with relevant guidance and advice from Trinity House and the MCA:

- Trinity House Provision and Maintenance of Local AtoN Marking OREI
- Civil Aviation Authority Policy and Guidelines on Wind Turbines

- IALA Recommendation G1162 on the Marking of Man-Made Offshore Structures
- MCA OREI: Requirements, Guidance and Operational Considerations for SAR and Emergency Response.

1.4.7.2 Appropriate marking, lighting and AtoN will be employed during the construction, O&M, and decommissioning phases as appropriate to ensure the safety of all parties. The nacelles, blades and towers will be painted light grey (RAL 7035) and the foundation structures, not less than 15 m from Highest Astronomical Tide (HAT), will be traffic light yellow (RAL 1023).

1.4.7.3 Appropriate lighting, in line with MCA (2018) guidance, will ensure the offshore structures are visible for SAR and emergency response procedures. In addition, the Mona Offshore Wind Project lighting will conform to the following:

- Red, medium intensity aviation warning lights (of variable brightness between a maximum of 2000 candela (cd)) to a minimum of 10% of the maximum which would be 200 cd) will be located on either side of the nacelle of significant peripheral wind turbines. These lights will flash simultaneously with a Morse W flash pattern and will also include an infra-red component
- All aviation warning lights will flash synchronously throughout the Mona Array Area and be able to be switched on and off by means of twilight switches (which activate when ambient light falls below a pre-set level)
- Aviation warning lights will allow for reduction in lighting intensity at and below the horizon when visibility from every wind turbine is more than 5 km (to a minimum of 10% of the maximum, i.e. 200 cd)
- SAR lighting of each of the non-periphery turbines will be combi infra-red/200 cd steady red aviation hazard lights, individually switchable from the control centre at the request of the MCA (i.e. when conducting SAR operations in or around the Mona Array Area)
- All wind turbines will be fitted with a low intensity light for the purpose of helicopter winching (green hoist lamp). All wind turbines will also be fitted with suitable illumination (minimum one 5 cd light) for ID signs
- Marine navigational lights will be fitted at the platform level on significant peripheral structures. These lights will be synchronized to display simultaneously an IALA ‘special mark’ characteristic, flashing yellow, with a range of not less than five 5 nm.

1.4.7.4 The location of all infrastructure (including wind turbines, substations, and cables) will be communicated to the UK Hydrographic Office (UKHO) so that they can be incorporated into Admiralty Charts and the Notice to Mariners procedures.

1.4.7.5 A marking and lighting plan will be submitted to the MCA and Trinity House for review prior to construction.

1.4.7.6 Further details on marking and lighting arrangements are included within the applied mitigation of the Mona Offshore Wind Project within section 1.4.8.

1.4.8 Applied mitigations

1.4.8.1 Table 1.10 describes risk controls committed to by the Mona Offshore Wind Project and therefore are included within the NRA.

1.4.8.2 Furthermore, commitments made by Mona Offshore Wind Project after PEIR described in section 1.1.3 are included within this assessment as applied mitigations.

Table 1.10: Applied mitigation measures.

Measures adopted as part of the Mona Offshore Wind Project	Justification	How the measure will be secured
Primary measures: Measures included as part of the project design		
Development and adherence to an Aids to Navigation Management Plan (AtoNMP) to ensure adequate navigational markers (including lighting), in accordance with the most recent relevant industry guidance and agreed prior to commencement of offshore construction	To ensure navigational safety and minimise risk, suitable AtoN lighting and marking of the Mona Array Area shall be undertaken complying with IALA Recommendations G1162 (IALA, 2021), to be finalised and approved in consultation with MCA and Trinity House through the preparation of an AtoNMP. Fog horns to alert vessels to the position of structures when visibility is poor. Wind turbine informal naming/associated markings shall not interfere with formal AtoNs. AIS transponders to be placed on periphery corner wind turbines.	AtoNMP secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.
Wind turbine blades will a minimum of 34 m clearance above LAT to ensure sufficient air draught clearance	MGN654 recommends that wind turbine blades will have at least 22 m clearance above MHWS (which is 29.4 m above LAT at Mona Array Area) in order to reduce the risk of striking yacht masts.	Secured as an offshore parameter in requirement 2 of Schedule 2 of the draft DCO and within the deemed marine licence in Schedule 14 of the draft DCO
Development of and adherence to a Design Plan (DP) which includes for two lines of orientation	Wind turbine layout plan to be agreed with NRW in consultation with MCA and Trinity House prior to commencement of construction and maintain two lines of orientation for navigation and SAR access within the Mona Array Area.	DP secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.
Development and adherence to an offshore environmental management plan (OEMP) that includes a fisheries liaison and co-existence plan (FLCP) which sets out use of guard vessels where required	Where cable exposures exist during the operational and maintenance phase, which could result in significant risk, guard vessels will be used where appropriate until the risk has been mitigated by burial and/or other protection methods, ensuring navigational safety and minimising the potential risk of gear snagging. Guard vessels facilitate engagement with commercial fisheries stakeholders during specific project works, maximising awareness of temporary hazards and reducing potential for interactions between the commercial fishing activity and the Morgan Generation Assets.	OEMP and FLCP is secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence. An outline of the FLCP has been submitted as part of the Application (Document Reference J13).
Development and adherence to an Offshore Construction Method Statement (OCMS) which includes a Cable Specification and	To ensure navigational safety and maintain a suitable UKC for navigating vessels, a CSIP, informed by a Cable Burial Risk Assessment (CBRA) will be undertaken pre-construction. Selected	OCMS, which includes a CSIP, are secured within the deemed marine licence in Schedule

Measures adopted as part of the Mona Offshore Wind Project	Justification	How the measure will be secured
Installation Plan (CSIP) and details of cable monitoring to ensure under keel clearance (UKC) is maintained and no more than a 5% reduction in water depth (referenced to Chart Datum) will occur as a result of cable protection at any point over cables without prior written approval from the Licensing Authority	methods will be based on the risk assessment and the protection will be periodically monitored and maintained as practicable. This will reduce the risk of snagging of cables and grounding of vessels.	14 of the draft DCO and expected to be secured within the standalone NRW marine licence.
Tertiary measures: Measures required to meet legislative requirements, or adopted standard industry practice		
Notification of construction, maintenance and decommissioning activities through the use of Notice to Mariners (NtMs)	To ensure that the appropriate authorities and stakeholders are informed of works being carried out in waters adjacent to the Mona Offshore Wind Project. To include: • NRW • MCA • Trinity House • UKHO • Kingfisher • Northern Lighthouse Board • RYA • Local Ports and Harbours • O&G operators • MMO.	NtMs secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.
Marking and charting	Mona Offshore Wind Project is marked on nautical charts including an appropriate chart note to facilitate safe passage planning.	Secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.
Use of advisory clearance distances and safety zones during construction and periods of maintenance	To ensure navigational safety and minimise risk, 500 m safety zones will be implemented around wind turbines and OSPs during their construction. 50 m safety zones will also be implemented around each item of infrastructure during the construction phase, where no construction works are taking place on that infrastructure (for example, where a	An application for safety zones will be made under the Energy Act 2004 as set out in the Safety Zone Statement (Document Ref J6).

Measures adopted as part of the Mona Offshore Wind Project	Justification	How the measure will be secured
	wind turbine generator is incomplete or is in the process of being tested before commissioning). During the maintenance phase, 500 m safety zones will also be implemented around any vessel involved in major maintenance works. Whilst no formal application for a safety zone around cable laying operations is possible under Section 95 of the Energy Act 2004, it is the Applicant's intention to propose rolling advisory safety zones of up to 500 m around vessels installing inter-array cables and interconnector cables in the interests of the safety of all users of the sea, and to provide clearance of 500 m from laid cables until burial is confirmed in case of interaction with anchors or fishing gear. Application and use of safety zones in accordance with the Safety Zone Statement (Document Ref J6).	
Development and adherence to a Vessel Traffic Management Plan (VTMP) requiring continuous Watch by multi-channel Very High Frequency (VHF), including Digital Selective Calling	Continuous watch to monitor vessel activities, reducing the risk of incidents and improving response.	VTMP secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.
Development and adherence to an OEMP which includes a FLCP	Provision of detailed Mona Offshore Wind Project information to fishermen to aid co-existence, such as site and export cable route location for upload into fish plotters.	OEMP and FLCP secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence. An outline FLCP has been submitted as part of the Application (document reference J13).
Development and adherence to an Emergency Response and Cooperation Plan (ERCoP)	ERCoP, agreed with MCA prior to construction and aligned with MGN654 "OREIs – Guidance on UK Navigational Practice, Safety and Emergency Response Issues". This will establish the approach to incident response to minimise resulting consequences.	ERCoP secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.
Development and adherence to an OEMP which includes a Marine Pollution Contingency Plan (MPCP) to minimise and manage the risk of marine pollution events	Development of an OEMP that details minimum environmental management requirements expected of the Applicant and all contractors and subcontractors, to ensure accidental pollution into the marine environment is minimised, through the development and	OEMP and MPCP secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.

Measures adopted as part of the Mona Offshore Wind Project	Justification	How the measure will be secured
	adherence of a MPCP, for approval prior to commencement of construction.	
Incident investigation and reporting	Risk assessments to be reviewed following incidents, and additional risk controls identified if appropriate to reduce the likelihood of recurrence. Lessons learnt will be disseminated to improve safety record of Mona Offshore Wind Project operations.	Incident reporting requirements and expectations, including: • MAIB (Merchant Shipping Act 1995) • Health and Safety Executive (RIDDOR 2013) • Harbour Authority under Port Marine Safety Code.
Development and adherence to an AtoNMP, which includes details for a buoyed construction area	To ensure navigational safety and minimise risk, buoys will be deployed around construction work in the Mona Array Area in line with Trinity House requirements and may include a combination of cardinal and/or safe water marks. To be finalised and approved in consultation with MCA and Trinity House prior to construction through an AtoN Management Plan.	AtoNMP secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.
Hydrographic Surveys	To ensure depths of water and promulgated, MGN654 and its annexes requires that hydrographic surveys should fulfil the requirements of the International Hydrographic Organisation (IHO) Order 1a standard, with the final data supplied as a digital full density data set, and survey report to the MCA Hydrography Manager and the UKHO.	Secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.
Development and adherence to a OCMS which includes a CSIP that set out details of electromagnetic interference minimisation	To minimise the impact on ship compasses and preserve navigational safety, a CSIP will be prepared that will include the technical specification of offshore electrical circuits, and a desk-based assessment of attenuation of electromagnetic field strength, shielding and cable burial depth in accordance with industry good practice.	OCMS and CSIP secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.
Development and adherence to an OCMS Construction Programme (CP)	OCMS and CP to be approved by NRW in consultation with MCA and Trinity House. Where possible, construction to follow linear progression avoiding disparate construction sites across development area and therefore minimising impact to operators.	Secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence. An outline VTMP has been submitted as part of the Application (Document Reference J14).
Development and adherence to a VTMP	To ensure navigational safety and minimise risk, a VTMP will be prepared to ensure the co-ordination of Mona Offshore Wind	VTMP secured within the deemed marine licence in Schedule 14 of the draft DCO and

Measures adopted as part of the Mona Offshore Wind Project	Justification	How the measure will be secured
	Project vessels during construction and O&M by the Project Marine Co-ordination Centre to ensure project vessels do not present unacceptable risks to each other or third parties. Mona Offshore Wind Project marine traffic coordination plans to be made available to all maritime users. Information and warnings will be distributed via Notices to Mariners and other appropriate media (e.g. Admiralty Charts and fishermen's awareness charts) to enable vessels and operators to effectively and safely navigate around the Mona Array Area and activities during the Mona Offshore Cable Corridor construction.	expected to be secured within the standalone NRW marine licence. An outline VTMP has been submitted as part of the Application (Document Reference J14).
Development and adherence to a VTMP setting out vessel standards	To ensure navigational safety, all work vessels operating on behalf of the Mona Offshore Wind Project will have: • MCA Vessel Coding (e.g. Small Commercial Vessel Code) • Appropriate insurance • Crewed by suitably trained/qualified personnel • AIS (Class A/B) • VHF (Ch16) • Appropriate mooring arrangements.	VTMP secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence. An outline VTMP has been submitted as part of the Application (Document Reference J14).
Personal Protective Equipment (PPE)	To maintain the safety of those working at the Mona Offshore Wind Project, all personnel to wear the correct PPE suitable for the location and role at all times, as defined by the relevant Quality, Health, Safety and Environment documentation. This will include the use of Personal Locator Beacons.	Industry best practice.
Inspection and Maintenance Programme	To ensure the safe operation of the Mona Offshore Wind Project, regular maintenance regime by developer to check the Mona Offshore Wind Project infrastructure, its fittings and any signs of wear and tear. This should identify any defects which might cause a failure.	Industry best practice.
Training	To maintain the safety of those working at the Mona Offshore Wind Project, the Applicant is responsible for ensuring that all staff engaged on operations are competent to carry out the allocated work.	Industry best practice.

Measures adopted as part of the Mona Offshore Wind Project	Justification	How the measure will be secured
Compliance with International, UK and Flag State Regulations including IMO conventions	To ensure navigational safety, compliance from all vessels associated with the proposed Mona Offshore Wind Project with international maritime regulations as adopted by the relevant flag state such as COLREGS (IMO, 1972) and SOLAS (IMO, 1974).	Industry best practice.
Vessel health and safety requirements	To ensure navigational safety, the Applicant will ensure that all Mona Offshore Wind Project related vessels meet both IMO conventions for safe operation as well as Health, Safety and Environment requirements, where applicable. This shall include the following good practice: • Wind farm associated vessels will comply with International Maritime Regulations • All vessels, regardless of size, will be required to carry AIS equipment on board • All vessels engaged in activities will comply with relevant regulations for their size and class of operation and will be assessed on whether they are "fit for purpose" for activities they are required to carry out • All marine operations will be governed by operational limits, tidal conditions, weather conditions and vessel traffic information • Walk to work solutions will be utilised where possible.	VTMP secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence. A Vessel Traffic Management Plan will be prepared, an outline of this plan has been submitted as part of the Application (Document Reference J14).
Continued engagement of the MNEF post consent	To ensure that the appropriate authorities and stakeholders are informed of works being carried out in waters adjacent to the Mona Offshore Wind Project, a regular engagement forum will be maintained.	Secured through the Mitigation and Monitoring Schedule (Document reference J10)
Development and adherence to a Navigation Monitoring Strategy setting out vessel traffic monitoring	To ensure navigational safety is maintained, continuous monitoring during construction and immediate period post construction will be provided to MCA approval as set out in the Offshore In-principle Monitoring Plan (Document Reference J15).	Navigation Monitoring Strategy secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.

1.5 Description of the marine environment

1.5.1 Principal navigational features

1.5.1.1 Key relevant features relevant to the Mona Offshore Wind Project and features relating the management of vessels and safety of navigation are described in this section.

1.5.1.2 Principle navigational features relevant to the Mona Offshore Wind Project have been identified using the appropriate UKHO Admiralty charts and UKHO Admiralty Sailing Directions appropriate to the area. Principle navigational features in proximity to the Mona Offshore Wind Project are shown in Figure 1.5. Details of these navigational features are described in the following sections.

Responsible Authorities - MCA

1.5.1.3 The shipping and navigation study area is in a region of general navigation in UK waters with the MCA as the responsible authority for safe navigation.

IMO routeing schemes, reporting measures and recommended channels

1.5.1.4 There are two IMO adopted routeing measures located within the Irish Sea. The Liverpool Bay TSS is located approximately 4.5 nm southeast of the boundary of the Mona Array Area, as shown in Figure 1.5. The Off Skerries TSS is located 17.6 nm southwest of the Mona Array Area.

1.5.1.5 The area surrounding the Douglas Oil Field infrastructure is charted on Admiralty Chart 1826 as an Area to be Avoided with the accompanying note: 'The IMO-adopted Area to be Avoided should only be entered by authorised vessels to access the Douglas Oil Field'.

1.5.1.6 There are no reporting measures within the shipping and navigation study area.

Aids to navigation

1.5.1.7 AtoNs located in the shipping and navigation study area are shown in Figure 1.5.

1.5.1.8 All AtoNs within 10 nm of the Mona Array Area are fixed on offshore structures such as O&G platforms and wind turbines.

1.5.1.9 The Mona Offshore Cable Corridor passes within 500 m of the West Constable cardinal mark, north of Llandudno.

Pilot boarding stations

1.5.1.10 Pilot boarding stations are shown on Figure 1.5. These include, Douglas, Liverpool, Mostyn, Mostyn Outer, Point Lynas (Liverpool) and Menai Strait. None of these stations fall within the shipping and navigation study area.

PEXA schemes

1.5.1.11 There are no practice and exercise areas (PEXA) used by the Ministry of Defence within the shipping and navigation study area.

Anchorages and waiting areas

1.5.1.12 Two charted anchorages are located within the Port of Liverpool Statutory Harbour Authority Area, as shown on Figure 1.5. One of these lies to the south of the approaches to Liverpool between the Burbo Bank Extension and Gwynt y Môr windfarms. The other anchorage is to the north of the approaches to the Mersey.

1.5.1.13 Douglas Bay is used as an anchorage for vessels waiting to enter the Port of Douglas and for cruise vessels when undertaking tendering operations.

1.5.1.14 There is an anchorage called Rhyl North used by vessels waiting for pilotage to the Port of Mostyn located directly north of the Mostyn Pilot Boarding Station.

1.5.1.15 Whilst not charted, analysis of vessel traffic data identified a commercial ship anchorage located to the east of Anglesey, by Point Lynas, that offers good shelter in westerly winds (see section 1.6.3).

Spoil and disposal grounds

1.5.1.16 A single spoil ground located to the north of Hamilton Gas Field was identified within the shipping and navigation study area.

Wrecks

1.5.1.17 There are over 1,300 charted wrecks in the Irish Sea. These are identified on navigational charts.

1.5.2 Existing infrastructure

Ports and harbours

1.5.2.1 There are no ports or harbours within the shipping and navigation study area. Table 1.11 lists the key ports and harbours within the Irish Sea.

1.5.2.2 Raynes Jetty, associated with the quarry at Llanddulas, is located near to cable landfall.

Table 1.11: Principal ports and harbours.

Name	Harbour Area Location Relative to the Mona Array Area
Port of Liverpool (England)	10 nm southeast of the Mona Array Area
Douglas Port (Isle of Man)	22 nm northwest of the Mona Array Area
Heysham Port (England)	33 nm northeast of the Mona Array Area
Belfast Port (Northern Ireland)	80 nm northwest of the Mona Array Area
Dublin Port (Ireland)	78 nm southwest of the Mona Array Area

Other offshore wind projects

1.5.2.3 Existing offshore wind infrastructure within the east Irish Sea is listed in Table 1.12. The only wind farm located within the shipping and navigation study area is Gwynt y Môr Wind Farm, located approximately 9.6 nm southeast of the Mona Array Area.

Table 1.12: Offshore wind.

Name	Type	Location Relative to the Mona Array Area	Status
Gwynt y Môr offshore wind farm	Operational wind farm (576 MW capacity)	9.6 nm southeast	Operational since 2015
North Hoyle offshore wind farm	Operational wind farm (60 MW capacity)	16.0 nm southeast	Operational since 2004
Rhyl Flats offshore wind farm	Operational wind farm (90 MW capacity)	13.8 nm south	Operational since 2009
Burbo Bank offshore wind farm (including extensions)	Operational wind farm (90 MW plus 258 MW extension)	16.0 nm southeast	Operational since 2007, extension operational since 2017
West of Duddon Sands offshore wind farm	Operational wind farm (389 MW capacity)	17.2 nm northeast	Operational since 2014
Barrow offshore wind farm	Operational wind farm (90 MW capacity)	23.4 nm northeast	Operational since 2006
Walney offshore wind farm (including extensions)	Group of operational wind farms (total capacity of 1026 MW)	18.4 nm northeast	Operational since 2011, with extensions operational in 2012 and 2018
Ormonde offshore wind farm	Operational wind farm (150 MW capacity)	23.8 nm northeast	Operational since 2012

Oil and gas

1.5.2.4 O&G infrastructure within the east Irish Sea is listed in Table 1.13 and shown in Figure 1.5. The nearest O&G infrastructure to the Mona Array Area include Conwy Oil Field and Calder Gas Field.

Table 1.13: O&G Infrastructure.

Name	Type	Location to the relative Mona Array Area	Status
South Morecambe Gas Field	Manned	10 nm northeast	Producing. Decommissioning of two drilling platforms commenced in 2021. DP3 decommissioned as of 2023.
Calder Gas Field	Normally unmanned	7 nm northeast	Producing
North Morecambe Gas Field	Manned	13 nm northeast	Producing
Millom Gas Field	Normally unmanned	13 nm north	Producing
Conwy Oil Field	Manned	4 nm to the east	Producing
Douglas Oil Field	Manned	9 nm southeast	Producing
Hamilton North Gas Field	Normally unmanned	7 nm east	Producing
Hamilton Gas Field	Normally unmanned	12 nm southwest	Producing
Lennox O&G Field	Normally unmanned	22 nm east	Producing

Submarine cables

1.5.2.5 A total of 10 submarine cables pass through the shipping and navigation study area and six pass through the Mona Array Area, as shown in Figure 1.5.

Aggregates

1.5.2.6 Aggregate and extraction areas are shown in Figure 1.5 and listed in Table 1.14.

Table 1.14: Aggregate and extraction areas.

Name	Type	Location relative to the Mona Array Area
Area 457: Liverpool Bay	Extraction Area	6 nm east of the array area.
Area 392/393: Hilbre Swash	Extraction Area	12 nm southeast of the array area.
Area 1808: Liverpool Bay	Exploration and Option Area	11 nm southeast of the array area.

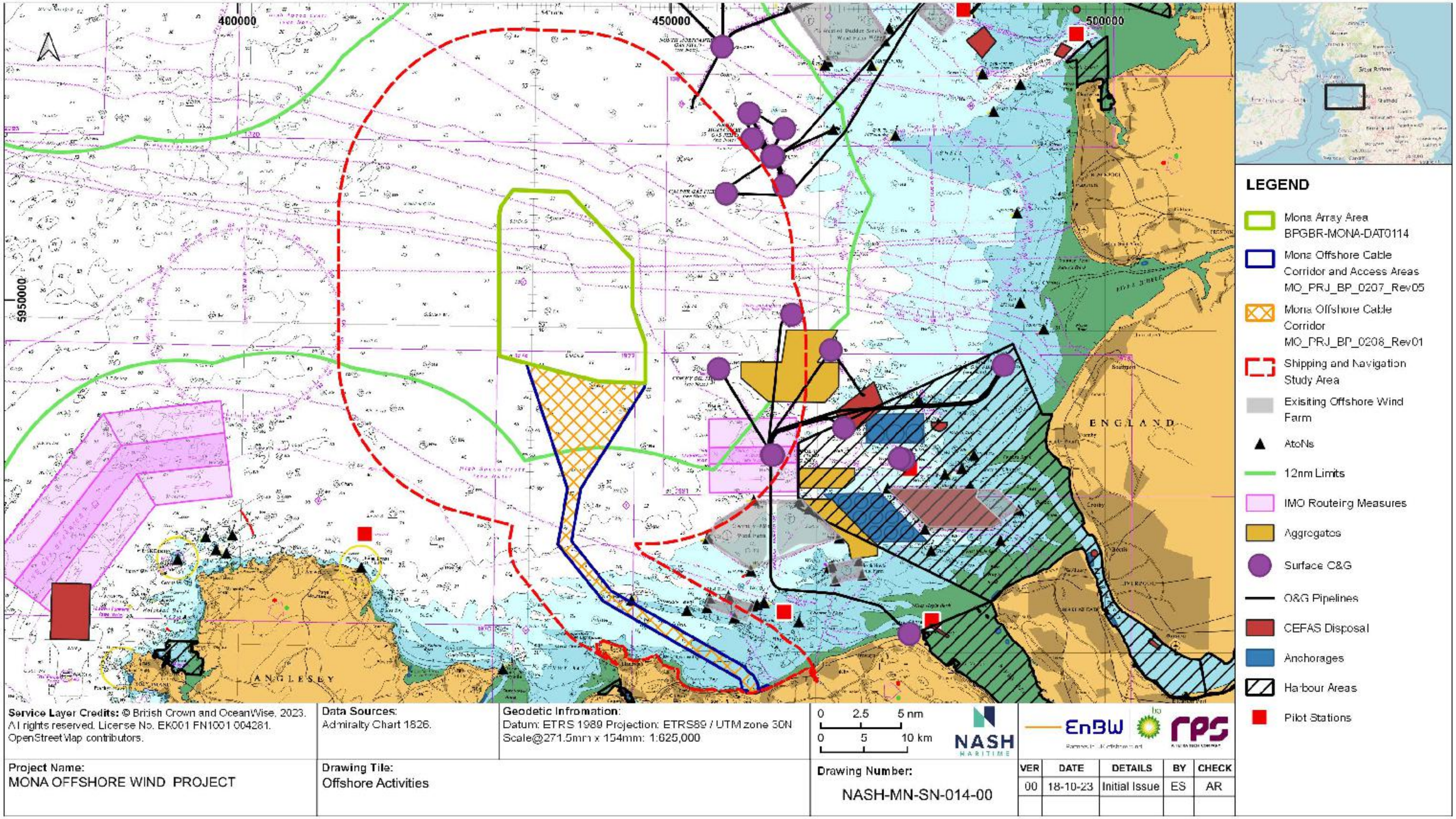


Figure 1.5: Offshore activities.

1.5.3 MetOcean conditions

1.5.3.1 In this section, MetOcean conditions are described for the shipping and navigation study area for the wind and wave climate, tide and currents, and visibility. Additional work was undertaken by HR Wallingford, to underpin the bridge navigation simulations which is reported in detail within Appendix E and summarised here together with information provided within Admiralty Sailing Directions West Coasts of England and Wales Pilot, NP37, 21st Edition, 2022.

Wind and Wave

1.5.3.2 Figure 1.6 shows the modelled wind speeds and directions within the centre of the shipping and navigation study area for the years 1988 to 2018. The predominant wind direction is from the southwest, and accounts for the greatest proportion of strong wind events. The Admiralty Sailing Directions state that gales are reported between 12 days/year (at Walney) and 30 days/year (at Ronaldsway).

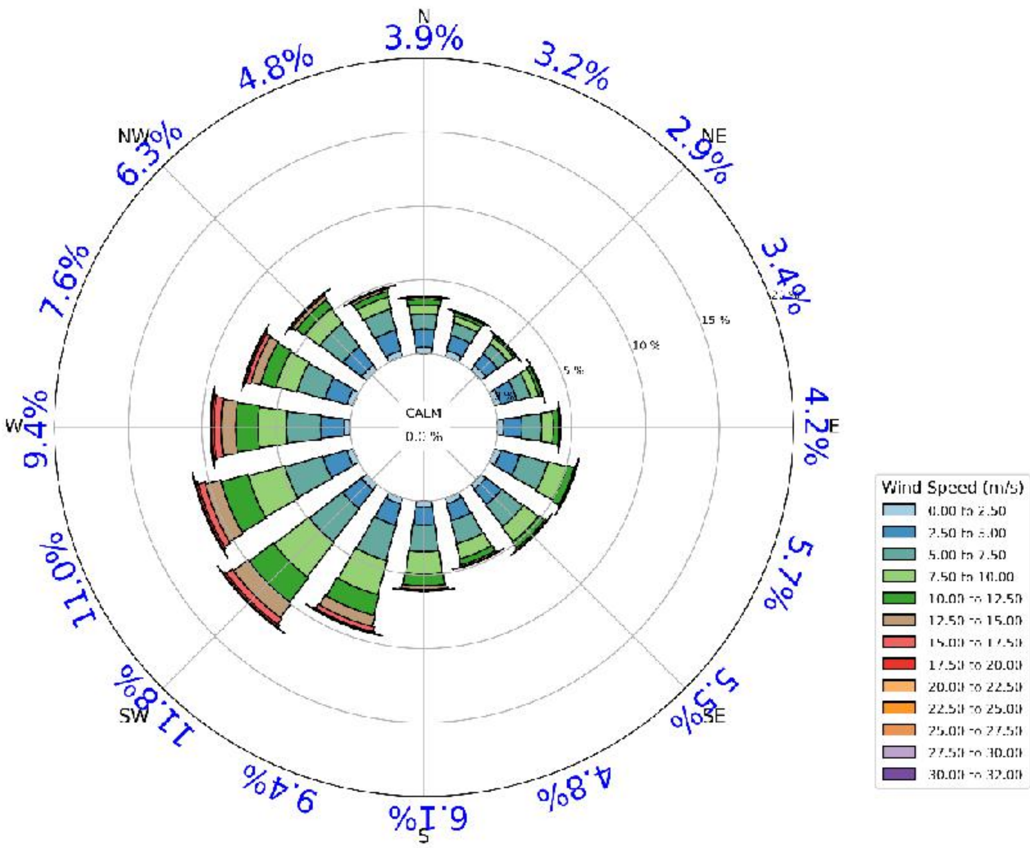


Figure 1.6: Annual average wind rose at surface level. Source: Mona Project (1988 to 2018). Analysed by HR Wallingford.

1.5.3.3 The Met Office North West Shelf Reanalysis Hindcast covers the period 1980 to 2021 and is based on coupled NEMO and WaveWatchIII hydrodynamics and wave models, with the wave model forced with ECMWF ERA5 model winds. The wave model's horizontal resolution is between 3 km to 1.5 km in coastal waters. Model wave data was downloaded for the southeast Irish Sea and a subset of model points were extracted and analysed by HR Wallingford.

1.5.3.4 Annual average wave conditions at a point (53.8°N, -4.0°E) within the area of interest is shown in Figure 1.7. These demonstrate that wave conditions are predominantly southwesterly and account for the majority of wave conditions greater than 2.5 m significant wave height (H_s). Table 1.15 demonstrates the extreme wave conditions within the shipping and navigation study area, with 4.2 m H_s and 50 knot winds from the southwest the typical annual extreme.

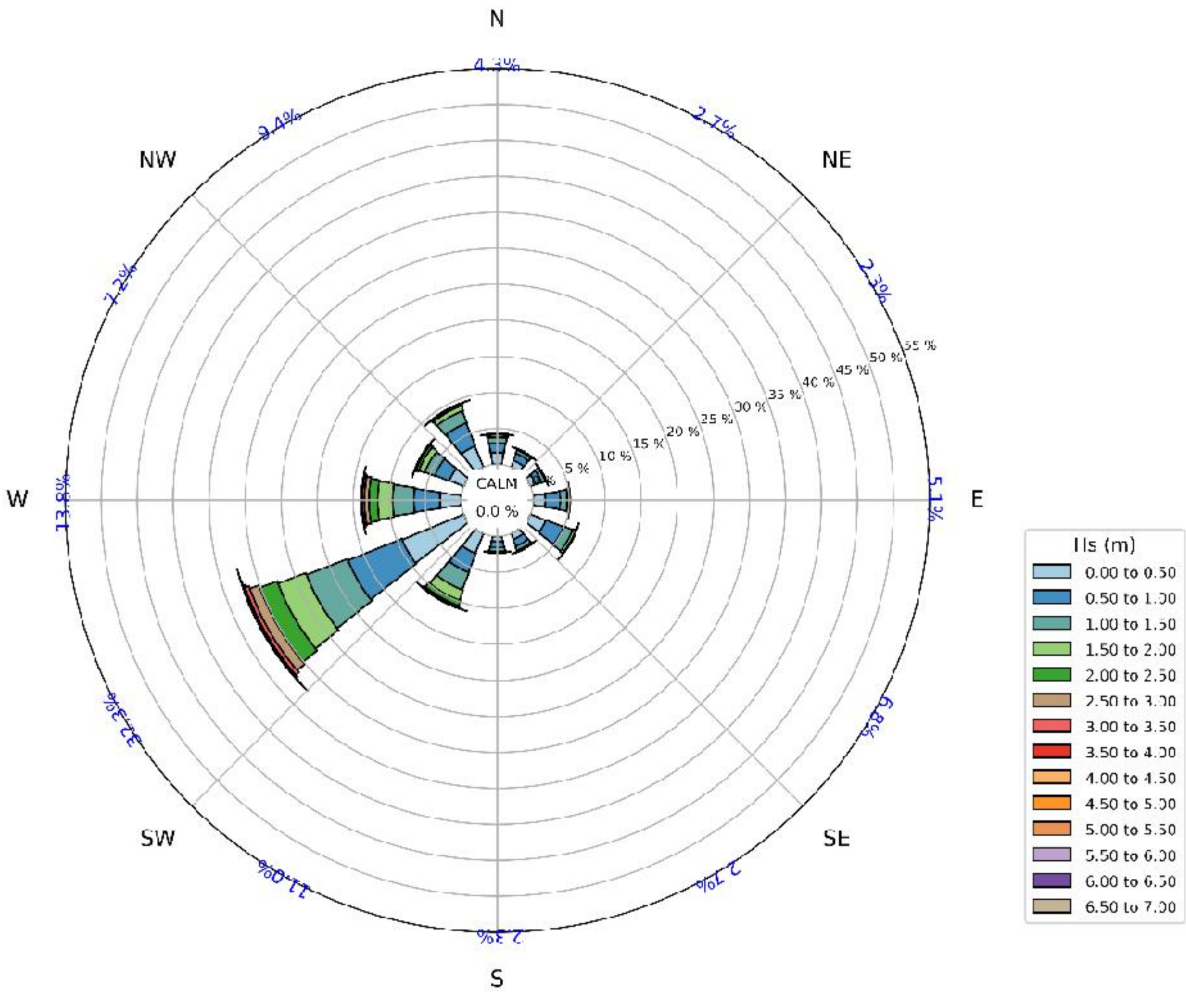


Figure 1.7: Annual average wave rose (53.8N, -4.0E) Source: Met Office NWS model (1980 to 2021). Analysed by HR Wallingford.

Table 1.15: Summary of wave extremes. Source: Met Office NWS model (1980 to 2021). Analysed by HR Wallingford.

Return Period	Significant wave height H_s (m)	Wave Direction	Corresponding Approximate Wind Speed (knots)
Weekly (1 in 50)	1.6	232	15
Monthly (1 in 10)	2.9	264	30
Yearly (1 in 1)	4.2	227	50
1 in 5 years	4.6	236	-
1 in 10 years	5.4	240	-

Tidal

1.5.3.5 Flow modelling for a spring tide by HR Wallingford for the Irish Sea is shown Figure 1.8. The maximum flow speeds in the shipping and navigation study area are there for less than 1.5 m/s.

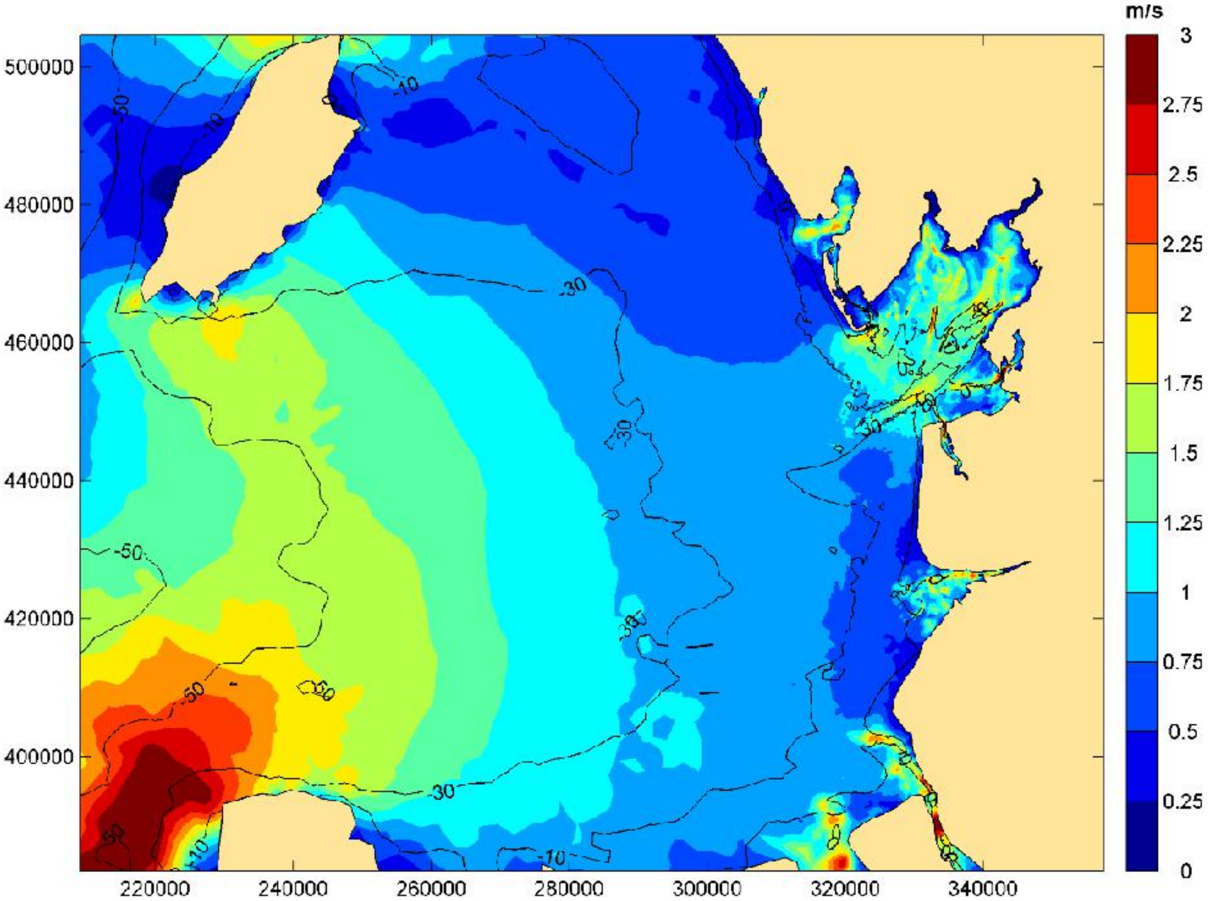


Figure 1.8: Maximum current flow speeds (m/s) for spring tide. Source: HR Wallingford.

Visibility

1.5.3.6 The Admiralty Sailing Directions report fog between 12 days/year (at Crosby) and 24 days/year (at Ronaldsway).

1.5.4 Search and rescue

HMCG

1.5.4.1 His Majesty's Coastguard (HMCG) is responsible for requesting and coordinating SAR activities within the UK's SAR region. The local coastguard base for the region is Holyhead Coastguard Operations Centre.

1.5.4.2 The nearest HMCG helicopter base is located at Caernarfon Airport, Gwynedd, as shown in Figure 1.9. The Caernarfon Facility provides a 24-hour SAR service, with two Sikirsky S-92 helicopters.

RNLI

1.5.4.3 There are 19 RNLI lifeboat stations within the region, as detailed in Table 1.16 and shown in Figure 1.9. The nearest lifeboat station is Llandudno, situated 16 nm south of the Mona Array Area and equipped with a Shannon class all-weather lifeboat and a D class inshore boat.

Table 1.16: RNLI stations.

Name	Type	Location relative to the Mona Array Area
Blackpool	Three inshore lifeboats, including an Atlantic 85 and two D class lifeboats.	28 nm east
Lytham St Annes	Shannon class all-weather lifeboat and a D class inshore boat. Lifeboats are housed in Lytham and St Annes.	28 nm east
New Brighton	B class Atlantic 85 lifeboat.	29 nm southeast
Hoylake	Shannon class lifeboat.	26 nm southeast
West Kirby	D class lifeboat.	27 nm southeast
Flint	D class lifeboat.	32 nm southeast
Rhyl	Shannon class all-weather lifeboat and a D class inshore boat.	20 nm southeast
Llandudno	Shannon class all-weather lifeboat and a D class inshore boat.	17 nm south
Conwy	D class lifeboat.	20 nm south
Beaumaris	B class lifeboat.	22 nm south
Moelfre	Tamar class and D class lifeboats.	18 nm south
Holyhead	Severn class and D class lifeboats.	28 nm southwest
Trearddur	B class and D class lifeboats.	29 nm southwest
Port Erin	B class lifeboat.	31 nm northwest
Port St Mary	Trent class and D class lifeboats.	29 nm northwest
Douglas	Mersey class lifeboat.	25 nm northwest
Barrow	Tamar class and D class lifeboats.	31 nm northeast
Morecambe	D class and Hover class lifeboats.	40 nm northeast
Fleetwood	Shannon and D class lifeboats.	31 nm northeast

Other assets

1.5.4.4 All vessels have an obligation under the SOLAS convention to render assistance to persons or vessels in distress, including CTVs or other project craft.

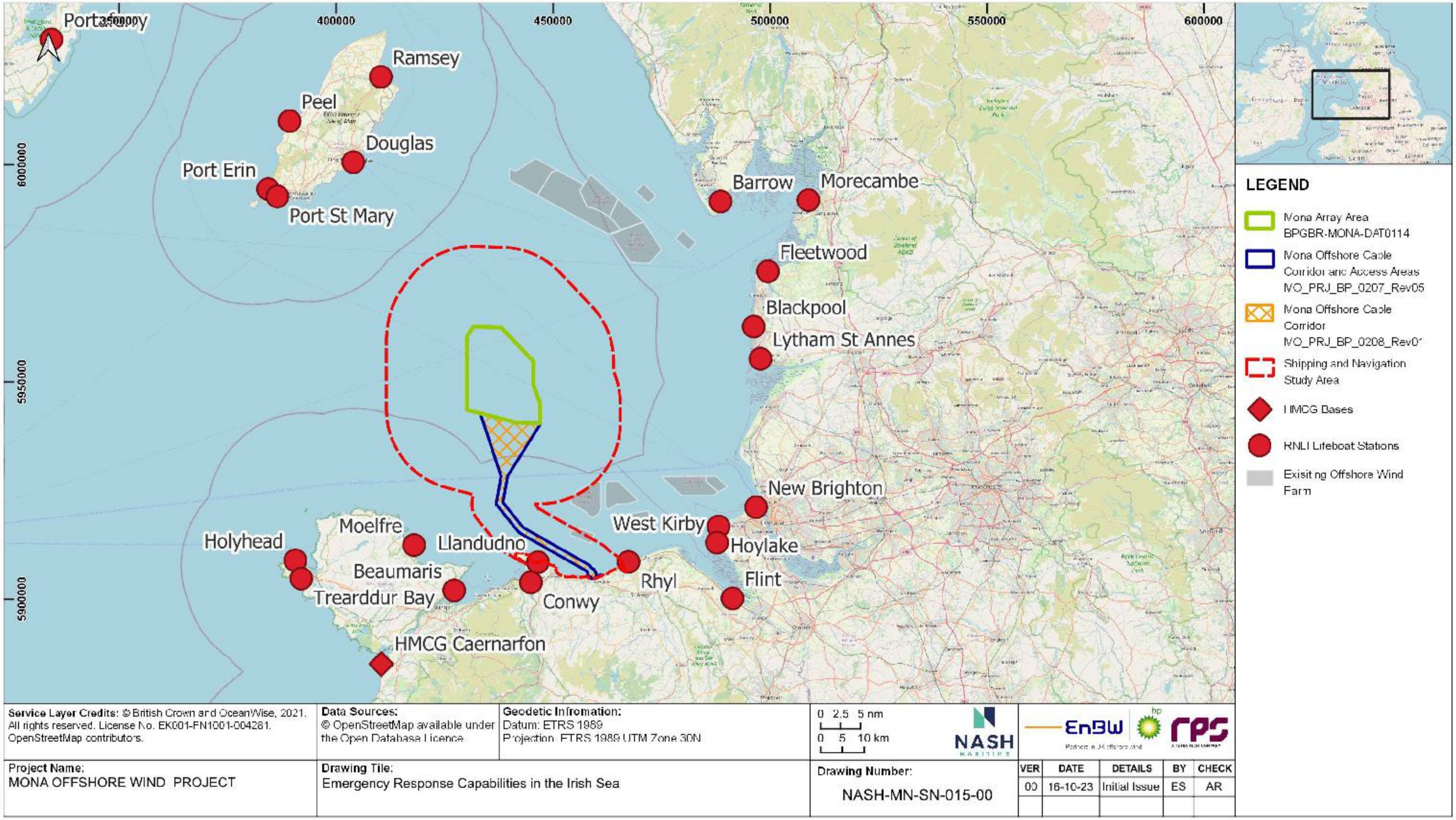


Figure 1.9: Emergency response capabilities in the Irish Sea.

1.6 Description of existing maritime activities

1.6.1 Introduction and data sources

1.6.1.1 A description of existing marine activities in the shipping and navigation study area is presented based on the data collected as listed in section 1.3.5. The following section includes:

- Description of COVID effects
- Details of the vessel traffic surveys
- Analysis of vessel traffic by:
  - Traffic types
  - Determination of vessel routes
  - During adverse weather
  - Non-transit activity
- Analysis of historical maritime incidents.

Effects of Covid-19

1.6.1.2 Since early 2020, the COVID-19 pandemic has substantially impacted recreational and commercial vessel movements both globally and locally. It is therefore possible that data collected between 2020 and 2022 may be influenced by the pandemic although vessel traffic is expected to have largely returned to pre-pandemic levels. As such, where appropriate, datasets have been used that precede the pandemic (including AIS data for 2019 for the whole Irish Sea. In addition, following the PEIR, a 2022 AIS dataset has been obtained to provide greater recency for the analysis.

1.6.2 Vessel traffic survey

1.6.2.1 As per MGN654 (MCA, 2021a), two 14-day vessel based traffic surveys were conducted at the Mona Array Area (see Figure 1.10). To account for seasonality, a winter (December 2021) and summer (June to July 2022) survey was undertaken. To ensure that maximum coverage of all vessel transits through the shipping and navigation study area, information was collected from the following sources:

- Commercial vessel traffic that are required to carry AIS under SOLAS
- Recreational and fishing captured through AIS for those vessels that choose to do so and through radar for those that do not
- Visual observations to identify non-AIS vessel types.

1.6.2.2 A summary of each of the two surveys is shown in Table 1.17.

1.6.2.3 MGN654 specifies that vessel traffic surveys should be undertaken within two years of Application (MCA, 2021a). As the December 2021 survey was outside this two year window, an additional 14-day top-up survey as per MGN654 4.6b was undertaken to extend the data validity for a further 12 month period. This survey is reported in Appendix D to benchmark the NRA results with the top-up survey.

Table 1.17: Summary of vessel traffic surveys.

Attributes	Winter	Summer
Vessel	Karelle (28 m Fishing Vessel) 	Morning Star (23 m Fishing Vessel) 
Dates	09:00 05 December 2021 to 09:00 19 December 2021	10:00 30 June 2022 to 10:00 14 July 2022
Downtime	None	None
Survey Area	Array Area + 10nm	Array Area + 10nm
Total Vessels Recorded (Array Area + 10nm)	857 (61.2/day)	771 (55.1/day)
Total Vessels Recorded (Array Area)	188 (13.4/day)	175 (12.5/day)
Cargo	**Array + 10nm**: 182 (13/day) **Array**: 31 (2.2/day)	**Array + 10nm**: 124 (8.9/day) **Array**: 29 (2.1/day)
Fishing	**Array + 10nm**: 124 (8.9/day) **Array**: 27 (1.9/day)	**Array + 10nm**: 18 (1.3/day) **Array**: 6 (0.4/day)
Passenger	**Array + 10nm**: 268 (19.1/day) **Array**: 81 (5.8/day)	**Array + 10nm**: 349 (24.9/day) **Array**: 82 (5.9/day)
Recreational	None	**Array + 10nm**: 10 (0.7/day) **Array**: 5 (0.4/day)
Tanker	**Array + 10nm**: 120 (8.6/day) **Array**: 19 (1.4/day)	**Array + 10nm**: 98 (7/day) **Array**: 19 (1.4/day)
Tug and Service	**Array + 10nm**: 134 (9.6/day) **Array**: 30 (2.1/day)	**Array + 10nm**: 160 (11.4/day) **Array**: 33 (2.4/day)

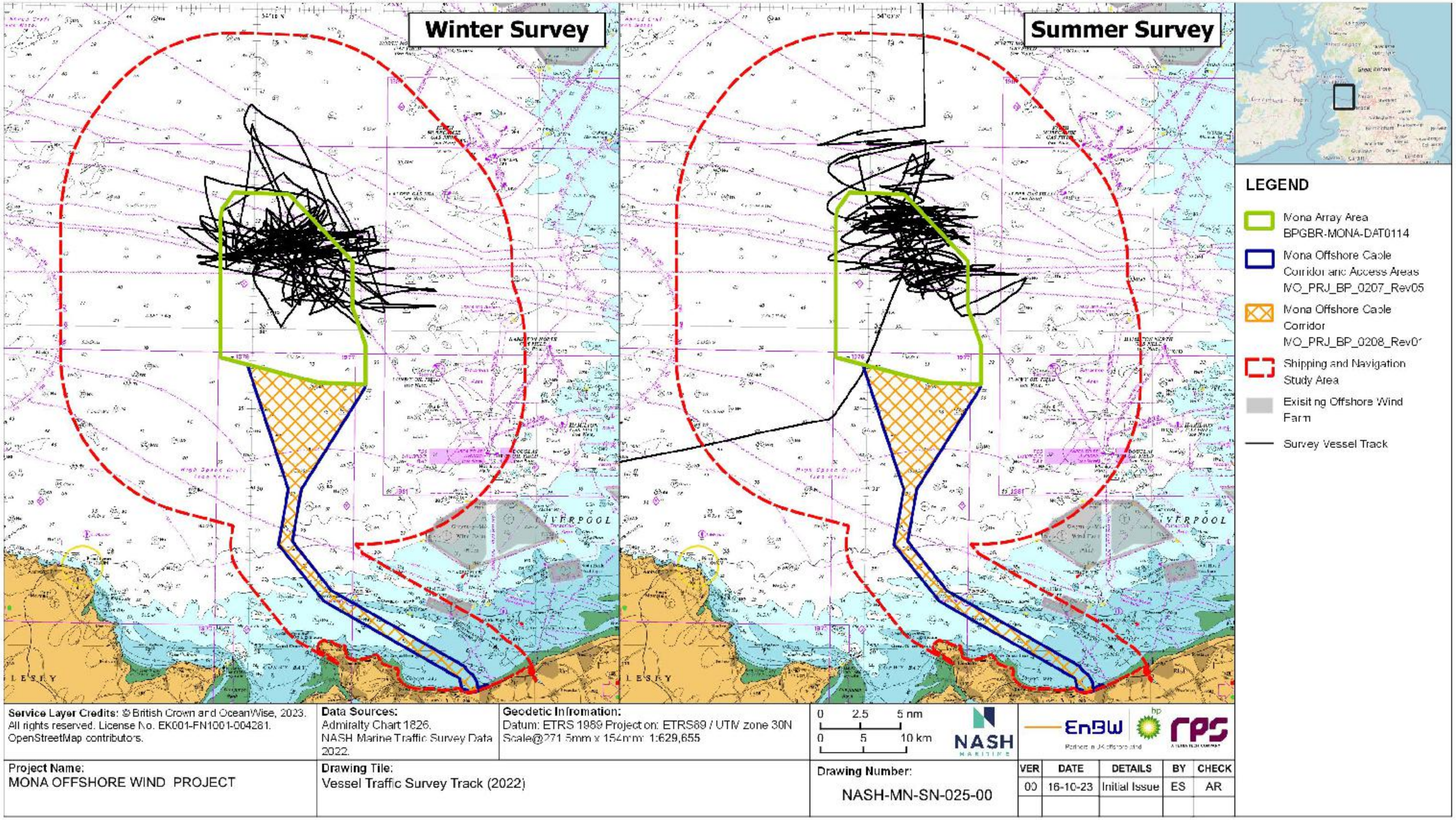


Figure 1.10: Vessel traffic survey track (source: vessel traffic surveys).

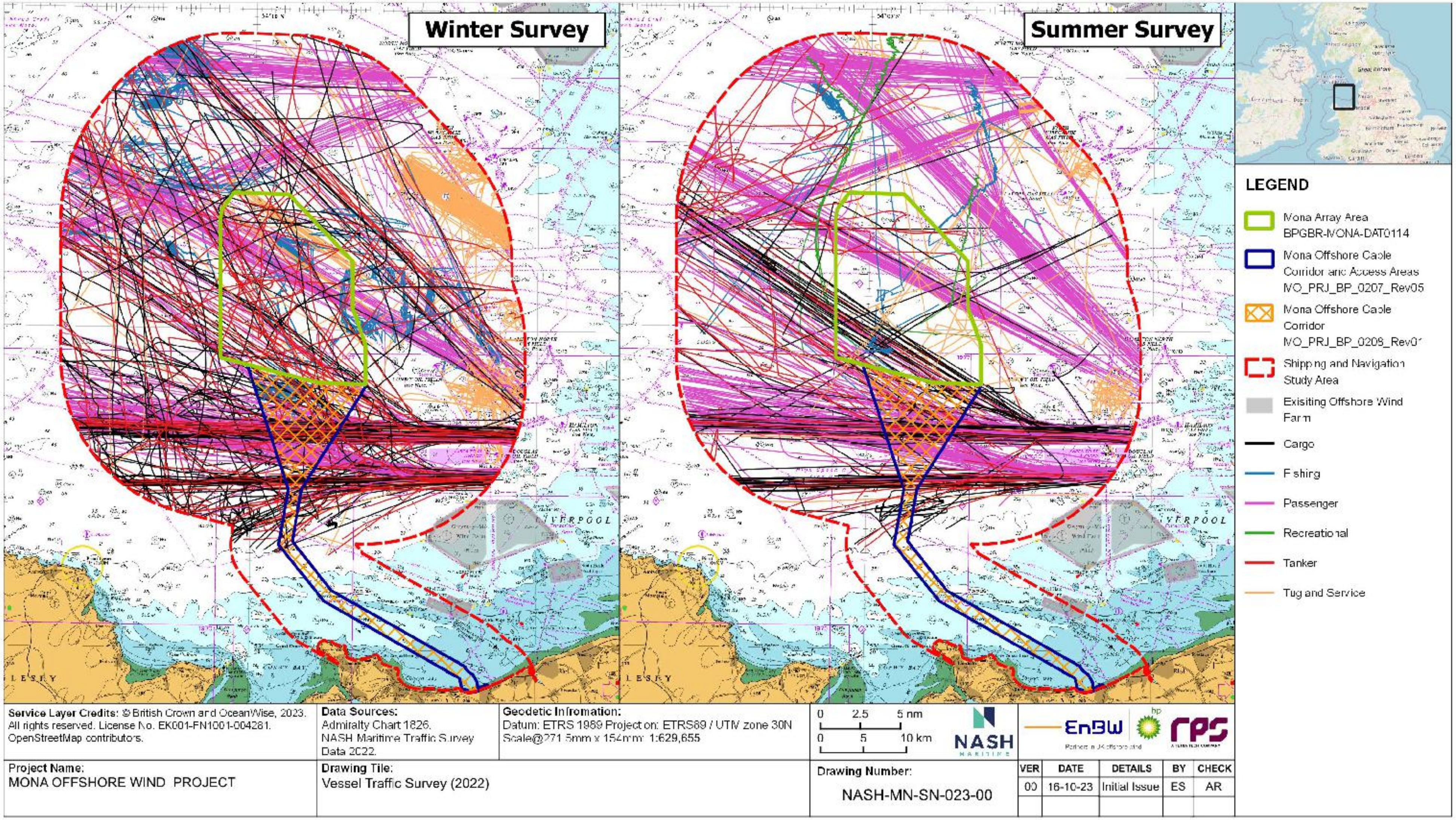


Figure 1.11: Vessel traffic survey (source: vessel traffic surveys).

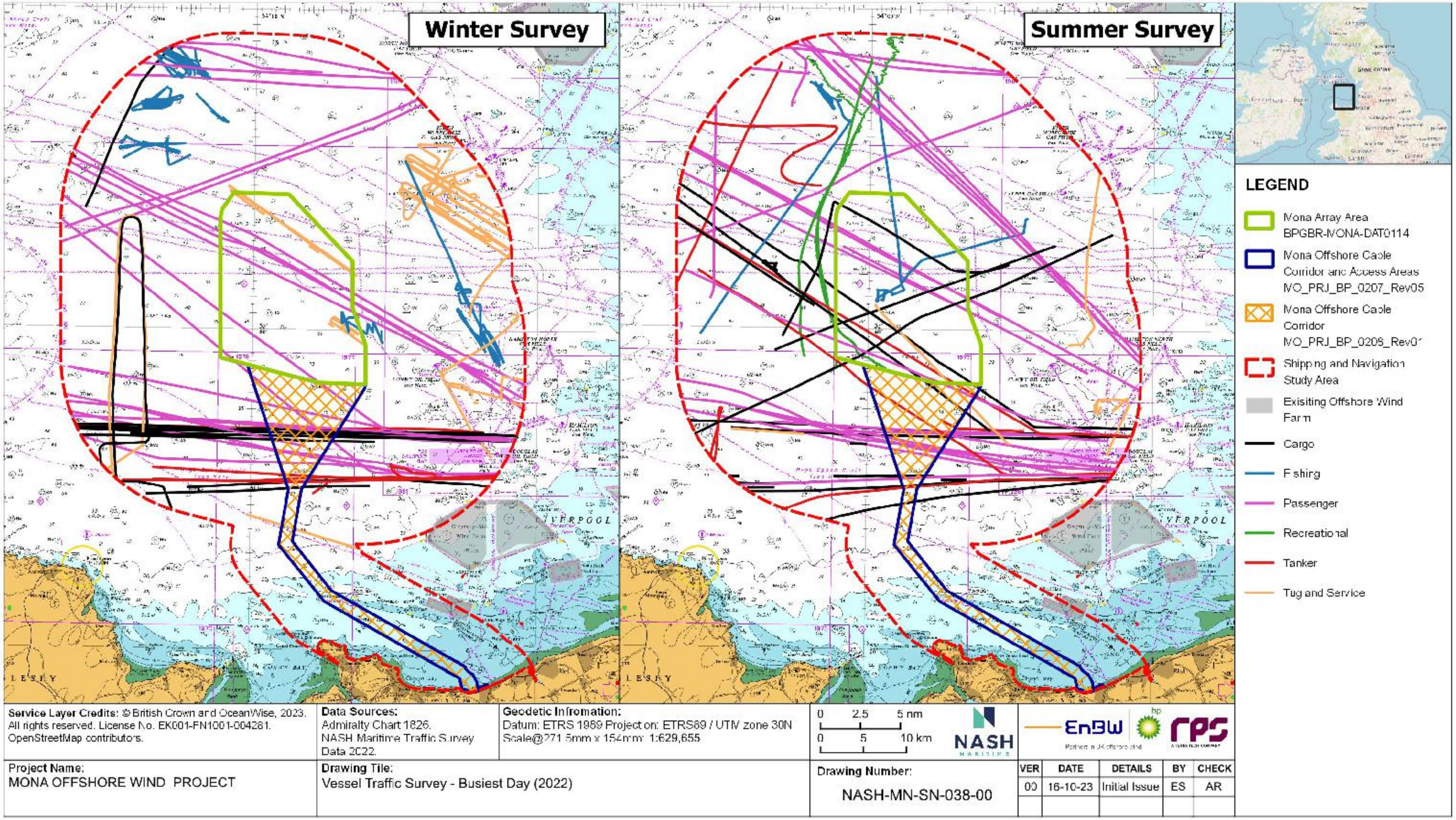


Figure 1.12: Vessel traffic survey – busiest day (2022) (source: vessel traffic surveys).

1.6.3 Vessel traffic analysis

Overview

1.6.3.1 Figure 1.13 shows the Mona Array Area in relation to the general shipping routes within the Irish Sea. Annualized vessel traffic density in Figure 1.13, which presents the number of vessel transits through each grid cell, shows that:

- The key vessel traffic route in the shipping and navigation study area is determined by the Liverpool Bay TSS located approximately 5.6 nm southeast of the Mona Array Area
- A vessel traffic route runs from Liverpool Port northwest through the Mona Array Area
- Ferry routes intersecting to the Mona Array Area are the routes between Liverpool-Belfast and Heysham-Dublin. Routes between Liverpool-Dublin and Liverpool-Douglas pass immediately adjacent to the Mona Array Area.

1.6.3.2 Figure 1.14 shows all vessel tracks by vessel draught. Vessels of draughts over 11 m navigate within the shipping and navigation study area and largely navigate within the vessel traffic routes determined by Liverpool Bay TSS and transit south of the Mona Array Area. Vessel traffic within the Mona Array Area largely comprises of vessel with a draught under 11 m, with some larger draught vessels crossing northwest through the south part of the Mona Array Area.

1.6.3.3 Figure 1.15 shows all vessel tracks by vessel length. Vessels up to 350 m navigate within the shipping and navigation study area. Vessels over 250 m are largely limited to the vessel traffic route determined by the Liverpool Bay TSS and transiting through the southwest portion of the Mona Array Area towards the south end of the Isle of Man and Belfast. There are distinct vessel traffic routes of vessels between 100 m and 200 m in length, due to the major ferry routes from Liverpool to Belfast. The largest vessels recorded in the shipping and navigation study area were the 349 m cargo vessel APL Gwangyang, the 326 m cruise ship Norwegian Getaway, and the 325 m cargo vessel, MSC Charleston. All of these vessels were bound for Liverpool.

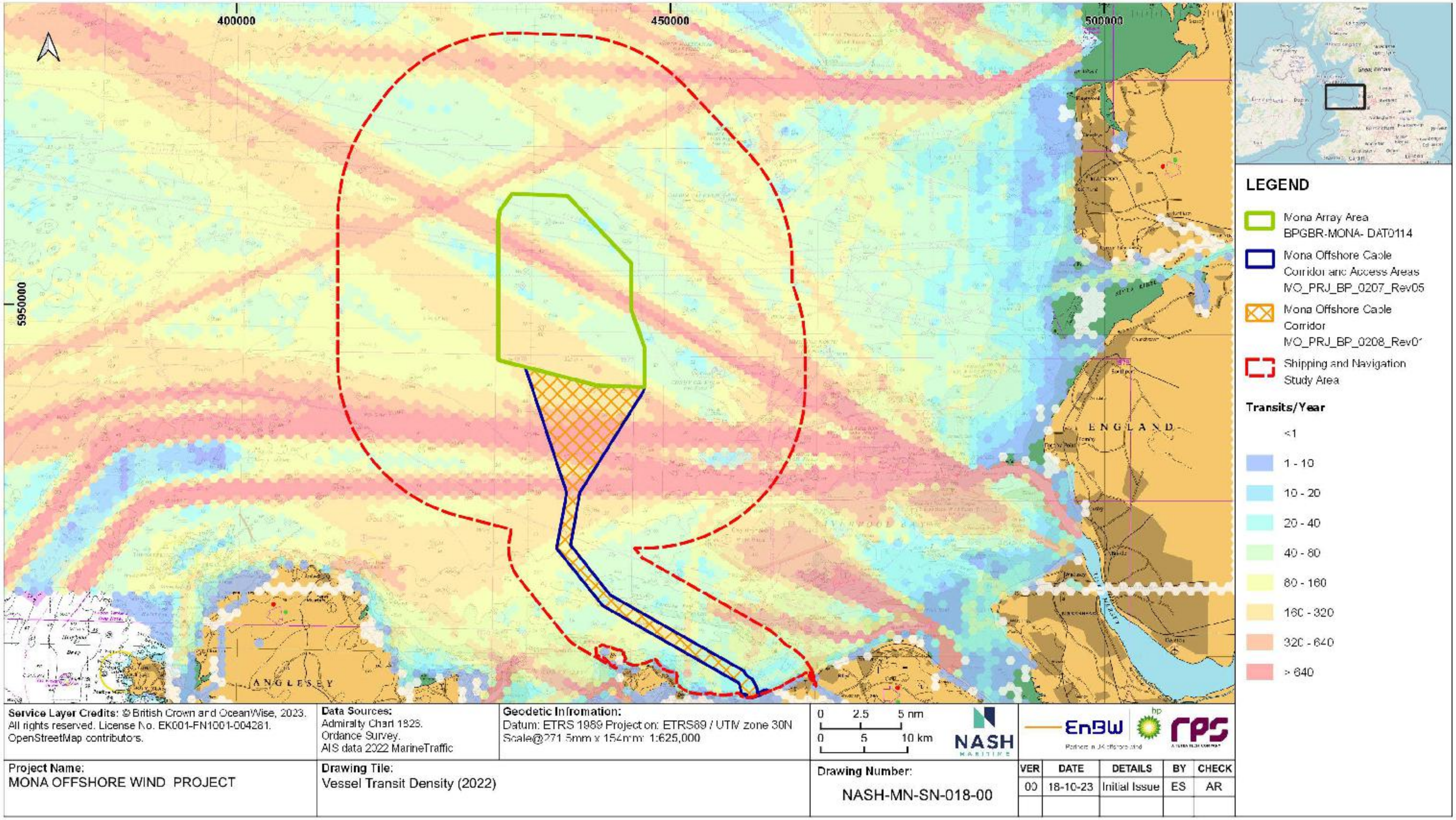


Figure 1.13: Vessel traffic density (source: MarineTraffic 2022).

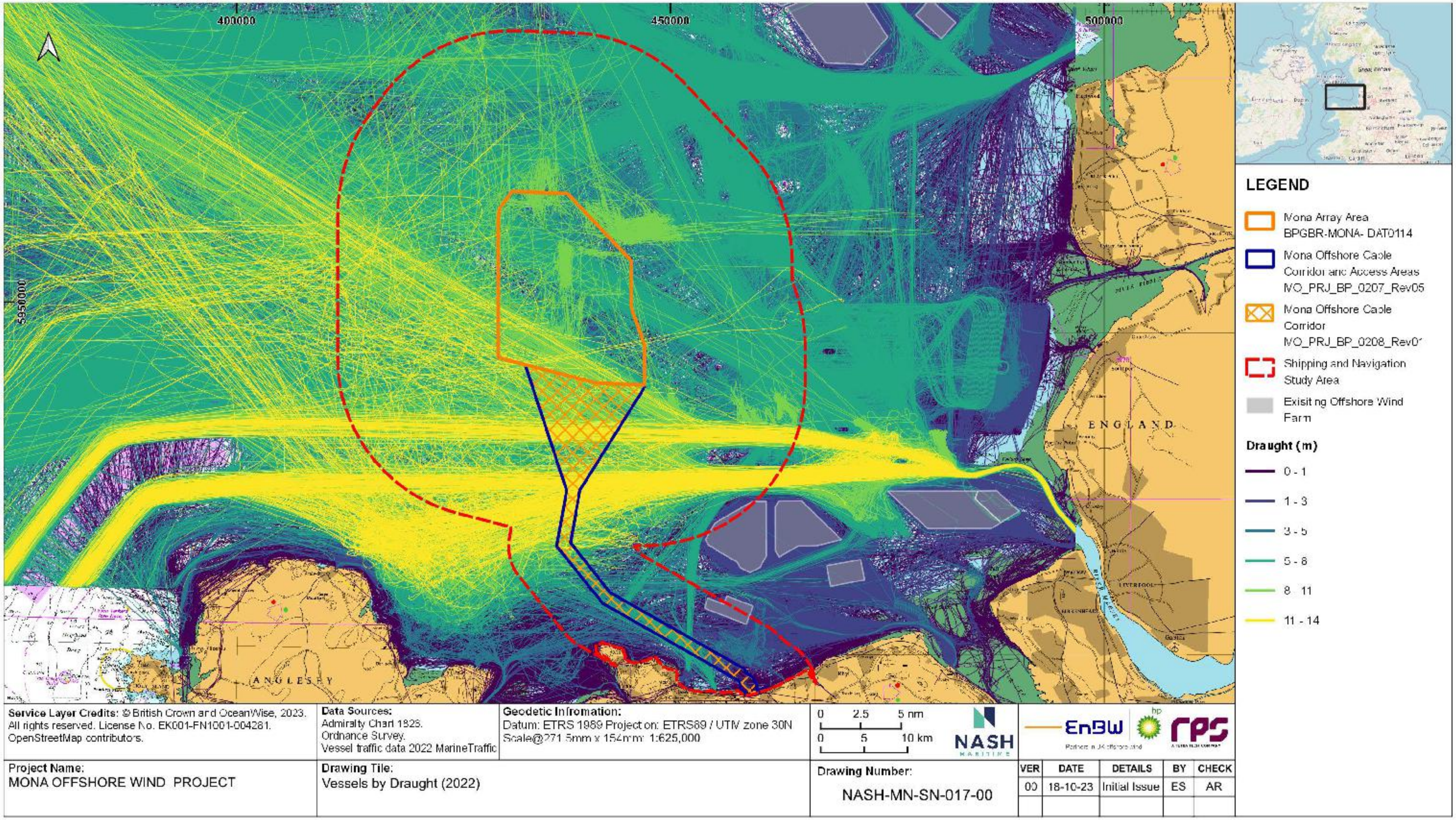
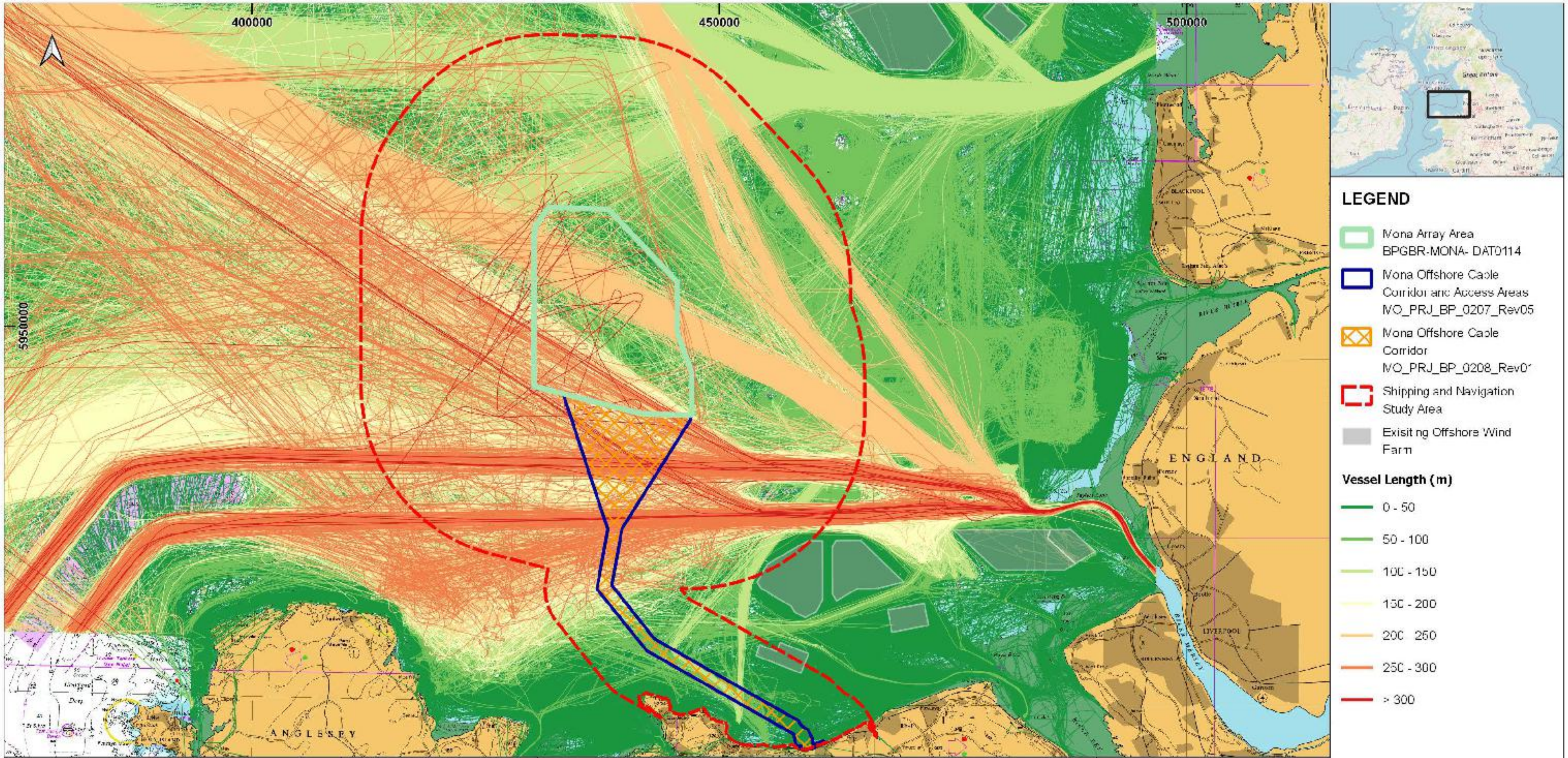


Figure 1.14: Vessels by draught (source: MarineTraffic 2022).



Service Layer Credits: © British Crown and OceanWise, 2023. All rights reserved. License No. EK001-FN1001-004281. OpenStreetMap contributors.	Data Sources: Admiralty Chart 1826. Ordance Survey Vessel traffic data 2022 MarineTraffic.	Geodetic Information: Datum: ETRS 1989 Projection: ETRS89 / UTM zone 30N Scale@271.5mm x 154mm: 1:625,000	0 2.5 5 nm; 0 5 10 km	NASH MARITIME	EnBW bp rps
Project Name: MONA OFFSHORE WIND PROJECT	Drawing Title: Vessels by Length (2022)		Drawing Number: NASH-MN-SN-016-00		

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Figure 1.15: Vessels by length (source: MarineTraffic 2022).

Vessel tracks by type

Cargo/tanker

1.6.3.4 The tracks of cargo/tanker vessels, namely dry cargo vessels and liquid tankers, are shown in Figure 1.16 and Figure 1.17 respectively.

1.6.3.5 More than 600 cargo vessel transits passed through the Mona Array Area in 2022, an average of 1.7 per day. Liverpool is a major UK port and cargo vessels passing through the shipping and navigation study area include 80 m to 90 m general cargo vessels and 300 m container ships. In addition, bulk carriers and vehicle carriers pass through the shipping and navigation study area.

1.6.3.6 Two primary cargo vessel routes are shown in Figure 1.16. Firstly, the inward and outward bound route to Liverpool Port via the Liverpool Bay TSS to the south of the Mona Array Area accounts for 3,000 movements per year, an average of 8.2 per day. Secondly, a route from Liverpool Port which runs northwest through the Mona Array Area and passes to the southwest of the Isle of Man consists of 1,750 movements per year, an average of 4.8 per day. Other less frequently transited cargo vessel routes are evident between Heysham, Douglas, Liverpool and the Irish Sea.

1.6.3.7 Tanker vessel tracks are shown in in Figure 1.17 and are largely consistent with the shipping routes identified for cargo ships, albeit with less frequency with just over 300 movements in 2022 through the Mona Array Area, an average of 0.82 per day. However, it is notable that relatively few tankers transit into Heysham and Morecambe Bay, with much greater concentration of routes into Liverpool. A variety of tanker types are recorded including crude oil, Liquified Natural/Petroleum Gas, chemical and asphalt/bitumen. The 77 m Keewhit accounts for the majority of tanker movements in the east portion of the shipping and navigation study area, from Liverpool to the north of the Isle of Man.

1.6.3.8 Detailed analysis of cargo/tanker shipping routes is contained in section 1.6.3. In addition, several commercial anchorages are evident along the North Welsh coast (see section 1.6.3).

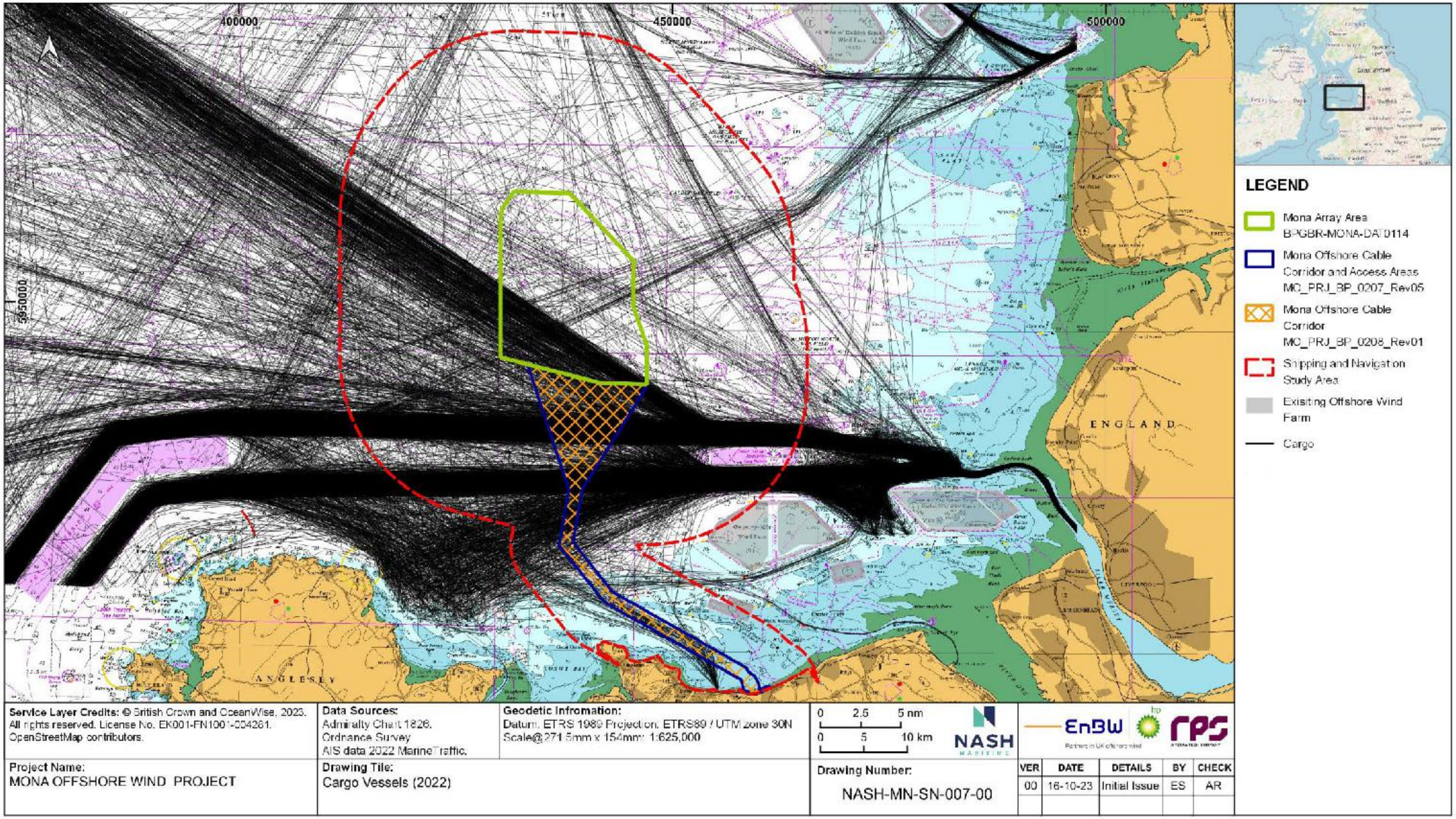

Figure 1.16: Cargo vessels (source: MarineTraffic 2022).

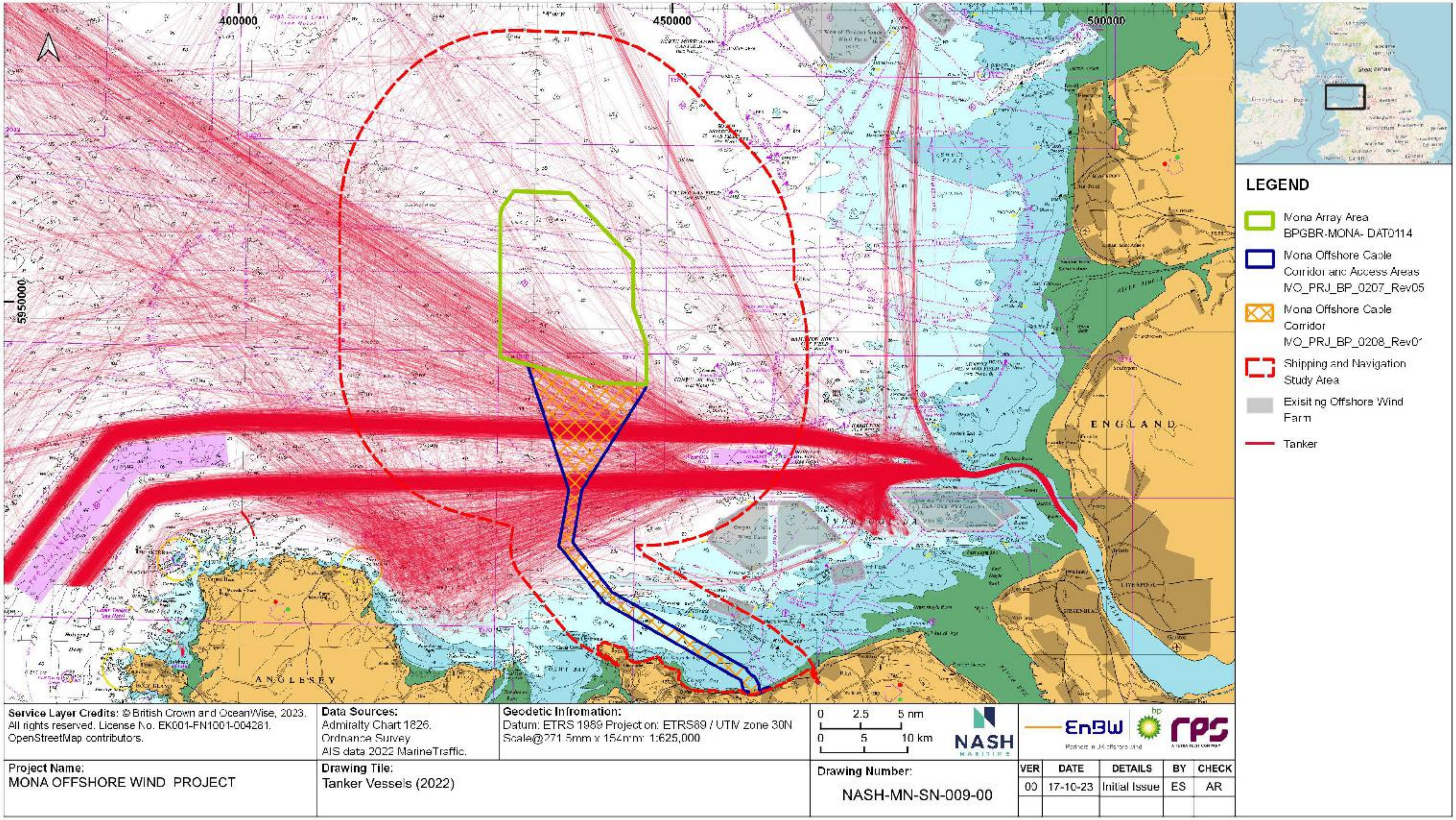

Figure 1.17: Tanker vessels (source: MarineTraffic 2022).

Ferries

1.6.3.9 The tracks of ferries are shown in Figure 1.18, including passenger and freight services. 1,570 ferry transits passed through the Mona Array Area in 2022, a rate of 4.3 per day. Four principal operators are identified in the east Irish Sea. The IoMSPC operate between Douglas, Liverpool and Heysham. Seatruck operate between Heysham, Liverpool, Warrenpoint and Dublin. Stena operate between Liverpool, Heysham and Belfast. Finally, P&O operate between Liverpool and Dublin.

1.6.3.10 Detailed analysis of these routes is contained within section 1.6.3.

Cruise Ships

1.6.3.11 The tracks of cruise ships are shown in Figure 1.19, with 52 transits recorded through the Mona Array Area during 2022, approximately once per week. The majority of these occurred between May and September. Cruise vessel activity in the area is centred around the Port of Liverpool and Douglas. Liverpool has a cruise terminal which has a regular cruise itinerary and provides turnaround services. Cruise vessels at Douglas regularly anchor in Douglas Bay using tenders to take passengers ashore.

1.6.3.12 Cruise ships up to 345 m in length (*Queen Mary 2*) have called at Liverpool and proceeded to navigate through the Mona Array Area. However, the largest cruise ship recorded during 2022 was the 319 m long *Celebrity Silhouette*, and most were between 200 m and 300 m in length.

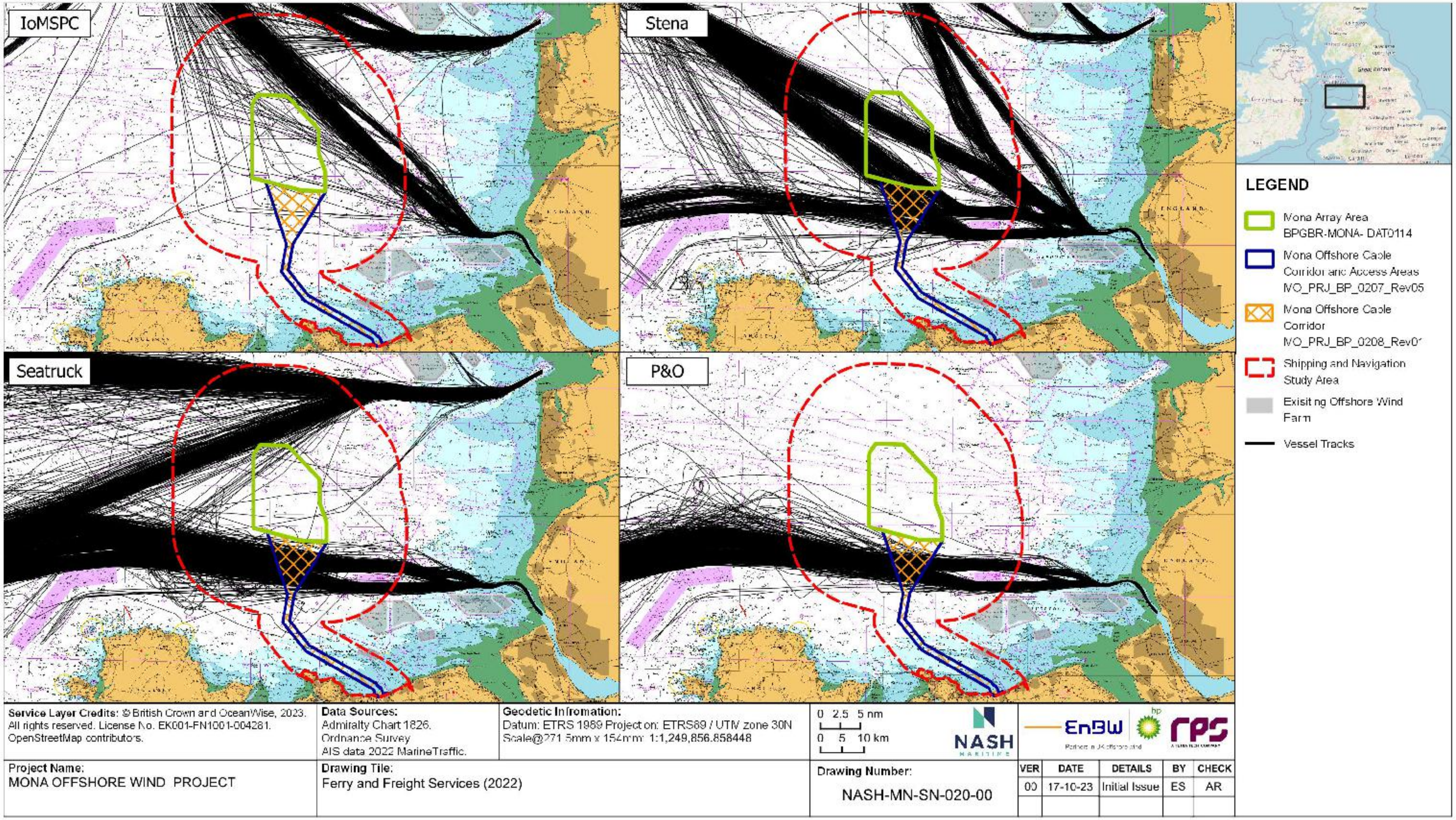

Figure 1.18: Ferry and freight services (source: MarineTraffic 2022).

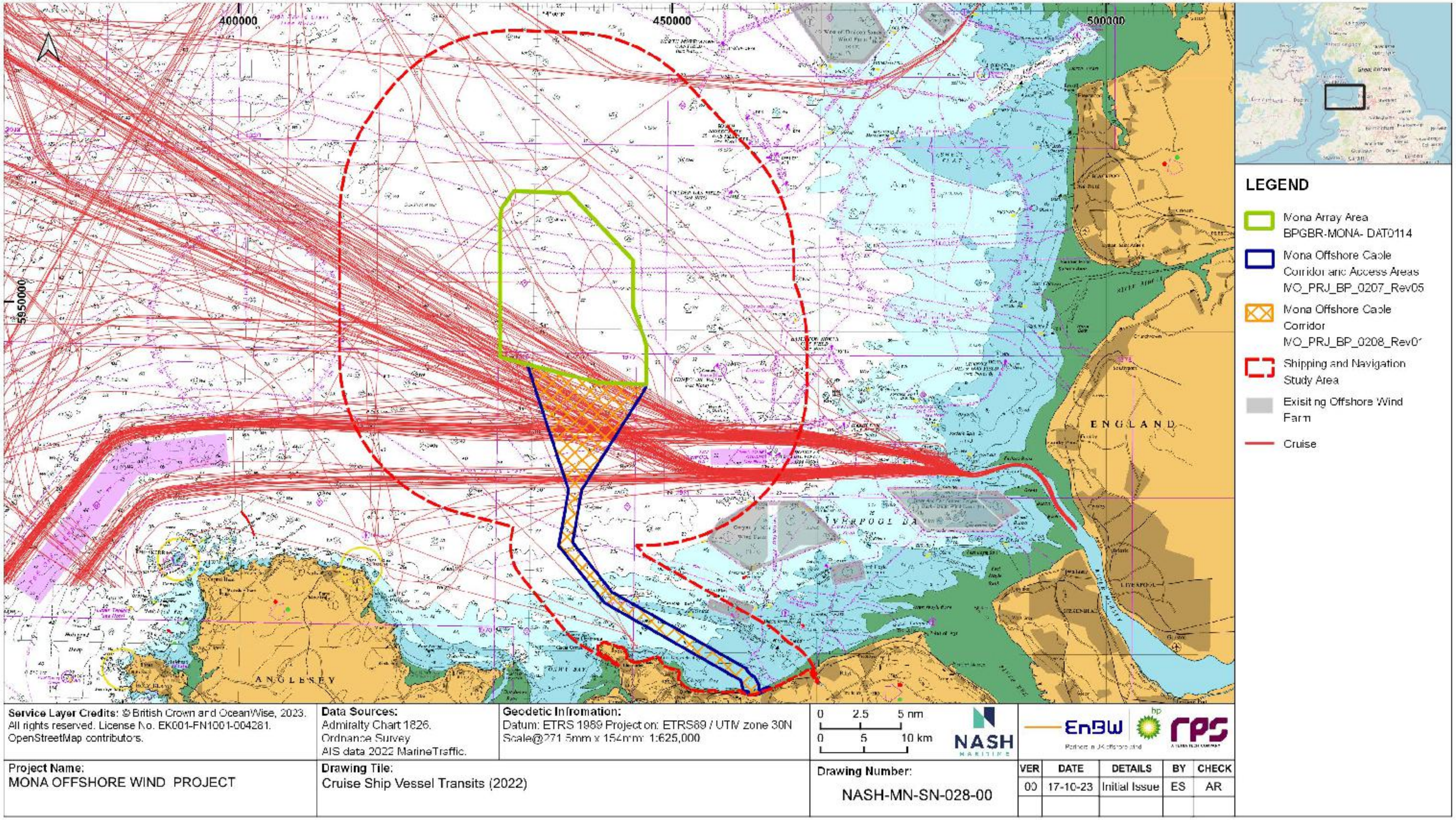

Figure 1.19: Cruise ship vessel transits (source: MarineTraffic 2022).

Recreational activity

1.6.3.13 The intensity of recreational activity within the study area is shown in Figure 1.20. The vessel traffic surveys, historical AIS data for 2022 and the RYA Coastal Atlas, were combined to identify areas of increased recreational activity. The Mona Array Area is characterised by relatively sparse recreational activity with most recreational vessels transiting along the coast, particularly along the entrance to Liverpool, and around Holyhead, Douglas, and Rhyl. In shore cruising routes are clear of the Mona Array Area. Low to moderate intensity is also evident within the study area, notably south of the windfarm site towards Conwy Bay.

1.6.3.14 Offshore cruising routes are evident between Liverpool, Douglas, Menai Straights, and Morecambe Bay, running adjacent to the Mona Array Area (Figure 1.21). Five major cruising routes are evident within the AIS data: (1) Conwy to Douglas, (2) Conwy to Morecambe, (3) Liverpool to Douglas, (4) Morecombe to Douglas, and (5) Whitechapel to Anglesey. Relatively few yachts were recorded during the 2021/2022 vessel traffic surveys, with less than one per day during the summer survey and none at all recorded during the winter survey. This suggests significant seasonality in recreational movements through the shipping and navigation study area.

1.6.3.15 This Isle of Man Midnight Race, organised by the Liverpool Yacht Club (LYC), is the only notable yacht race that crosses the Mona Array Area with approximately 10 vessels participating each year (there were 40 vessels in 2019 due to 100th anniversary of race). Nevertheless, 90% of recreational vessels detected along this route did not sail through the Mona Array Area. Similarly, 94% of vessels on the route between Douglas and Conwy, which runs adjacent to the southwest boundary of the Mona Array Area, pass clear of it. All vessels detected sailing along the other identified routes (i.e., Morecambe to Douglas, Conwy to Douglas, and Whitechapel to Anglesey) do not cross the Mona Array Area.

1.6.3.16 There is a higher intensity of recreational activity near to cable landfall.

1.6.3.17 Existing offshore windfarms can also serve as a reference for understanding how recreational crafts respond when their routes intersect with proposed offshore windfarms. For example, the route between Morecambe and Douglas is intersected by two offshore windfarms (Walney and West of Duddon Sands). About 79% of cruising vessels sailing along this route opted for a longer passage to avoid crossing the existing windfarms. The majority of crafts chose a southerly route around the wind farms, extending the shortest possible passage of 46 nm by an additional 4 nm, which can add up to one hour of passage time (depending on the vessel type and weather conditions). However, during consultation with the RYA, it was noted that recent evidence from AIS data suggests that yachts avoid transiting through an offshore wind farm less than previously thought based on responses to surveys.

1.6.3.18 A challenge in analysing recreational vessel patterns using AIS data is that not all vessels, particularly the smaller crafts, transmit AIS signals. A 2014 RYA survey found that 37% of recreational vessels around the UK transmit AIS signals. Previous RYA studies have concluded that between 10 to 30% of recreational crafts are transmitting AIS signals in the UK, though this varies greatly depending on the specific location. For comparison, 63% of vessels participating in the LYC Isle of Man Midnight Race in 2022 were transmitting AIS signals (81% in 2019).

Fishing activity

1.6.3.19 Commercial fishing in the east Irish Sea region has a wide spatial distribution and targets a number of valuable fisheries for demersal, pelagic and shellfish species. Key shellfish species include king scallop, and queen scallop which are targeted by dredges; and whelk, lobster and crab, which are targeted by pots. The most important demersal target species include bass, sole, thornback ray and plaice, which are typically caught by beam and otter trawlers. Pelagic fish landings from this area are mainly of herring and mackerel, which are predominantly caught by pelagic trawls. Fishing ports in the region with the highest fishing efforts are Amlwch, Conwy, Holyhead and Fleetwood. Fishing vessels are also active from Annan, Douglas, Kilkeel, Kirkudbright, Maryport and Peel. In addition, Belgian trawlers are known to operate throughout the shipping and navigation study area.

1.6.3.20 The tracks of fishing vessels are shown in Figure 1.22, a combination of AIS data with VMS data. There is considerable fishing activity within and near the Mona Array Area, including amongst vessels up to 40 m in length (such as *Z60 Blue Angel)* engaged in mobile and static gear fishing. However, some fishing vessels are engaged in guard vessel duties or other survey works and account for some of the concentrations around O&G installations. During the vessel traffic surveys, between 0.5 and two fishing vessels per day were identified within the Mona Array Area.

1.6.3.21 Analysis of fishing vessel activity in the shipping and navigation study area showed that fishing activity routinely takes place within the existing Irish Sea offshore wind farms, namely Walney Extension and Gwynt y Môr, both of which have significantly smaller spacings between wind turbines compared to the Mona Offshore Wind Project (under 1,000 m compared to 1,400 m).

1.6.3.22 Additional data on fishing activity is contained within the Mona Offshore Wind Project fisheries chapter (Volume 6, Annex 6.1: Commercial fisheries technical report of the Environmental Statement).

Tug and Service

1.6.3.23 The tracks of tug and service vessels are shown in Figure 1.23. These have been subdivided into key categories.

1.6.3.24 CTVs operating between O&M bases and the existing offshore wind farms are mostly clear of the Mona Array Area, except when relocating on less routine transits.

1.6.3.25 O&G associated supply ships and standby safety vessels have a high intensity to the east of the shipping and navigation study area where the platforms are located.

1.6.3.26 The activities of dredgers and pilot vessels are concentrated to the southeast and southwest of the shipping and navigation study area. SAR vessels are dispersed throughout the shipping and navigation study area.

1.6.3.27 Other vessel types, including survey vessels and tugs, are concentrated inshore, with relatively few intersecting the Mona Array Area compared to other vessel types.

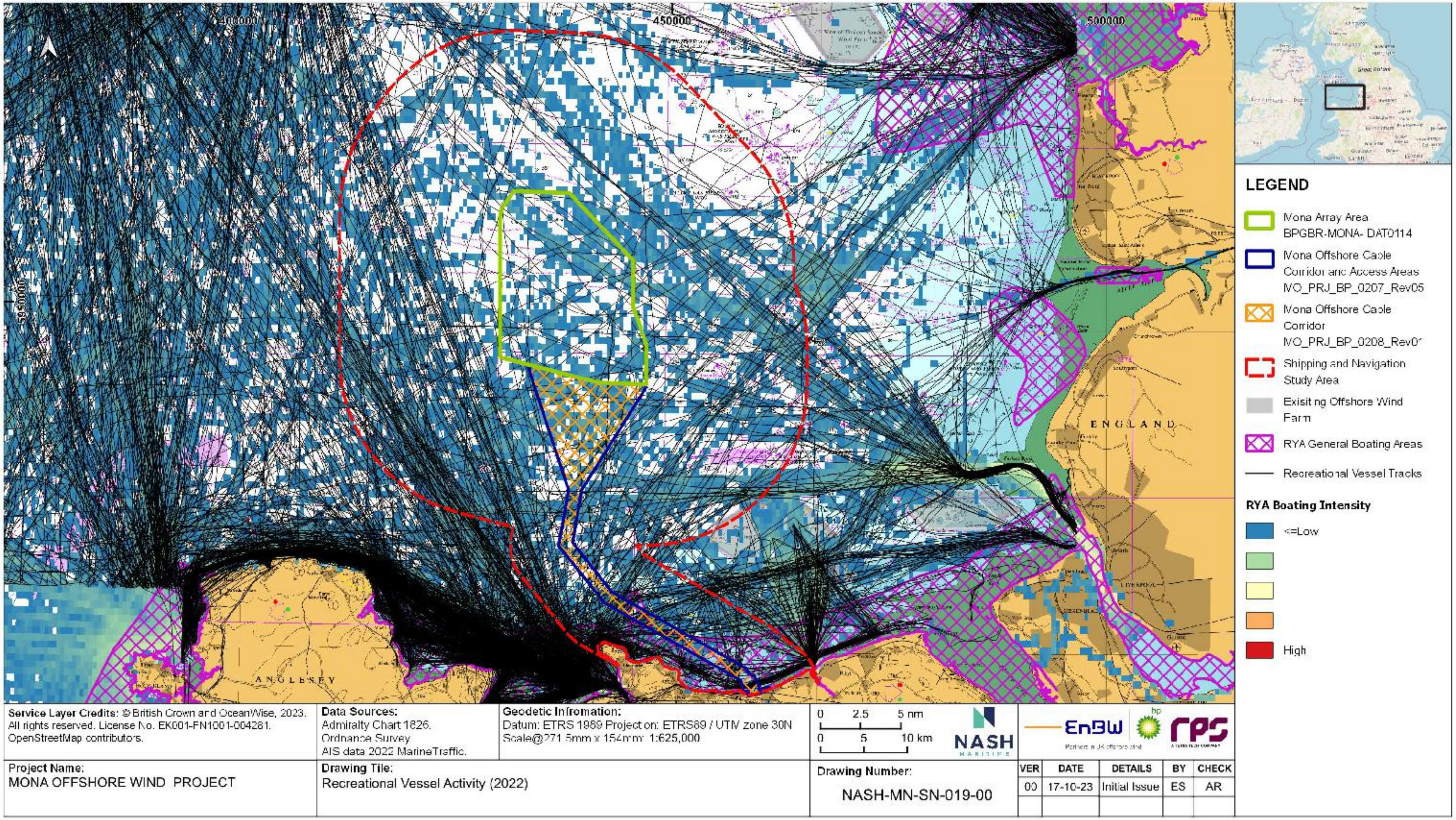

Figure 1.20: Recreational vessel activity (source: MarineTraffic 2022).

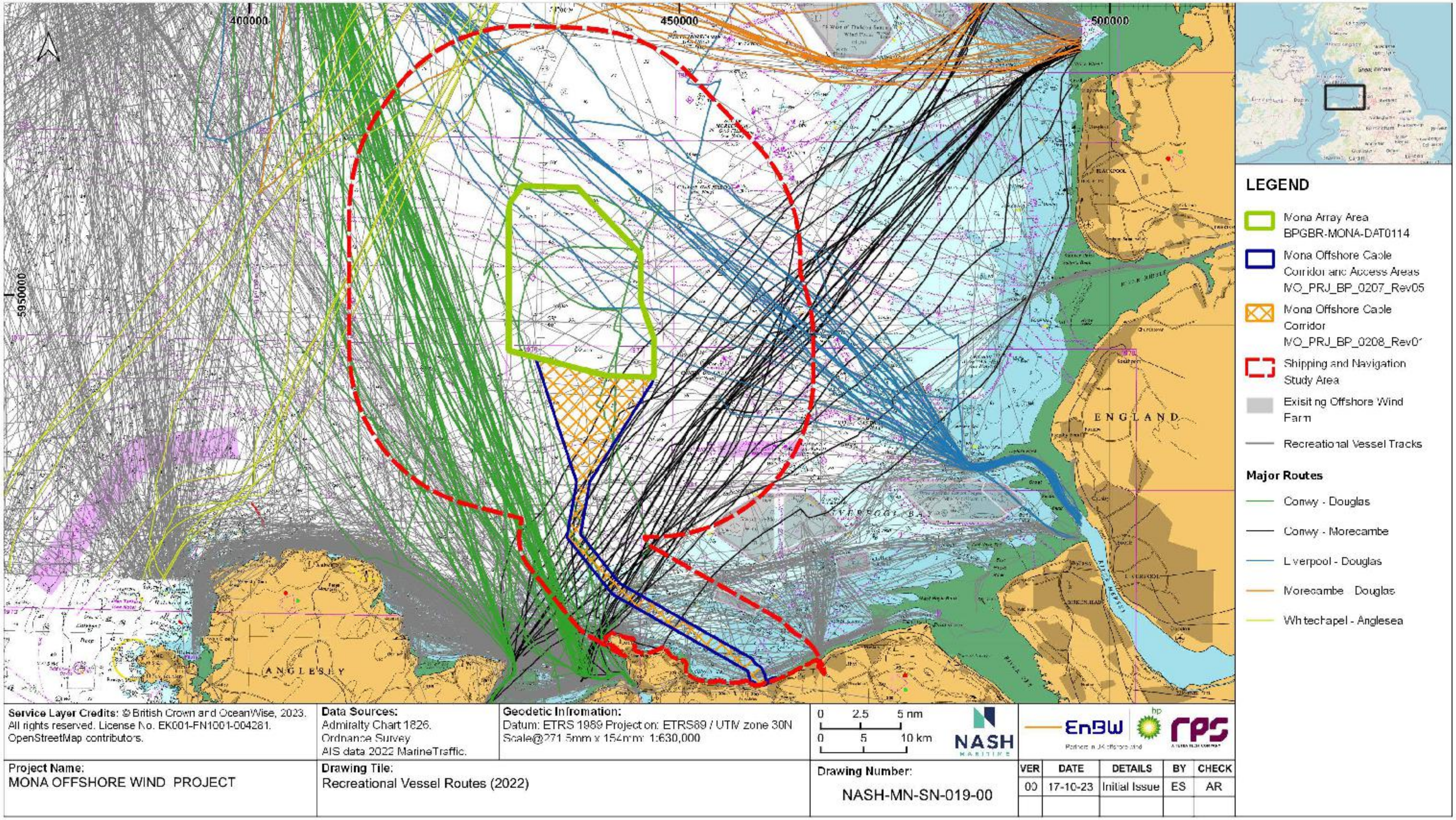

Figure 1.21: Recreational vessel routes (source: MarineTraffic 2022).

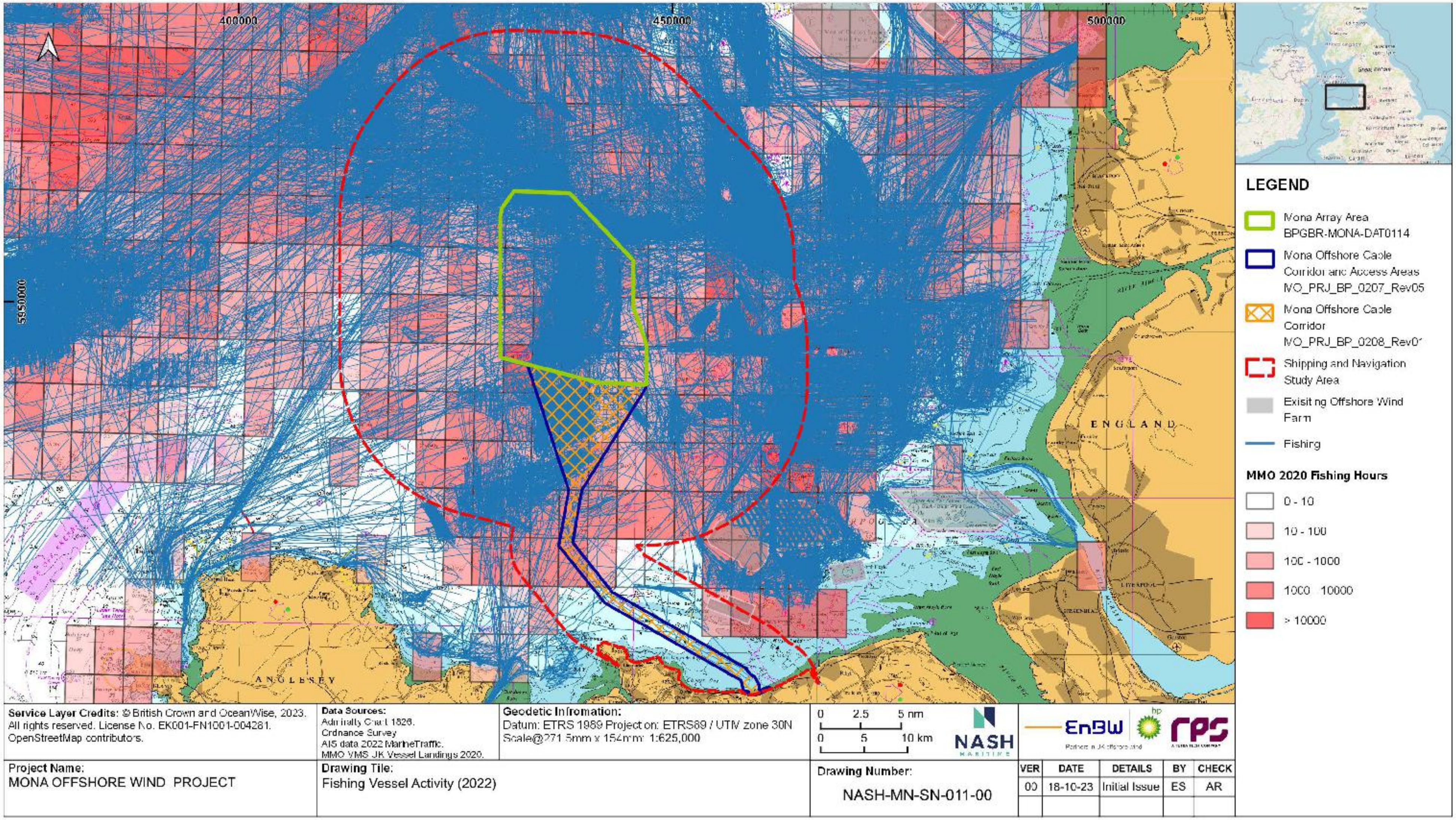

Figure 1.22: Fishing vessel activity (source: MarineTraffic 2022).

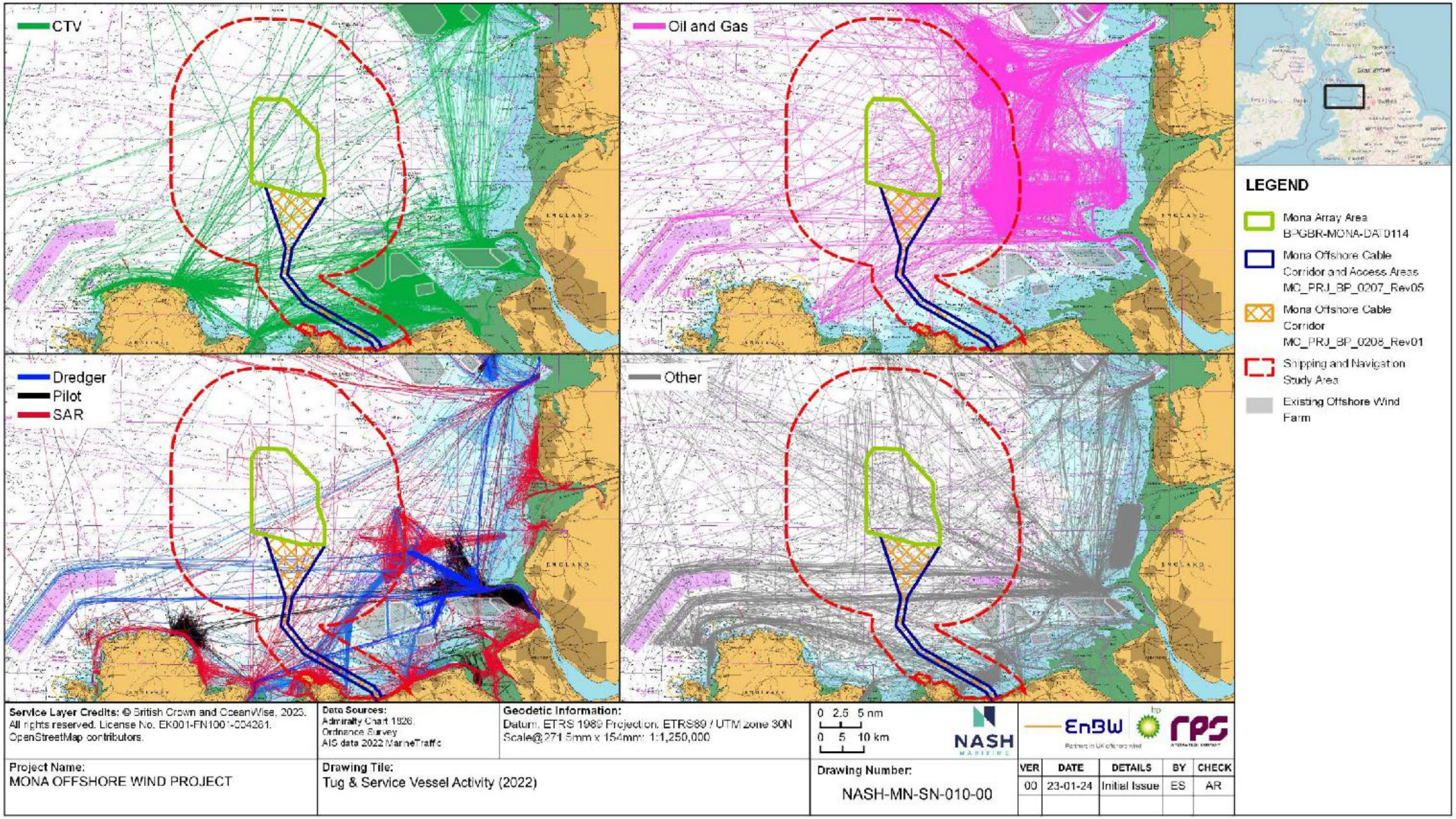

Figure 1.23: Tug and service vessel activity (source: MarineTraffic 2022).

Vessel traffic counts and seasonality

Count by vessel type

1.6.3.28 Figure 1.24 shows the number of vessel transits through both the Mona Array Area and shipping and navigation study area from analysis of 2022 AIS data. 3,166 vessels in total passed through the Mona Array Area during this year, a rate of nine per day. Passenger vessels were responsible for the majority of this activity, representing 50% of the vessel traffic through the Mona Array Area in 2022. This is mainly the regular ferry routes present in the area.

1.6.3.29 940 cargo and tanker vessels passed through the Mona Array Area during 2022, a rate of 2.6 per day.

1.6.3.30 The shipping and navigation study area had a vessel count at 20,487 vessels during 2022, or 56 per day. As within the Mona Array Area, passenger vessels contribute a high proportion of traffic with 37.6% of the total. A greater proportion of cargo and tanker traffic is due to the inclusion of the approaches to Liverpool from the west within the shipping and navigation study area.

1.6.3.31 A noticeable difference between the Mona Array Area and the shipping and navigation study area (other than the evident increase in total count) is that in the shipping and navigation study area, the proportion of total activity attributed to tug and service, is far greater (25% compared to 11%), including the tugs, pilot boats and other craft operating in the approach to Liverpool.

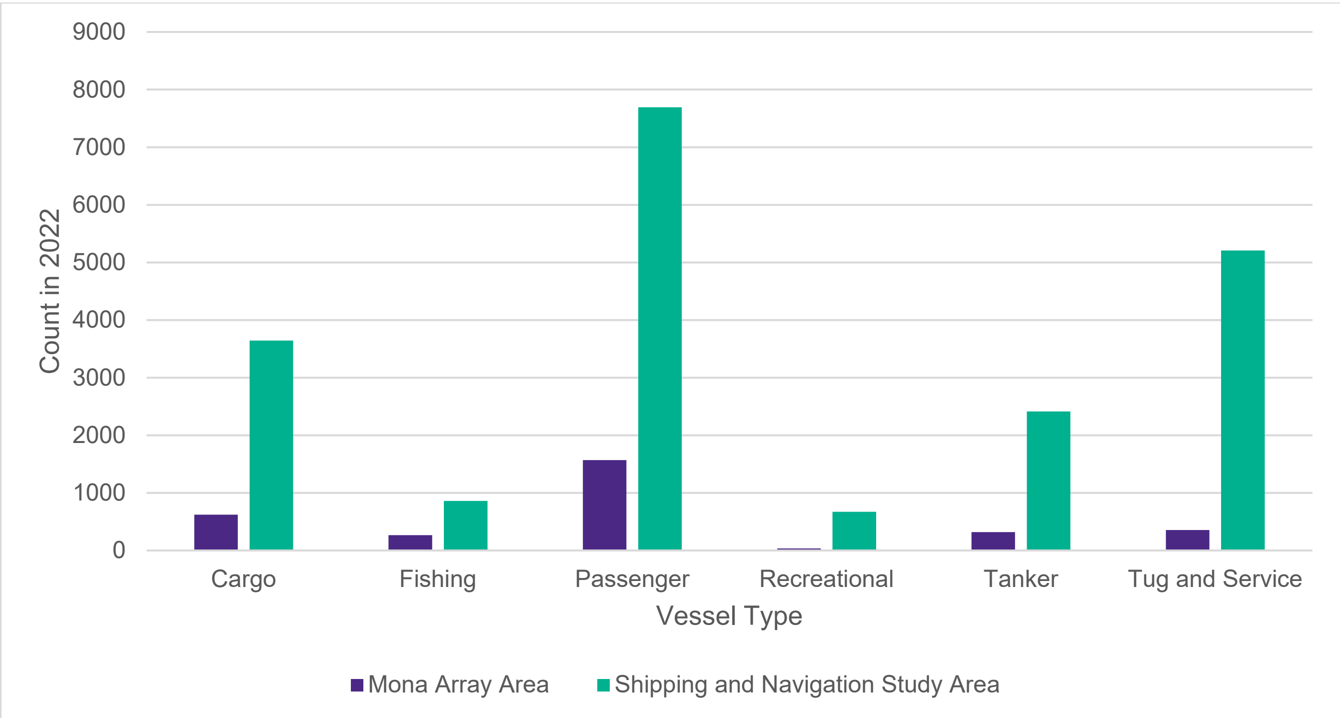

Figure 1.24: Vessel count during 2022 by vessel type for the Mona Array Area and shipping and navigation study area (source: MarineTraffic 2022).

Count by vessel size

1.6.3.32 Figure 1.25 shows that whilst there is a great range of vessel sizes intersecting the Mona Array Area, vessels between 50 m and 200 m account for the majority, but vessels up to 350 m are recorded on occasion.

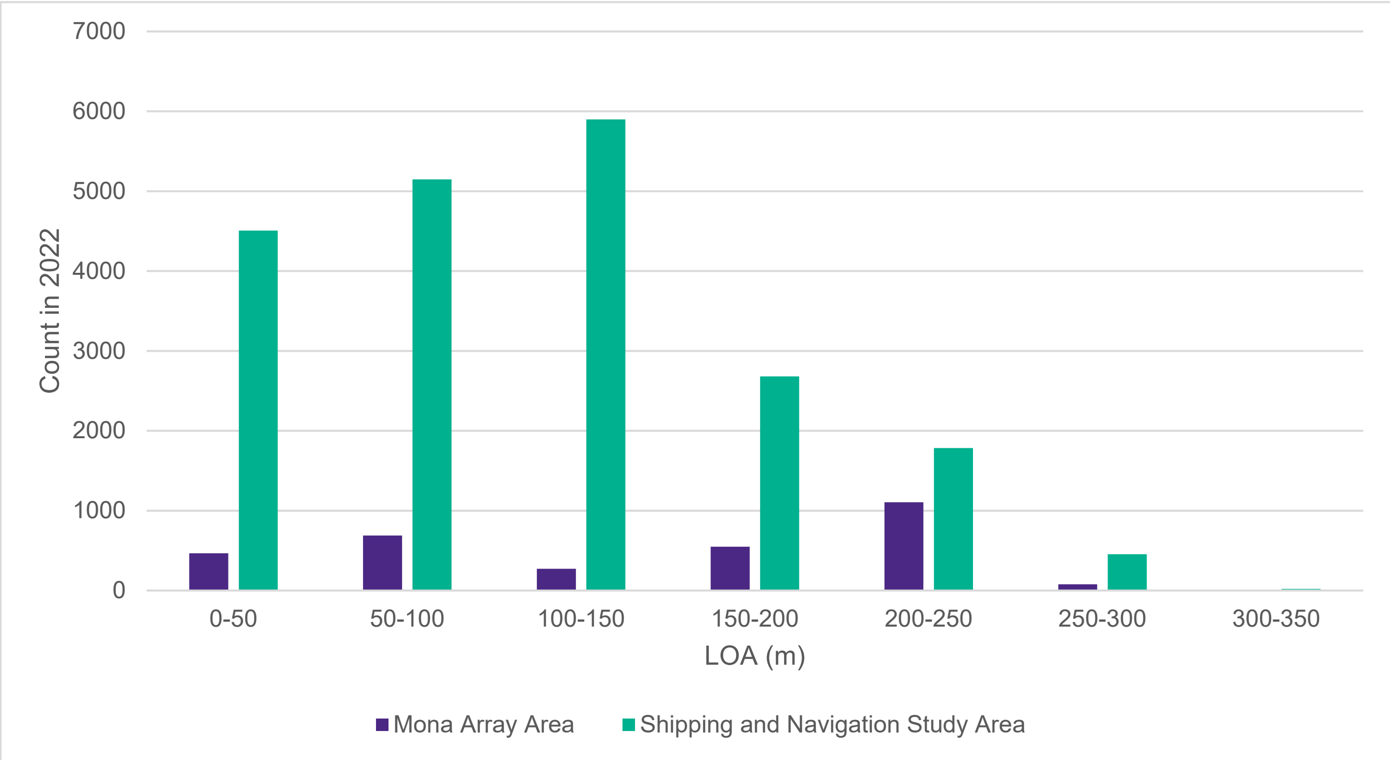

Figure 1.25: Vessel count in 2022 by vessel length over all (LOA) (m) for the Mona Array Area and shipping and navigation study area (Source: MarineTraffic 2022).

Monthly Count

1.6.3.33 Figure 1.26 shows a seasonal trend that peaks over the summer months (May to August) and decreases in the winter months (November to February). This is primarily due to an increase in ferry service operations and recreational activity.

1.6.3.34 Figure 1.26 is determined based on analysis of 2022 AIS data and therefore underrepresents small craft activity, particularly fishing and recreational movements. It is notable that during the winter vessel traffic survey, significantly more fishing vessel activity was recorded to the northwest of the Mona Array Area, of which relatively few had AIS data (see section 1.6.3).

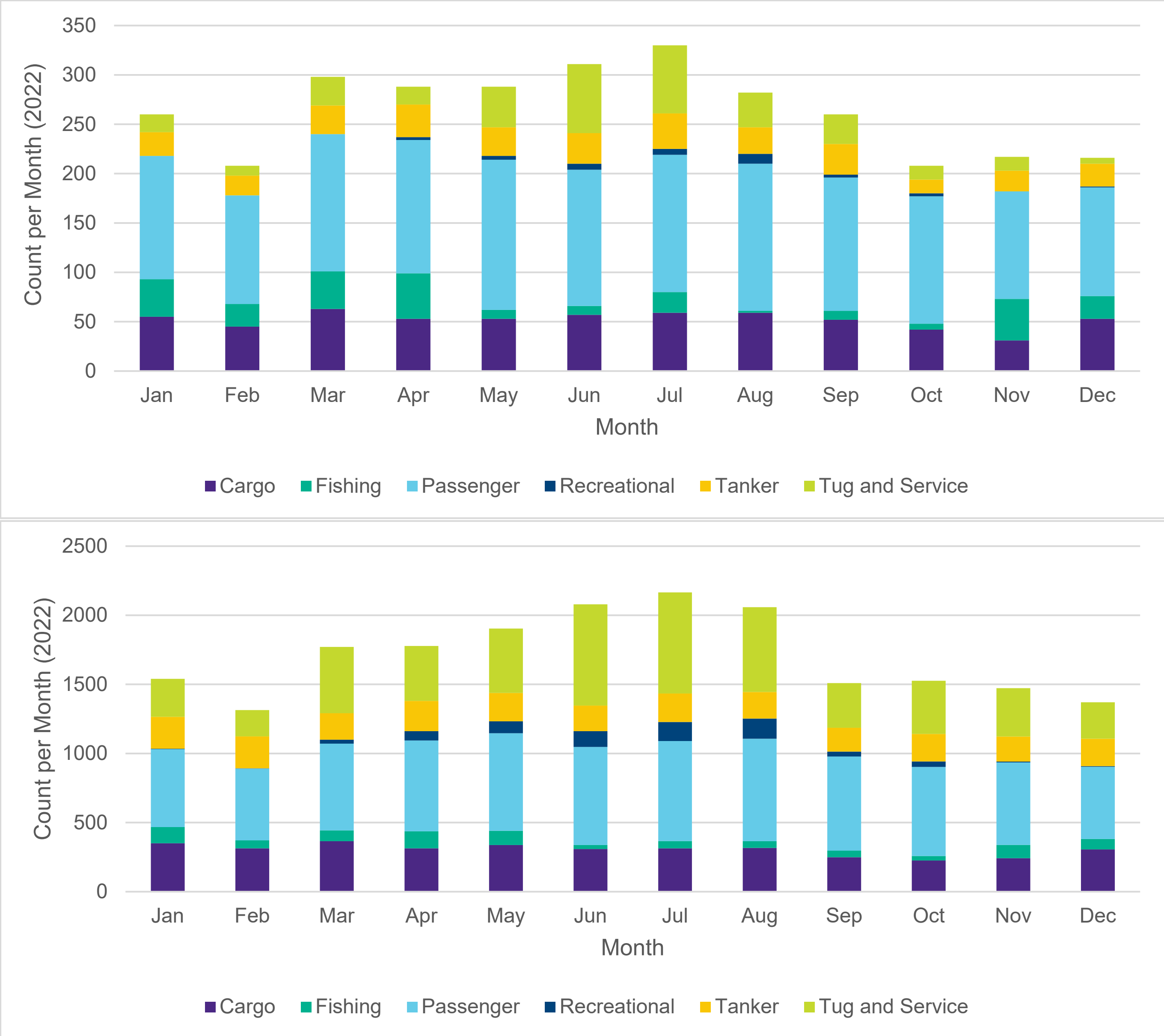

Figure 1.26: Vessel count per month through the Mona Array Area (top) and within 10 nm (bottom) (source: MarineTraffic, 2022).

Count across the Mona Offshore Cable Corridor

1.6.3.35 Figure 1.27 and Figure 1.28 shows that the majority of vessels crossing the Mona Offshore Cable Corridor are cargo, tanker and passenger vessels of between 75 m and 200 m. This is largely concentrated where the route crosses the approaches to Liverpool and the associated ferry routes.

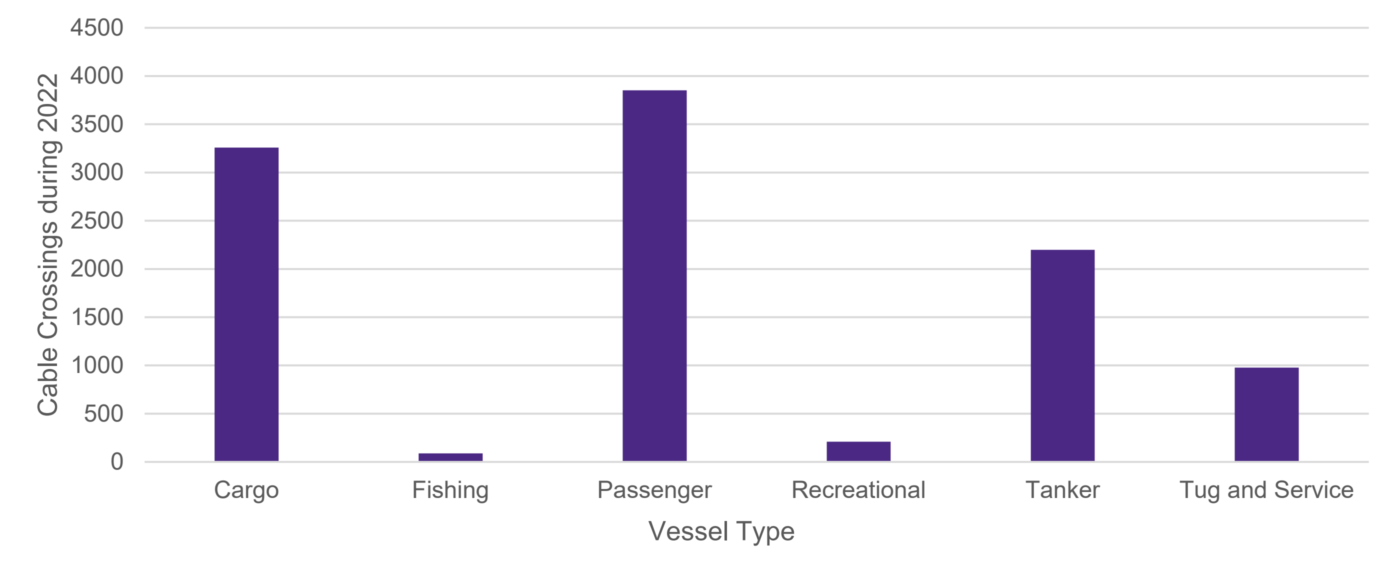

Figure 1.27: Vessel count by type intersecting the Mona Offshore Cable Corridor (source: MarineTraffic 2022).

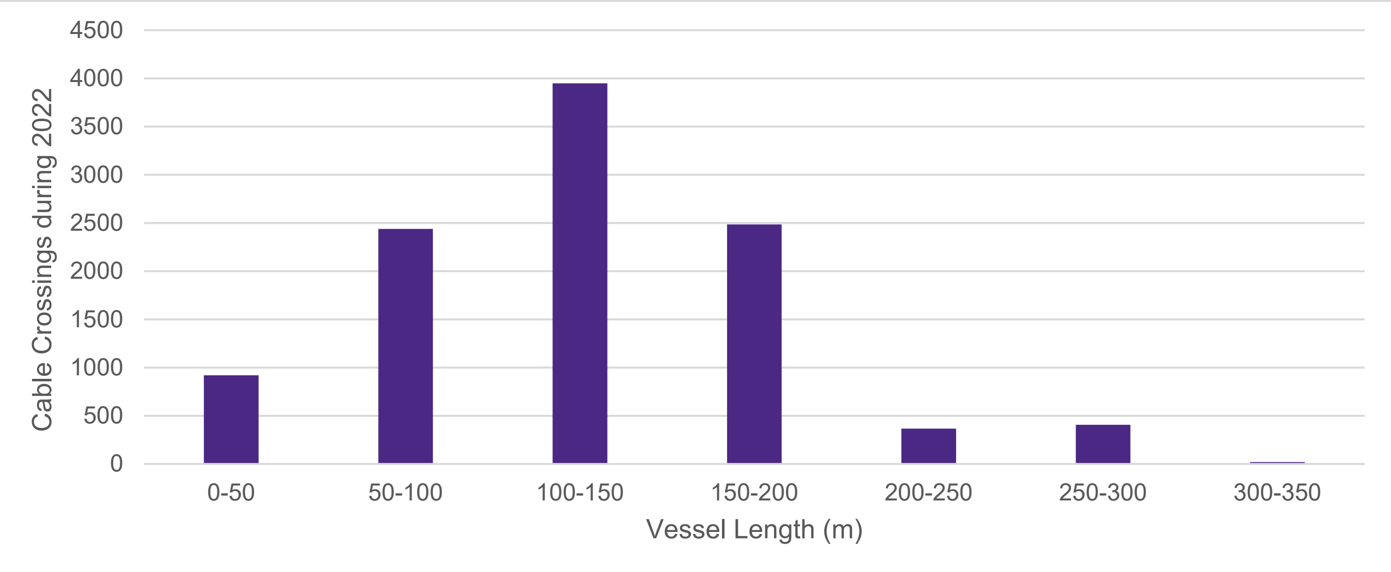

Figure 1.28: Vessel count by length intersecting the Mona Offshore Cable Corridor (source: MarineTraffic 2022).

Identification of vessel routes

1.6.3.36 MGN654 and its annexes (MCA, 2021a) provides guidance regarding the definition of shipping routes in order to inform offshore wind farm assessments. To account for variation of tracks taken by vessels, the guidance note establishes the 90th percentile corridor principles, the central portion of traffic on a route containing the majority of vessel traffic. The 90th percentile concept considers that as vessels navigate between specific locations, they may take a variety of routes due to avoiding other traffic or as a result of leeway from wind or waves. To minimise any anomalous tracks and therefore mark the width of a specified route, the MCA advise using the centre 90th percentile of the determined total route width (see Figure 1.29) around the assumed median or centre line, for all vessels engaged on passage between the same two points.

1.6.3.37 To identify the 90th percentile routes, the following data processing steps were undertaken:

1. Vessel tracks filtered to commercial only (cargo, tanker & passenger)
2. Tracks along a defined route selected
3. Gate transects constructed along the length of the route (ensuring transects at course changes are included
4. Calculate number of tracks through cross track transect subsections
5. Calculate location of 90th percentile through transect
6. Draw polygon capturing all 90th percentile locations on each transect.

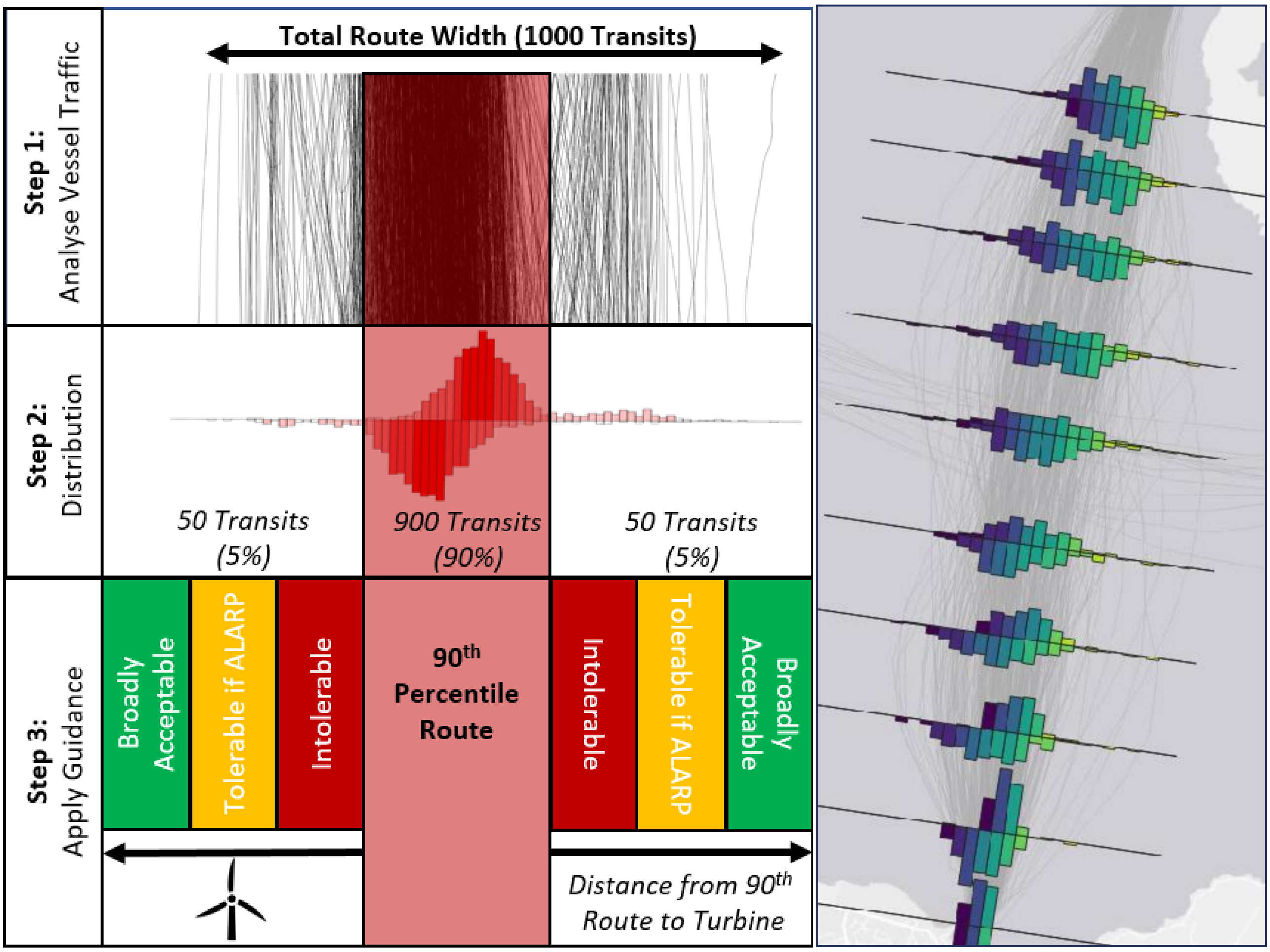

Figure 1.29: Identification of 90th percentile routes.

Cargo/tanker routeing

1.6.3.38 The cargo/tanker vessel routes have been identified in Figure 1.30 which also shows the number of vessel movements per day from analysis of 2022 AIS data. The routes with more than one vessel movement per day are all to/from the Port of Liverpool. The route between the Liverpool Bay TSS and the Off Skerries TSS has the most vessel traffic with four to six vessel moves per day in either direction.

1.6.3.39 Two vessel routes pass through the Mona Array Area with more than one vessel movement per day. Both of these routes are vessels transiting between the north Irish Sea to the west of the Isle of Man and the Liverpool Bay TSS.

1.6.3.40 There are numerous cargo/tanker routes with less than one vessel per day passing through or adjacent to the Mona Array Area. These include routes into Heysham from the southwest and alternative routes to/from Liverpool without using the TSS. Most of these routes have less than one cargo/tanker vessel transit per week.

Table 1.18: Statistics of cargo/tanker vessel routes in shipping and navigation study area (highlighted indicate intersect the Mona Array Area).

ID	Route	Approximate annual crossings (2022)	Baseline distance (nm)
>1 vessel per day			
1	Liverpool Bay TSS to Skerries TSS (E)	1119	46.9
2	W IoM to Liverpool Bay TSS (E)	334	55.1
3	Skerries TSS to Liverpool Bay TSS (W)	1461	51.6
13	Liverpool Bay TSS to W IoM (W)	407	53.0
4	Liverpool Bay TSS to Skerries TSS and Anglesey (E)	265	60.7
<1 vessel per day			
5	Inshore Anglesey to Liverpool Bay TSS (E)	39	45
6	Off Skerries TSS to Heysham (E)	21	71.2
7	Off Skerries TSS to Barrow (W)	31	72.8
8	Heysham to Off Skerries TSS (W)	13	73.9
9	Irish Sea to Liverpool Bay TSS (E)	44	49.9
10	Liverpool Bay TSS to Inshore Anglesey (W)	22	42.6
11	Liverpool Bay TSS to Central Irish Sea (W)	46	61
12	Liverpool Bay TSS to Irish Sea via Skerries TSS (W)	106	61.2
14	E IoM to Heysham	160	49.2
15a	Liverpool to E IoM - Central	48	70.5
15b	Liverpool to E IoM - West	174	77.6
15c	Liverpool to E IoM - East	25	68.0
16	Douglas to Heysham	5	48.7
18	Liverpool to W IoM	274	61.0
19	Douglas to Liverpool Bay TSS (E)	16	51.7
20	South Irish Sea to Solway Firth	56	69.8
21	Off Skerries TSS to Solway Firth	36	74.6
22	Douglas to Liverpool Bay TSS	89	51.1
23	Liverpool to E WoDS	60	36.6
24	Off Skerries TSS to Barrow (E)	33	66.9
25	Colwyn Bay to W IoM	25	63.7

Ferry routeing

1.6.3.41 The ferry routes in the shipping and navigation study area are presented in Figure 1.30 and Table 1.19 along with a count of the crossings during 2022. There are 11 ferry routes through the shipping and navigation study area, split between four operators. Figure 1.31 shows the passage plans as provided by the operators. Passage plans are shown as solid lines for a typical passage plan or hatched for adverse weather passage plans, passage plans are only shown where these have been made available by the ferry operators.

1.6.3.42 The IoMSPC ferries operate between Douglas on the Isle of Man, and either Heysham or Liverpool. The Heysham/Douglas route is the most frequently run route with 1,451 transits in 2022 (nearly 4/day) and passes east/west between South Morecambe Gas Field and West of Duddon Sands and Walney offshore wind farms. In normal conditions, this route passes 10 nm from the Mona Array Area.

1.6.3.43 The Liverpool/Douglas route had 593 transits in 2022 (1 to 2/day), passing northwest/southeast through the shipping and navigation study area. The passage plan for the route traverses to the east of the Mona Array Area and intersects the north-east tip of the Array Area. The vessel Manannan runs a seasonal service with four transits/day in summer. The route runs primarily west of the single buoy mooring, passing 1.5 nm. In normal conditions, this route passes approximately 1 nm east of the Mona Array Area. A small proportion of vessels on this route transit east of the Hamilton North Gas Field (41 transits in 2022, <1day), principally northbound to avoid congestion in Liverpool Bay TSS (thereby exiting the TSS earlier) and are dependent on current and forecast weather conditions to ensure safe and comfortable passage for passengers.

1.6.3.44 Stena Line operates routes between Belfast and either Liverpool or Heysham. Vessels using the route between Belfast and Liverpool pass east or west of the Isle of Man dependent on prevailing metocean conditions. Primarily, vessels use the westerly route that passes northwest-southeast through the central portion of the Mona Array Area with 1,098 transits in 2022 (three vessels/day). Ferries passing east of the Isle of Man transit northwest/southeast on two planned routes. One route passes east of the Mona Array Area to the west of the Calder platform (194 transits in 2022). 80% of traffic used on this route is southbound traffic, passing 3.2 nm from Mona Array Area. The second route passes to the east of Calder and is utilised by northbound traffic exiting Liverpool Bay TSS (196 transits/year, <1 vessel/day).

1.6.3.45 Seatruck operates two east-west routes through the shipping and navigation study area. Heysham to Warrenpoint passes 7 nm to the north of the Mona Array Area with 1099 transits in 2022 (3/day). The Heysham to Dublin route transits next to the north tip of Mona and 606 transits were recorded on this route in 2022, none of which intersected Mona. Seatruck also operates a route between Liverpool to Dublin south of the shipping and navigation study area between Gwynt y Môr and the Mona Array Area (1,627 transits in 2022, 4 to 5/day). Eastbound transits on this route pass to the north of the TSS Off Skerries, before crossing the traffic flow out of Liverpool into the eastbound lane of the Liverpool Bay TSS. Westbound transits on this route either pass out of the Liverpool Bay TSS and into the westbound lane of the TSS Off Skerries, or pass to the north, depending on traffic conditions.

1.6.3.46 P&O ferries operate a route between Liverpool and Dublin which passes south of the shipping and navigation study area between Gwynt y Môr and the Mona Array Area with 1,625 transits in 2022 (4 to 5/day).

Table 1.19: Ferry routes and annual crossings by operator.

Operator	Route	Example vessels (2019 to 2022)	Approximate annual crossings (2022)
IoMSPC	HEY - DOUG	Ben-my-Chree	1,451
	LIV - DOUG	Manannan	552
	LIV - DOUG	Ben My Chree	41
Stena	LIV - BEL W IoM	Stena Edda/Stena Embla/Stena Mersey/Stena Horizon/Stena Lagan/Stena Forecaster/Stena Forerunner	1,098
	LIV - BEL E IoM West of CALDER		194
	LIV - BEL E IoM East of CALDER		196
	HEY - BEL	Stena Hibernia/Stena Scotia	1,094
Seatruck	HEY - WAR	Seatruck Performance /Seatruck Precision	1,099
	HEY - DUB	Seatruck Pace/Seatruck Panorama	606
	LIV - DUB	Seatruck Pace/Seatruck Power/Seatruck Panorama/Seatruck Progress	1,627
P&O	LIV - DUB	Mistral/Norbay/Norbank	1,625

Adverse weather routeing

Cargo/tanker routeing

1.6.3.47 Analysis of vessel tracks during Met Office named storm events did not identify any repeatable adverse weather routeing behaviours taken by cargo/tanker shipping. During strong southwesterlies, the anchorage to the east of Anglesey was in greater demand by vessels.

Ferries routeing

1.6.3.48 Figure 1.32 shows the non-typical routes taken by ferries, including during adverse weather conditions. Prevailing southwesterlies result in vessels taking a more southwesterly transit in order to both control the course relative to the conditions and take advantage of the lee from the shore. This minimises dangerous motions aboard the vessel and improves passenger comfort.

1.6.3.49 During adverse weather, the IoMSPC take routes to the southwest of their typical route. For the Liverpool to Douglas route, this takes vessels directly through the Mona Array Area as opposed to their usual passage plan passing adjacent to its east boundary. The Heysham to Douglas route is similarly deviated, but vessels pass 8 nm clear to the north of the Mona Array Area.

1.6.3.50 The Stena route to the west of the Isle of Man between Liverpool and Belfast similarly is deviated further southwest, outside of the Mona Array Area. There is little evidence of significant adverse weather routeing through the Mona Array Area for Stena transits to the east of the Isle of Man.

1.6.3.51 The Seatruck adverse weather routes between Heysham to Dublin/Warrenpoint are more evident to the northwest of the Mona Array Area.

1.6.3.52 Further discussion on adverse routeing of ferries is contained in section 1.8.3.

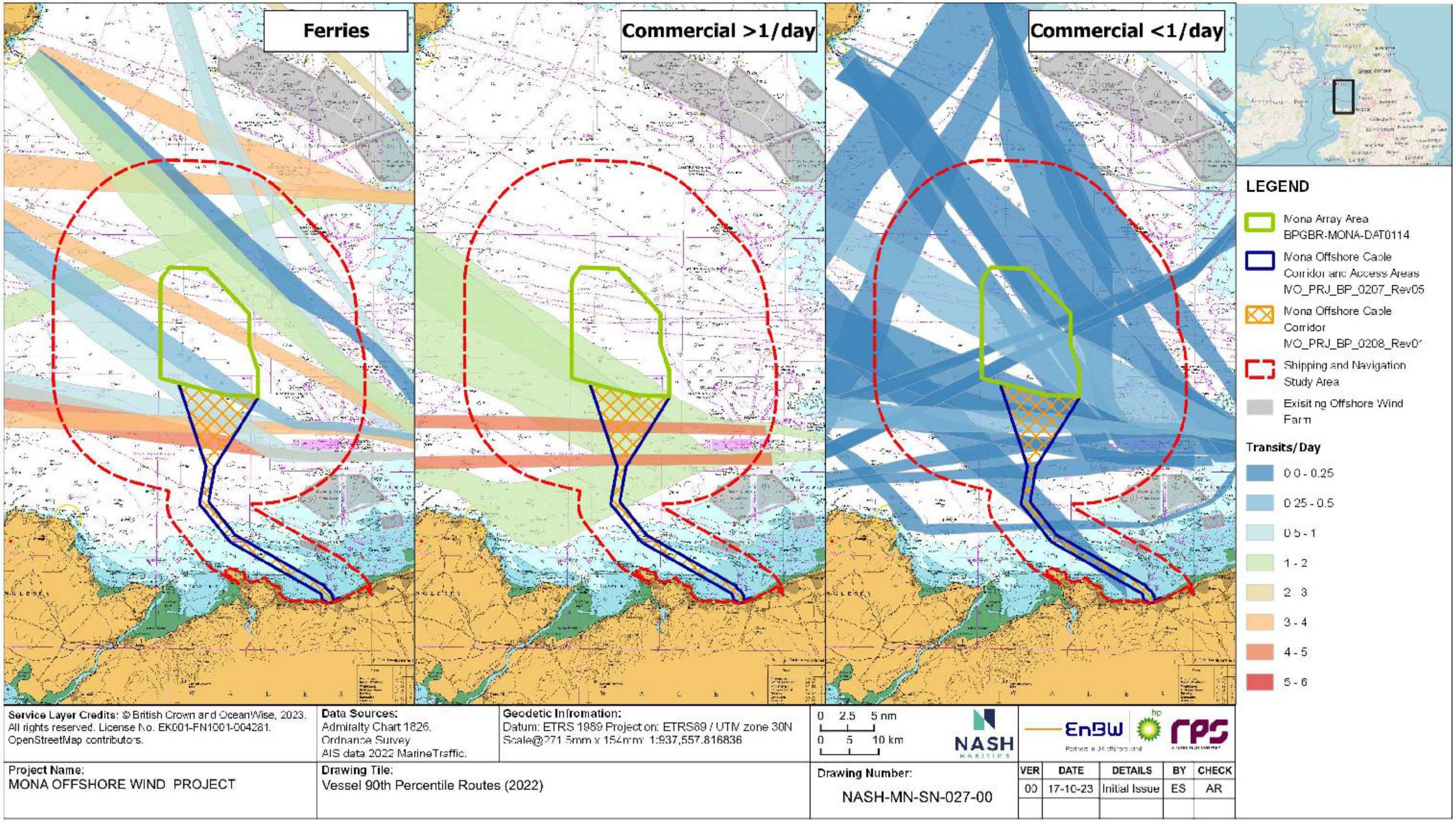

Figure 1.30: Vessel 90th percentile routes (2022).

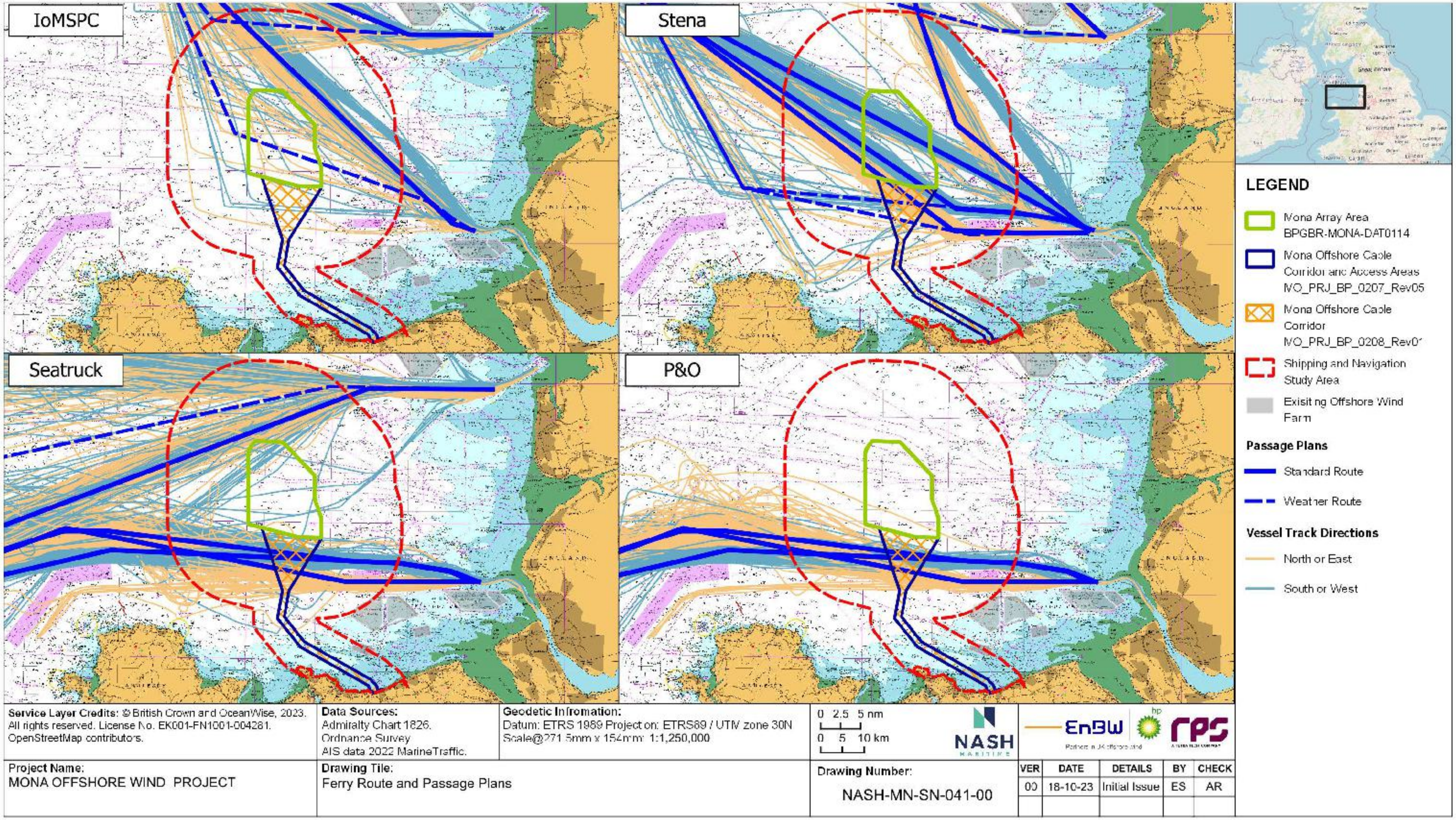

Figure 1.31: Ferry route and passage plans (source: MarineTraffic 2022).

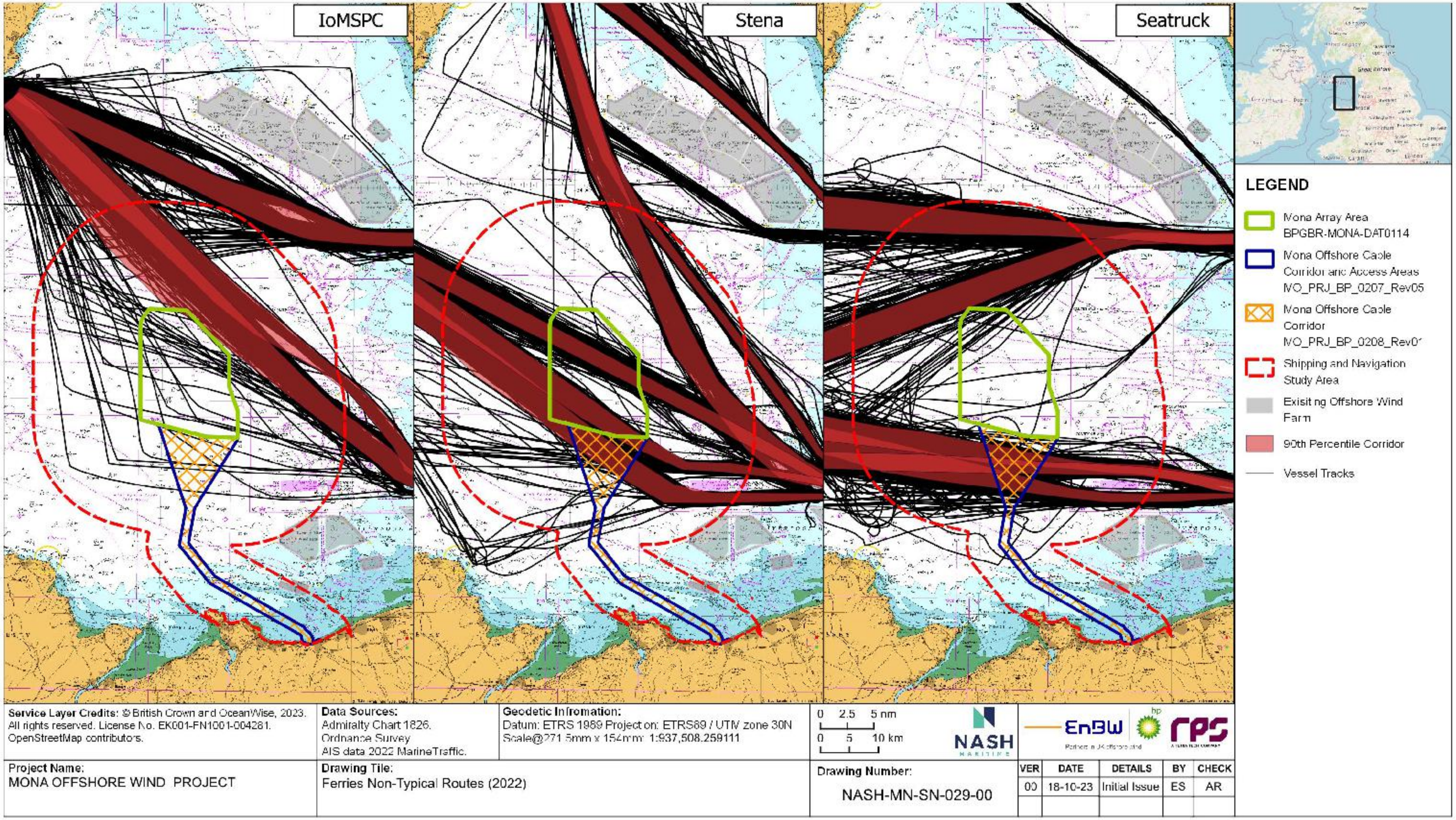

Figure 1.32: Ferries non-typical routes (source: MarineTraffic 2022).

Non-transit activity (including anchoring, loitering and out of region pilot transfer)

1.6.3.53 Anchored or vessels not in transit are shown in Figure 1.33. The intensity of anchoring has been identified by extracting AIS positions with speeds of less than 0.5 knots for vessels over 100 m in length. Non-Transit tracks have been extracted manually through identifying vessels which are not navigating directly between two locations.

1.6.3.54 There is considerable anchored vessel activity shown of the east coast of Anglesey near the Point Lynas Pilot Boarding Station. Use of this area as an anchorage is not displayed on the navigational chart but is regularly used by crude oil tankers waiting to berth at the Tranmere oil jetty on the River Mersey.

1.6.3.55 There is also anchoring activity shown at the designated anchorages to the north and south of the entrance to the River Mersey as well as at Douglas Bay. There is limited evidence of anchoring sporadically through the Mona Array Area.

1.6.3.56 There are extensive non-transit vessel tracks through the Mona Array Area shown between the Liverpool Bay TSS, Douglas Bay, the north Irish Sea and the anchorage off the east coast of Anglesey.

1.6.3.57 During consultation with the IoMSPC, it was identified that during strong northwesterlies, it was common for vessels to undertake pilotage transfers in the lee of the Isle of Man at Douglas, rather than at Liverpool. A letter from Laxey Towing Company explained that on average 175 ships per year are attended to, although during 2022 this was 76. Through correlation with the 2022 AIS data, Figure 1.34 shows the tracks of those considered to have conducted this behaviour, including 6 over 200 m in length, 50 tankers, eight cruise ships and 182 cargo ships. It is notable that during significant adverse weather events, these transfers can result in convoys of vessels navigating between Liverpool and Douglas. For example, on the 14 February 2022, three tanker vessels departed Liverpool and a cargo vessel departed the Anglesey anchorage, meeting at Douglas to conduct transfers within the same hour.

Vessel traffic around Mona landfall

1.6.3.58 Figure 1.35 shows vessel transits immediately adjacent to Mona landfall. The vessel traffic data suggests little recreational and fishing activity within this area. The most frequent vessel types are service vessels (including hydrographic survey work) and 90 m general cargo vessels calling at Raynes Jetty.

1.6.3.59 A small harbour at Rhos-on-Sea accounts for some small craft movements near to cable landfall.

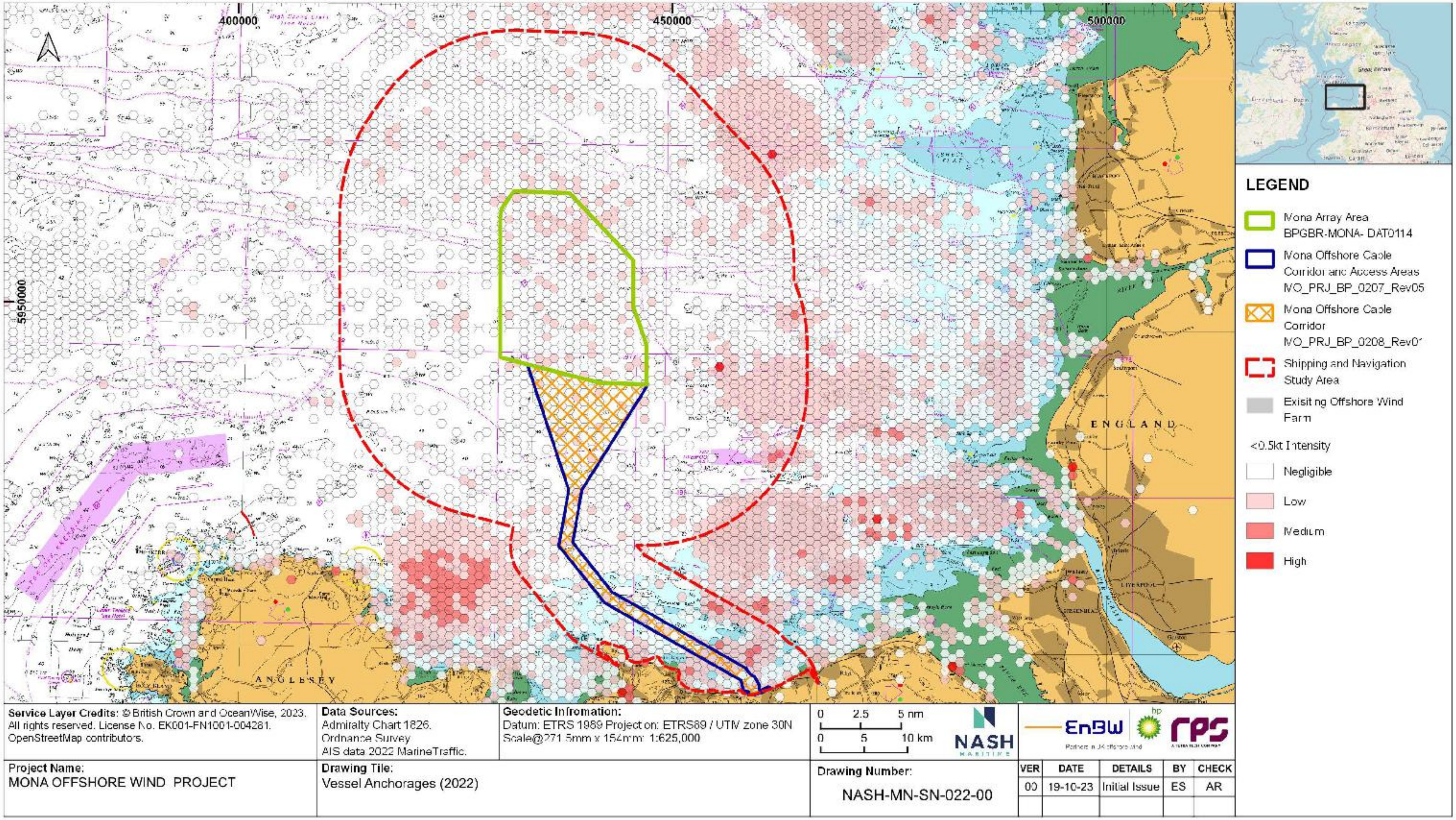

Figure 1.33: Vessel anchorages (source: MarineTraffic 2022).

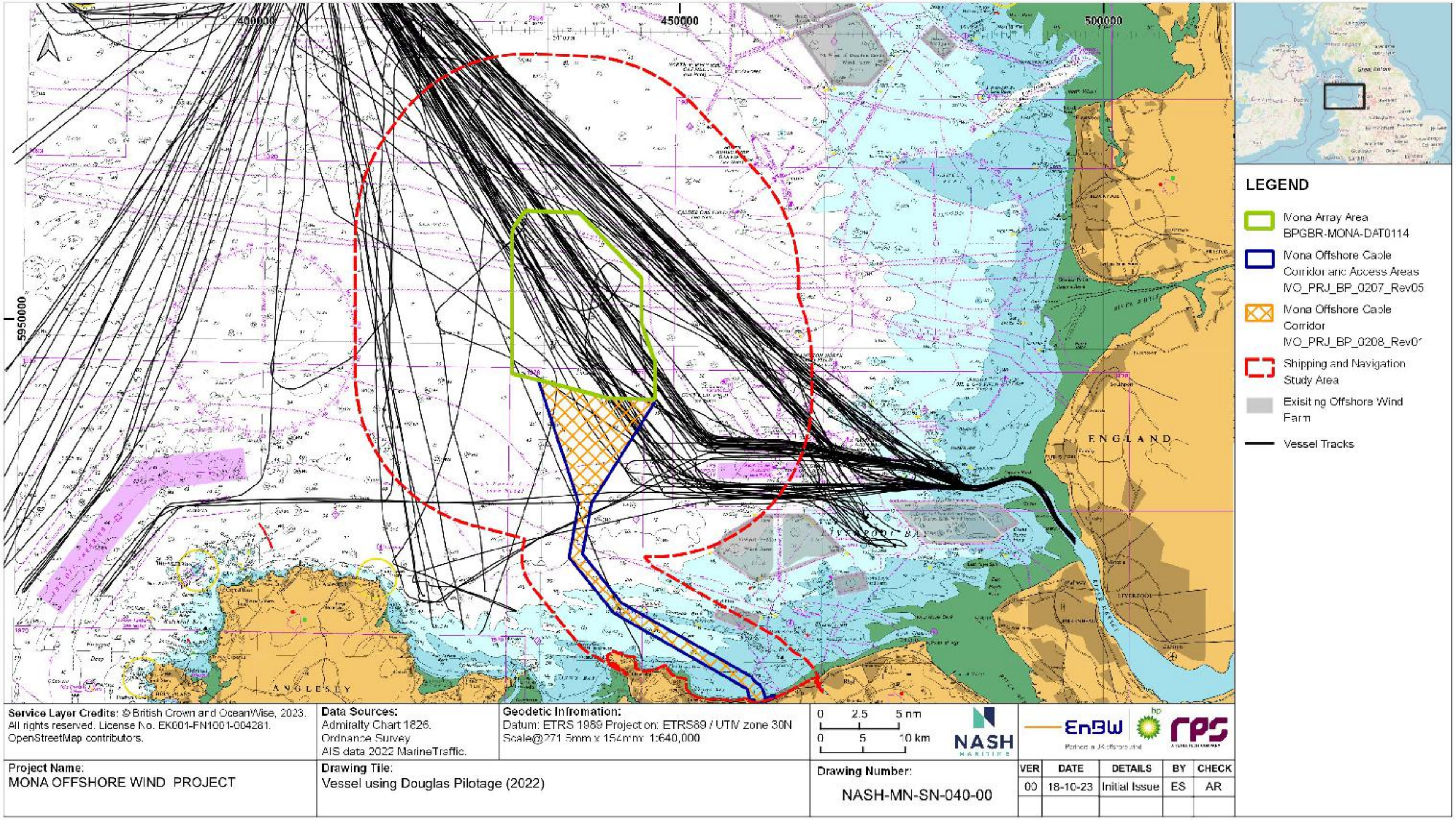

Figure 1.34: Vessels using Douglas pilotage (source: MarineTraffic 2019).

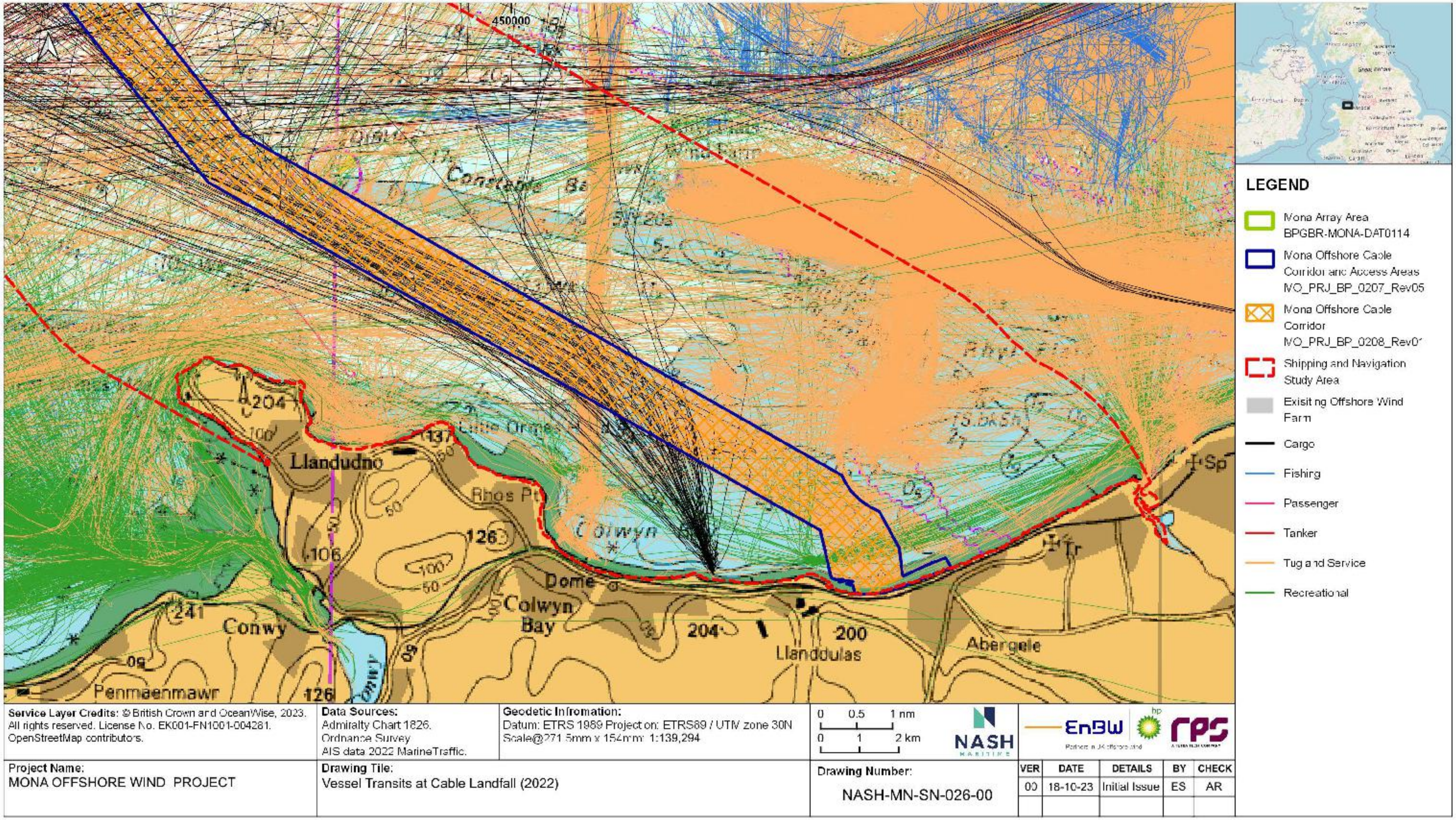

Figure 1.35: Vessel transits at cable landfall (source: MarineTraffic 2022).

1.6.4 Incident analysis

Incidents associated with other offshore wind farms

1.6.4.1 To better understand the types and frequency at which navigational incidents might occur with the proposed Mona Offshore Wind Project, analysis was conducted of historical accidents associated with UK operational offshore wind farms. Analysis was conducted of the MAIB database (2010 to 2019), RNLI databases (2008 to 2019), MAIB reports and news reports.

1.6.4.2 In total, 69 incidents were identified between 2010 and 2019 (see Table 1.20). This includes six collisions between vessels, 29 allisions of a vessel with a fixed structure, 21 groundings and 13 near misses. Where the information is available, 36% occurred within the array boundary, 43% occurred within ports or harbours and 20% occurred on-transit between the two. 82% of incidents involved project craft (such as CTVs or construction vessels). Few allisions are recorded by a non-project vessel, however, anecdotally there have been more allisions involving fishing and recreational vessels which are not reported in the dataset.

Table 1.20: Incident frequency for offshore wind farm relevant incidents between 2010 to 2019 in UK.

Vessel	Allision	Grounding	Collision	Near Miss
Project Vessel	27	21	9	15
Fishing	2	0	0	2
Recreational	0	0	2	4
Other	0	0	1	5

1.6.4.3 From the historical incident record and using an estimate of the number of years of operation for UK offshore wind farms, incident rates per an average project are derived (see Table 1.21) (see Rawson and Brito, 2022). The accident return rates are generally low, between 10 and 45 operational years between incidents. The majority of these events are accounted for by project vessels and all have a low consequence, without loss of life or serious pollution. Therefore, over a typical 25 to 35 year operational duration it would be expected that a typical project would experience three allisions, two groundings and one collision or near miss. It is notable that there are no recorded accidents involving large commercial shipping and offshore wind farms in the UK.

Table 1.21: Average incident rate per project between 2010 to 2019 in UK.

Incident Type	N	Rate Per Year	Return Period
Collision	6	0.022	45.4
Grounding	21	0.077	13.0
Near Miss	13	0.048	20.9
Total Allision	29	0.107	9.4
CTV Allisions	27	0.099	10.1
Fishing Allisions	2	0.007	136.9
Total	69	0.254	3.9

Incidents within shipping and navigation study area

1.6.4.4 Figure 1.36 shows navigational incidents recorded in the shipping and navigation study area between the MAIB (1992 to 2021) and RNLI (2008 to 2022) databases. In processing the incidents, non-navigationally significant incidents have been removed, such as shore based activities (e.g. people cut off by the tide or swimmers in distress). Furthermore, duplicate values recorded in both databases have been removed.

1.6.4.5 Nine incidents were recorded within the Mona Array Area between 1992 and 2022. These include two near misses, one flooding of a fishing vessel and six mechanical failures across recreational and fishing boats. The majority of incidents in the study area are located to the south of the shipping and navigation study area, contained within the TSS or close inshore.

1.6.4.6 For the most recent years of data (2008 to 2022), accident rates per year have been calculated per vessel type within the shipping and navigation study area. These are shown in Table 1.22. These show very low incident rates, particularly for larger commercial vessels.

1.6.4.7 MAIB Report 8/2013 concerns a grounding of a general cargo vessel at Raynes Jetty, near to cable landfall.

Table 1.22: MAIB/RNLI incident frequencies within shipping and navigation study area per year (2008 to 2022).

	Incident Type	Cargo	Fishing	Passenger	Recreational	Tanker	Tug and Service	Total
Array Area Buffer (10 nm)	Collision	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Contact	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Grounding	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Other	0.27	0.93	0.27	0.27	0.00	0.00	0.00
	Total	**0.27**	**0.93**	**0.27**	**0.27**	**0.00**	**0.00**	**1.73**
Cable Area Buffer (3 nm)	Collision	0.00	0.00	0.00	0.07	0.00	0.00	0.07
	Contact	0.00	0.07	0.00	0.00	0.00	0.00	0.07
	Grounding	0.20	0.00	0.00	0.53	0.00	0.00	0.73
	Other	0.07	2.60	0.13	17.73	0.00	0.27	20.80
	Total	**0.27**	**2.67**	**0.13**	**18.33**	**0.00**	**0.27**	**21.67**

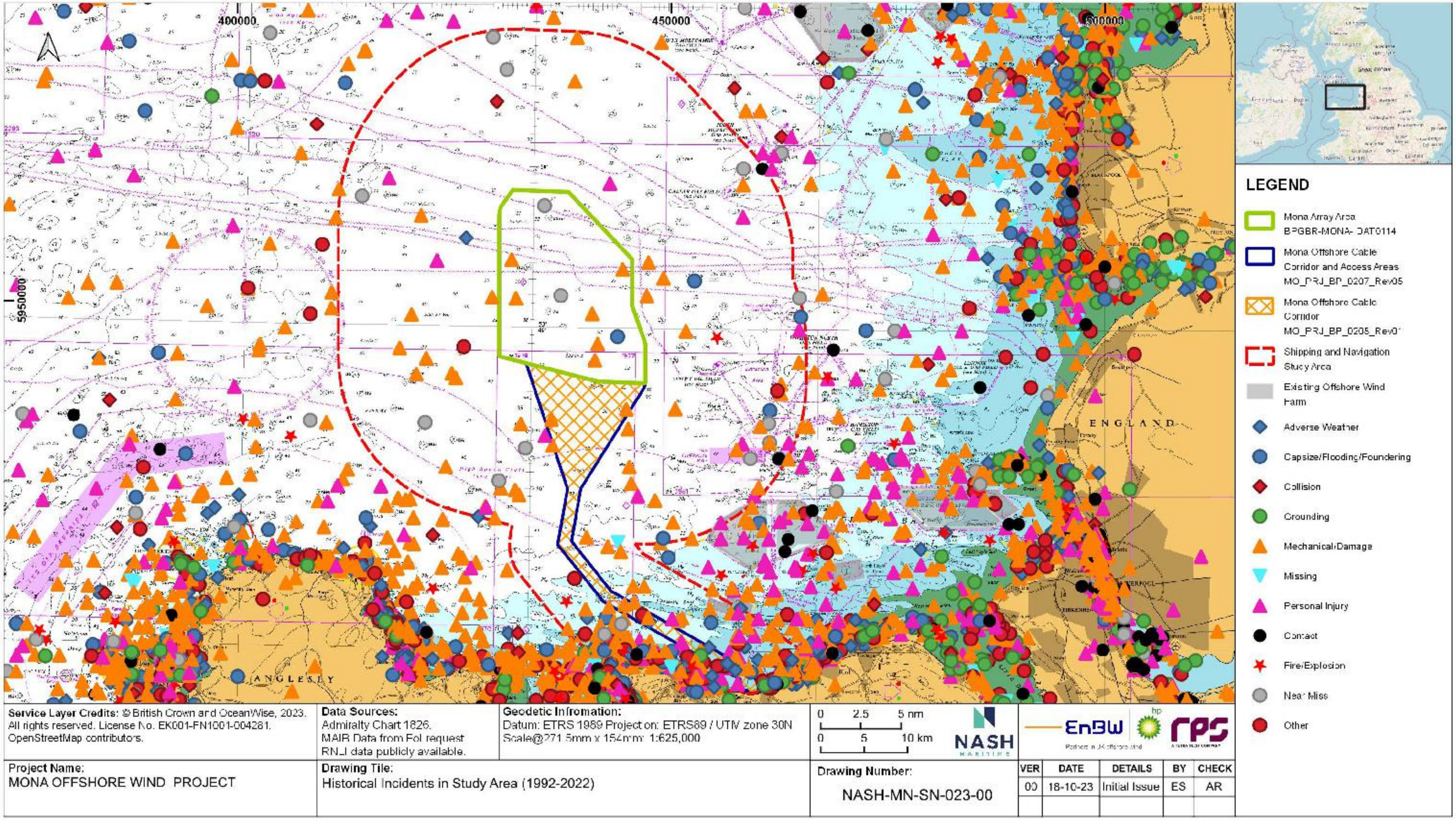

Figure 1.36: Historical incidents in study area (source: MAIB and RNLI datasets).

Consequences of collision

1.6.4.8 International studies have explored the consequences of collision between large vessels. The European Maritime Safety Agency (2015) collision risk model developed for their FSA based on historical incidents estimated that 33% of struck RoPax vessels would result in water ingress and 14% of those would result in sinking (joint probability of 4.6%). The MSC 85-17-2 FSA gives probabilities of 16% of collisions being a serious casualty of which 50% of struck vessels would flood, of which 22% would sink and a further 50% split between gradual sinking or rapid capsize (joint probability of the latter being 0.8%).

1.6.4.9 Analysis of MAIB data suggests that approximately 1% of collisions would result in loss of life. However, it is likely as most collisions occur within ports and harbours, vessels are navigating at slower speeds than they may do in open sea. Furthermore, there are relatively few incidents in UK waters of significant loss of life following collisions or allisions involving large commercial shipping including ferries. Collisions between commercial vessels, even at speed, often result in only damage and no pollution or injuries (MAIB 7/2018, 28/2015, 3/2017, 15/2013).

1.6.4.10 Several consultees noted that a collision between a large commercial ship including a ferry with a small craft such as fishing boat would likely to result in the loss of the small craft and multiple fatalities (7/2007, 10/2015). However, a more likely outcome is serious damage to the small craft and either no or minor injuries/pollution (MAIB 4/2019, 16/2015, 20/2011, 17/2011).

1.6.4.11 During the hazard workshops, some consultees made reference to the highly fragile nature of the Manannan high speed ferries structural integrity, having been designed for high-speed transit and therefore with aluminium build. Therefore, any collision involving this vessel would have a very high potential consequence in most cases.

Consequences of allision

1.6.4.12 Given the infrequency at which vessels have collided with wind turbines, there is some uncertainty to the degree of damage that would result from an allision. The degree of damage depends on the vessel characteristics, the type of allision (at speed or drifting), angle of allision (broadside or head on) and the engineering of the wind turbines. Several academic studies using finite element modelling have sought to explore this, including Biehl and Lehmann (2006), VINDPILOT (2008), Dai et al. (2013), Moulas et al. (2017) and, Presencia and Shafiee (2018).

1.6.4.13 These studies suggest that:

- Ship allisions, even at low speeds, can cause significant damage to wind turbines including deformation and buckling
- Some studies of in-field construction/maintenance vessels (up to 4000 tons), with allisions at high speeds, did not result in wind turbine collapse
- Modelling of allisions with large commercial ships could result in holing of the vessels hull and cargo release
- Larger vessels (30,000 deadweight tonnage) alliding with the turbine might typically result in the tower collapsing away from the vessel
- However, some studies suggested that large commercial ships could result in the tower collapsing towards the vessel, with the damage likely to penetrate the deck.

1.6.4.14 To better understand the potential consequences of ship allision with wind turbines, Table 1.23 presents some case studies of past incidents and the resulting impacts to people, property and the environment. These have been collated from accident reports or news articles. It can be concluded that where incidents have occurred, they have been at low speed, involve in-field project vessels and typically result in only minor damage or injuries. However, it is feasible that a serious allision with an offshore wind farm might result in turbine collapse, holing and eventual flooding of a vessel and potential loss of life.

Table 1.23: Case studies of allision.

Date	Site	Vessel	Description
25 April 2023	Gode Wind (Germany)	Petra L – 74 m, 1,162 Gross Tonnes (GT) General Cargo	Vessel missed a turn and collided with a wind turbine causing significant damage. There were no injuries.
31 January 2022	Hollandse Kust Zuid	Julietta D – 190 m 24,196 Gross Tonnage (GT) Bulk Carrier	Disabled vessel in a storm struck the foundation of a substation jacket that result in minor damage to both the vessel and jacket. There were no injuries or pollution.
23 April 2020	Borkum Riffgrund	Njord Forseti – 24 m 137 GT	Vessel skipper not keeping proper lookout collided with wind turbine at speed. Resulted in three injuries (one seriously) and significant flooding of CTV through 0.5 m crack in bow.
10 April 2018	AOWF (Baltic)	Vos Stone – 80 m 4,956 GT Offshore Supply Vessel	Construction vessel casting off from a wind turbine lost control and was forced against the wind turbine due to adverse weather. Resulted in 3 minor injuries, dry dock to the vessel and minor damage to platform. There was no pollution.
14 August 2014	Walney	OMS Pollux – Stand by Safety Vessel	Whilst conducting inspection work, the vessel collided with a turbine that resulted in no injuries, and minor leaking of marine gas.
21 November 2012	Sheringham Shoal	Island Panther – 17 m 22 GT CTV	CTV made heavy contact with unlit transition piece. Resulted in 5 injuries and damage to the vessels bow.
06 October 2006	Scroby Sands	Jack up	Large jackup barge collided with turbine resulting in damage to a turbine blade.

1.7 Future case traffic profile

1.7.1 Introduction

1.7.1.1 This section presents the predicted future case traffic profile within the shipping and navigation study area for cargo/tanker, ferries, O&G, fishing and recreational vessel traffic.

1.7.2 Cargo/tanker traffic

1.7.2.1 DfT data on UK port trade is presented in Figure 1.37 and Figure 1.38 and shows a decline in port freight in 2020 at both the national and port level, respectively. The DfT report that UK ports were affected by measures to prevent and reduce the global spread of COVID-19 throughout 2020, as well as the UK exiting the European Union at the end of 2020. The DfT report a 9% decrease in tonnage handled by UK ports in

2020 compared to 2019. However, given the lifting of COVID-19 related restrictions, it is anticipated that port freight will continue to return to pre-pandemic levels.

1.7.2.2 Port freight activity at the Port of Liverpool steadily increased between 2014 and 2019, before undergoing a significant reduction in 2020, likely due to pandemic related restrictions. It should be noted that an increase in tonnage does not necessarily correlate with an increase in vessels. New build vessels are often larger, capable of carrying more cargo, and ports such as Liverpool have invested in shoreside infrastructure to better handle these larger vessels.

1.7.2.3 Figure 1.39 shows projected freight traffic into UK major ports, produced by the DfT in 2019. Overall, port traffic is forecast to remain relatively flat in the short term but grow in the long term, with tonnage 39% higher in 2050 compared to 2016. This equates to approximately a 15% increase in national freight tonnage by 2035.

1.7.2.4 The long-term growth in port traffic is driven by increases in unitised freight traffic, which compensates for decreases in other freight in the short term. Liquid bulk traffic (principally crude oil) has the largest forecasted decreases, continuing a historical trend. Similarly, general cargo is forecast to decrease, in line with the historic decreasing trend, which is likely driven by increased containerisation of goods. Dry bulk traffic is forecast to have a relatively large decrease in the short term, driven primarily by demand for coal being projected to fall. In the long term, dry bulk traffic is forecast to increase, with other dry bulk, the largest category, continuing to increase as it has done historically (principally biomass). Motor vehicles, Twenty Foot Equivalent Units forecast for Lo-Lo and the unit forecast for Ro-Ro are all forecast to grow strongly, driven by economic growth.

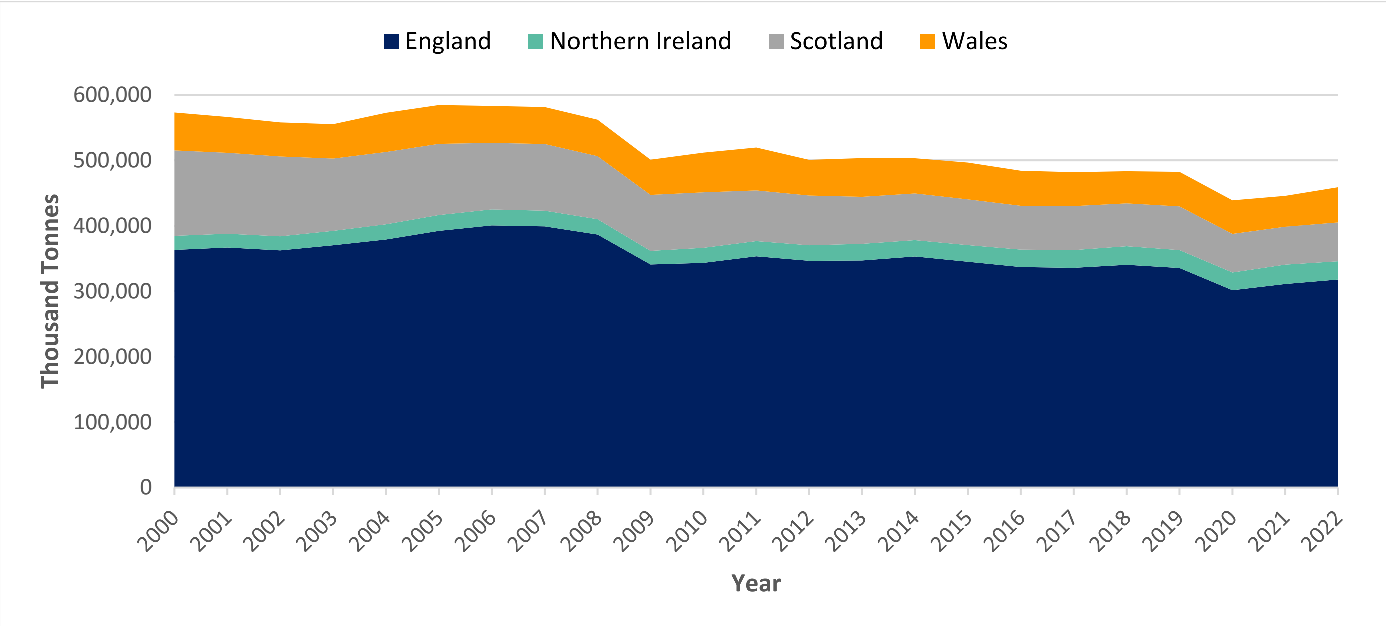

Figure 1.37: UK major port freight.

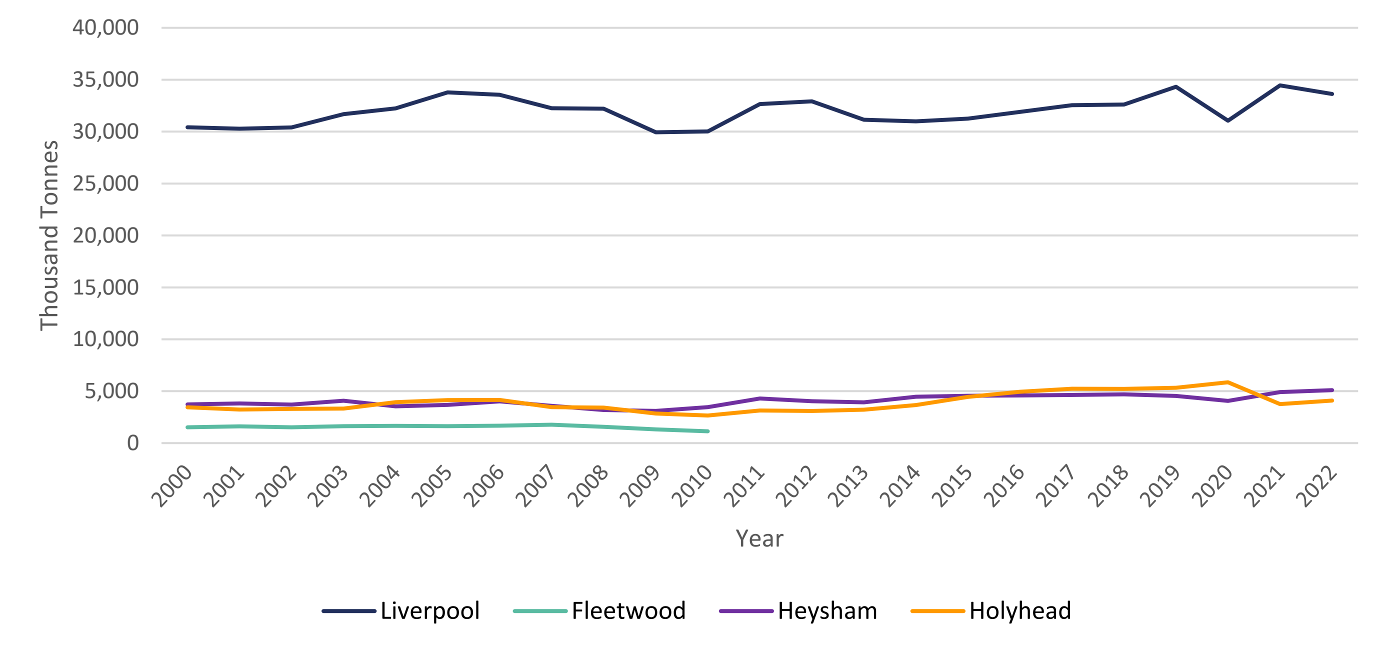

Figure 1.38: Port freight for UK major ports (Fleetwood ferry service closed at the end of 2010).

1.7.2.5 It is also noted that the Douglas Harbour Master Plan (Isle of Man Government, 2017) considers the potential for development of a day-call cruise ship berth, which might increase the number of cruise ship calls to the Isle of Man.

1.7.2.6 Other future changes that might occur by 2035 could include the increased operation of autonomous vessels within UK waters. During the course of the NRA, autonomous or remote-controlled survey vessels were active within the Mona Array Area. Regulatory bodies have insisted that any introduction of autonomous vessels into UK waters would have equivalent safety standards as conventional crewed vessels.

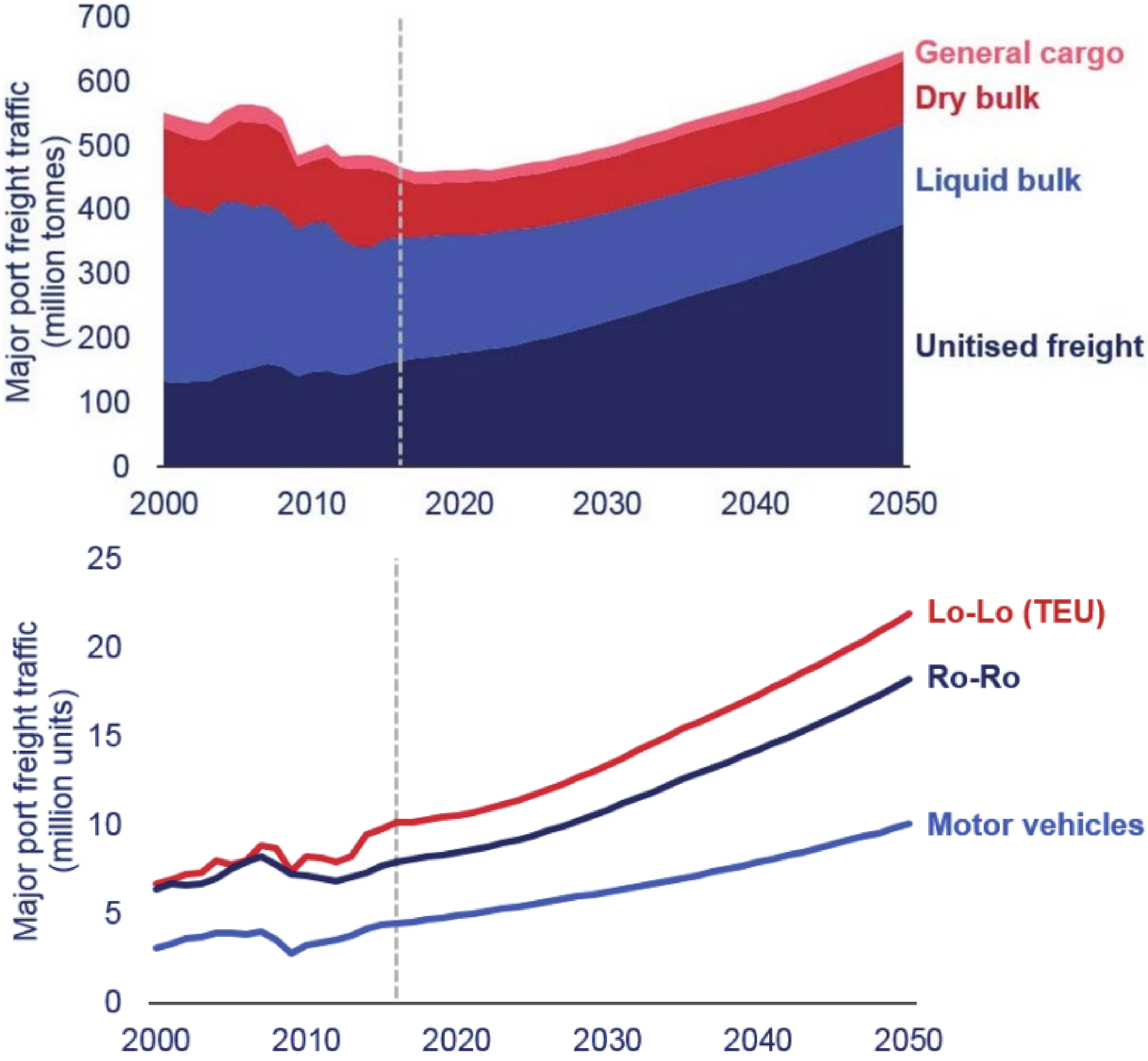

Figure 1.39: UK port freight projections (DfT, 2019).

1.7.3 Ferries

1.7.3.1 Freight and passenger ferries account for a large proportion of vessel movements within the shipping and navigation study area. These routes are subject to change both in terms of schedule, vessels and the addition of new routes in order to meet market demand. For example, between the 2019 AIS analysis and the 2022 NRA, Stena replaced several of their ferries with the new E-flex class. During consultation, each operator was asked on any potential future changes, noting that these were subject to change.

1.7.3.2 Seatruck have showed significant growth in demand, in 2018, Seatruck reported a 30% increase in volumes since 2015, with a 10% increase in 2017 alone. The increase in unaccompanied trailer volumes between 2007 and 2018 was reportedly 250%. A €100 million investment by Seatruck in 2018 was announced to increase capacity on the Warrenpoint to Heysham route by 30%.

1.7.3.3 Both of the IoMSPC vessels are twenty years old and will require replacement before 2035. In 2023, the IoMSPC new ferry Manxman started operating between Heysham and Douglas and it is anticipated that this vessel will also start operating between Liverpool and Douglas all year round. Consultation with IoMSPC determined that it is reasonable to assume that the Ben-my-Chree and Manxman will have similar handling and endurance capabilities. The Manannan is due for replacement before 31 December 2026 and therefore prior to the construction of the Mona Offshore Wind Project. This may be replaced by either a new fast craft or a fast conventional ferry.

1.7.3.4 In 2023, Stena Line announced that they were launching a service between Liverpool and Dublin, replacing the P&O route which was due to cease operations.

1.7.3.5 Trends for passenger numbers are shown in Figure 1.40 and show a gradual increase in passenger numbers across most routes (noting the exception of those figures impacted by COVID-19). Liverpool-Dublin has had a steady decline, meanwhile Liverpool-Belfast has experienced an increase, this is especially the case in the years since the impact of COVID-19 during which time Stena Line replaced ferries with the new E-flex class. Notably, the Liverpool-Belfast passenger number were the least affected of these routes by COVID-19. Predicting how this trend may influence vessel schedules and routes is uncertain. Therefore, in the absence of definitive information, an assumption is made that vessel routes and schedules will be similar in 2035 to the existing baseline but with a likely increase in services.

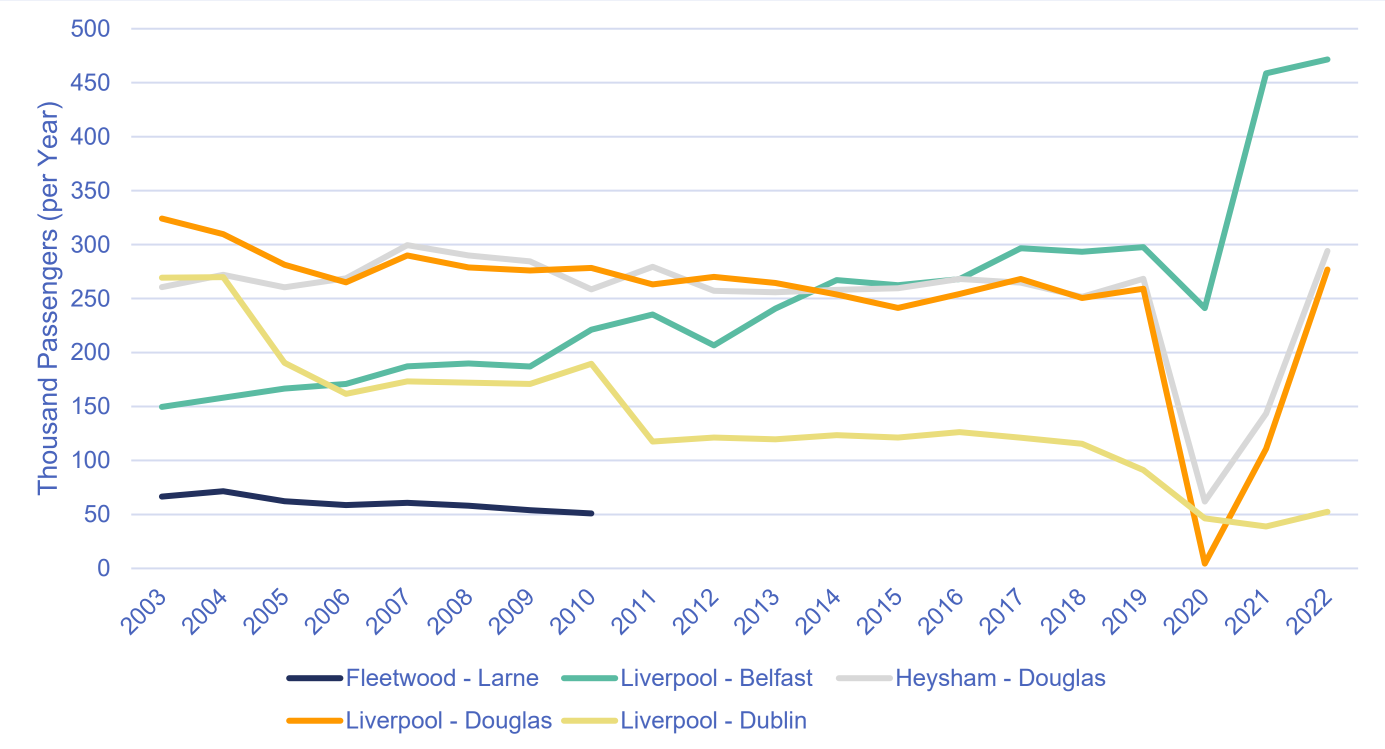

Figure 1.40: Passenger numbers (Fleetwood ferry service closed at the end of 2010). 2020/2021 figures heavily impacted by COVID-19.

1.7.4 Oil and gas

1.7.4.1 Irish Sea O&G platforms are reaching end of life and it is understood that some platforms may be decommissioned. Details of which platforms and when have not been fully ascertained by the Applicant. It is assumed that:

- The South Morecambe gas field platforms are expected to cease production in 2027 (+/-2 years) (Spirit Energy, 2019). The field includes the platforms DP3, DP4, DP6, DP8 and CPP1 and associated cable, pipeline and umbilical infrastructure. It is understood that DP3 and DP4 were removed in 2021 and decommissioning of CA1 is also scheduled to complete in 2027 onwards

- Millom West (Harbour Energy) is undergoing decommissioning with the platform anticipated to be removed by 2030.

1.7.4.2 A related question to Round 4 North Sea and Irish Sea developments is whether O&G vessels would navigate through or around an offshore wind farm. It is noted that the International Guidance for Offshore Marine Operations section 8.15 recommends that courses are planned so that, where practical, the vessel passes at the distance of at least 1 nm from each facility. However, the familiarity and manoeuvrability of offshore supply ships or emergency rescue and recovery vessels may facilitate navigation within large offshore wind farms. This assessment has assumed that there is sufficient space, in suitable conditions, for in-field navigation to take place.

1.7.5 Fishing Activity

1.7.5.1 Fishing within the Irish Sea is important for both the UK and Isle of Man fisheries. There is limited information available for future fishing vessel activity on which reliable assumptions can be made.

1.7.5.2 Within the shipping and navigation study area, UK fisheries primarily target non-quota shellfish species. Therefore, fishing fleets are unlikely to be impacted by quota transfers following the UK's withdrawal from the European Union. Market changes have the potential to impact fishing activity in the shipping and navigation study area. However, fishing activity in the area is not anticipated to change significantly, with both local and foreign vessels continuing fishing activity in the area.

1.7.6 Recreational Activity

1.7.6.1 The RYA Water Sports Participation Survey conducted in 2019 found that the proportion of adults participating in boating activities has fluctuated between 6% and 8% between 2002 and 2018 (RYA, 2019; 2022). Between 2008 and 2018, the proportion participating in yacht cruising, motor boating and power boating have remained consistent at 0.8%, 1.1% and 0.7% respectively. More recent data published in the 2021 Water Sports Participation Survey is significantly influenced by COVID with a significant variation between 2021 and 2022 due to national/local lockdowns.

1.7.6.2 Therefore, it is unlikely that there will be a significant change in the number of recreational users due to macro trends.

1.7.7 Project vessel movements

1.7.7.1 Details of vessel numbers associated with the Mona Offshore Wind Project are described in section 1.4. The O&M base for Mona has not yet been determined, however, the MDS assumes that O&M vessel movements are up to 849 per year (approximately three per day).

1.7.7.2 Major or significant maintenance will be managed in line with company operating procedures and the risk control measures as documented in section 1.4.8.

1.8 Mona Offshore Wind Project impact assessment

1.8.1 Impact identification

1.8.1.1 Following consultation with stakeholders, analysis of data and a review of guidance, 13 potential impacts of the Mona Offshore Wind Project were identified on shipping and navigation as documented in Table 1.24.

Table 1.24: Impact identification.

ID	Impact	Description
1	Impact to recognised sea lanes essential to international navigation	The Mona Offshore Wind Project could impede access into major international sea lanes.
2	Impact to ferry routeing	The Mona Offshore Wind Project could necessitate deviations to ferry routeing increasing distances resulting in additional cost and time for the passage.
3	Impact to cargo/tanker routeing	The Mona Offshore Wind Project could adversely impact routeing of cargo/tanker vessels, making services unviable.
4	Impact to small craft navigation and safety	The Mona Offshore Wind Project could interfere with the activities and safety of small craft navigation such as cruising.
5	Impact on vessel encounters and collision avoidance	The Mona Offshore Wind Project could result in greater frequency at which vessels meet one another.
6	Impact on modelled risk of collision and allision	The Mona Offshore Wind Project could increase the risk of collision between navigating vessels or allision with infrastructure, such as through the creation of choke points, reduced sea room or increased vessel movements.
7	Impact to vessel emergency response	The Mona Offshore Wind Project could adversely impact a vessel's ability to respond to an emergency.
8	Impact to SAR	The Mona Offshore Wind Project design could inhibit SAR access for vessels or aircraft during an emergency.
9	Impact to O&G activities and safety	The Mona Offshore Wind Project could disrupt or impede O&G activities or safety of installations or vessels.
10	Impact on communications, radar and positioning systems	The Mona Offshore Wind Project infrastructure could interfere with shipboard or land-based equipment essential to communications or positioning.
11	Impact on risk of snagging	Subsurface infrastructure could pose a risk of snagging of fishing gear on ship anchors.
12	Impact on UKC and grounding risks	Subsurface infrastructure could reduce the navigable depth and increase the risk of grounding.
13	Impacts during construction and decommissioning activities	The construction or decommissioning of the Mona Offshore Wind Project could have additional impacts above those described above.

1.8.1.2 Furthermore, three other impacts were identified by stakeholders, which are not considered within the scope of the NRA as described below.

1.8.1.3 Socio-economic impacts due to disruption of ferry or commercial services. Several stakeholders raised concerns on how cancellation or disruption to services as a result of increased steaming time could impact the Isle of Man through the transport of goods in a 'just-in-time' economy, medical supplies and tourists or business travellers amongst others. The socio-economics assessment and approach for considering potential impacts of the Mona Offshore Wind Project on the Isle of Man is set out within Volume 4, Chapter 3: Socio-economics of the Environmental Statement.

1.8.1.4 The presence of the Mona Offshore Wind Project may increase the travel distance of vessels which increases their fuel consumption and emissions of greenhouse gases. Measures such as the Energy Efficiency Existing ship Index introduced by the IMO could therefore be impacted. The climate change assessment and approach for considering potential impacts of the Mona Offshore Wind Project is set out within Volume 4 Chapter 2: Climate change of the Environmental Statement.

1.8.1.5 The presence of the Mona Offshore Wind Project may reduce the opportunities for operators to develop new routes where market conditions allow, by increasing the transit distance and makes them less competitive. This is considered separately in Volume 4 Chapter 3: Socio economics of the Environmental Statement.

1.8.2 Impact to recognised sea lanes essential to international navigation

1.8.2.1 As referenced in section 1.2.1, UNCLOS Article 60 and NPS EN-3 recognise that offshore wind farms should not interfere with the use of recognised sea lanes essential to international navigation.

1.8.2.2 The TSS Liverpool Bay and TSS Off Skerries are charted IMO routeing measures which provide the only route for large ships into Liverpool. This meets the definition of sea lanes essential to international navigation. The Mona Array Area is located to the northwest of the Liverpool Bay TSS at 4.4 nm distance. The separation distance would be 2.1 nm for vessels navigating due west along the most extreme north part of the Liverpool Bay TSS.

1.8.2.3 Figure 1.41 identifies the 2022 vessel tracks navigating the TSS. With the Mona Offshore Wind Project in place, the majority of tracks from the west Off Skerries TSS would pass clear to the southwest of Mona with no direct impact. For those arriving from the northwest, they would necessarily deviate to the southwest of Mona, but have continued access into Liverpool Bay TSS (see section 1.8.2). Therefore, given that the presence of the Mona Offshore Wind Project does not prevent access into Liverpool through the TSS, it is not considered that the Mona Array Area would interfere with these sea lanes. Passage adjacent to an offshore wind farm does however create an increased risk of collision or allision as described in the following sections.

1.8.2.4 During consultation, several stakeholders asserted that historic routes between any two ports are necessarily ‘recognised sea lanes’ and therefore could not be impacted. A review of UNCLOS Article 22 determines that: ‘4. The coastal State shall clearly indicate such sea lanes and TSS on charts to which due publicity shall be given’. Therefore, the onus is on the MCA to put forward a proposed sea lane to IMO who would formally designate it. Given that this has not occurred, and no such routes are indicated on charts, Article 60 and NPS EN-3 2.6.161 would not apply. Furthermore, given that alternative routes exist around the Mona Array Area, albeit at a greater transit distance (see section 1.8.3 and 1.8.3.16), they do not provide unique access and so cannot be regarded as ‘essential’. These principles were discussed during the Examination of the Thanet Extension Offshore Wind Farm and were reaffirmed by the Examining Authority in their Recommendation Report (Planning Inspectorate, 2019).

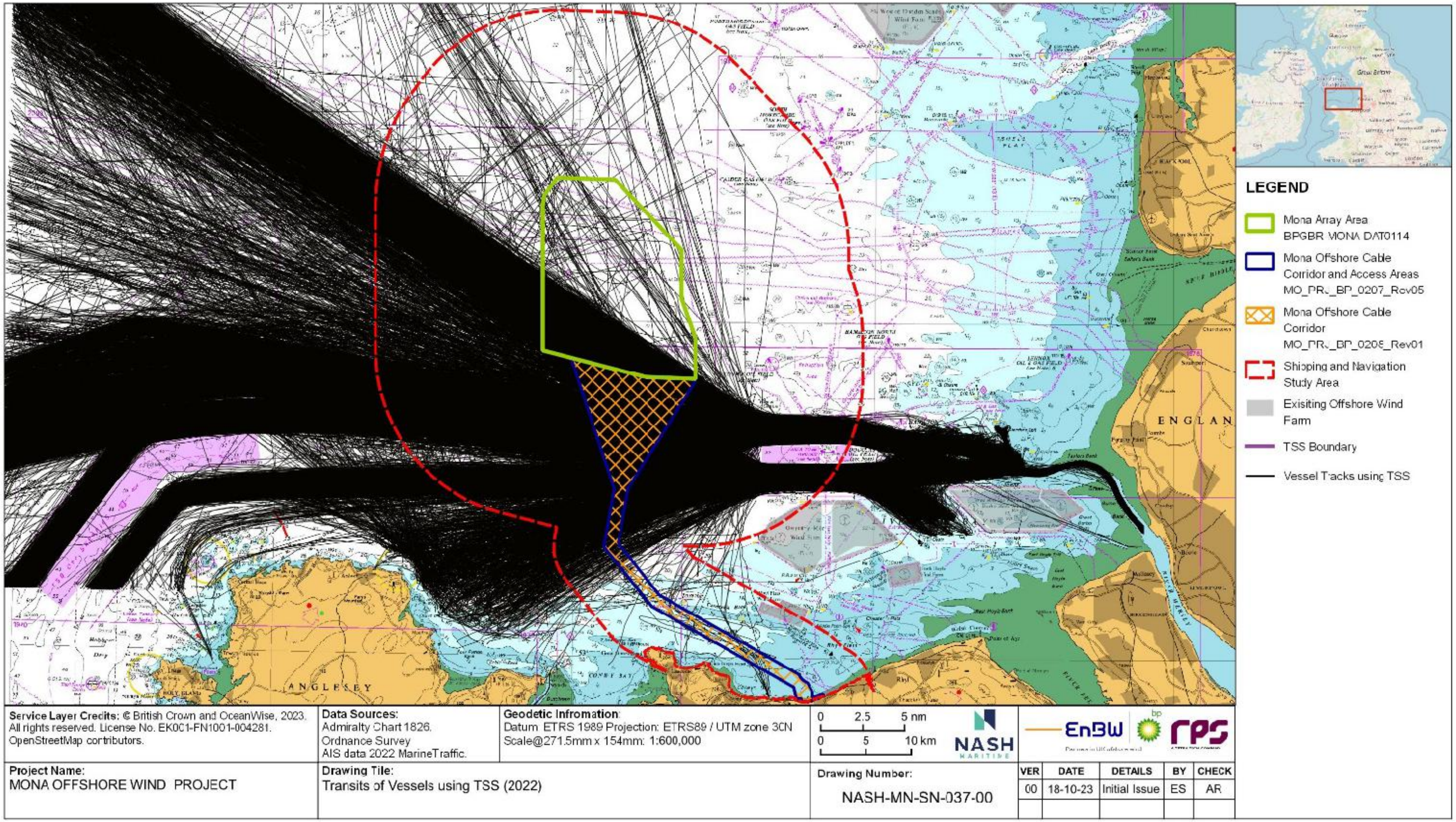

Figure 1.41: Transits of vessels using TSS (source: MarineTraffic 2022).

1.8.3 Impact to ferry vessel routeing

1.8.3.1 Offshore wind farms can impact on vessel routeing by creating an obstacle in otherwise navigable waters that requires a deviation of their route. For regular runners such as ferries, this has the potential to result in a significant increase in costs or make schedules unviable. Furthermore, impacts on routeing may result in increased risks of collision or allision, which are considered elsewhere in section 1.8. During consultation, ferry operators raised several existing operational constraints which should be considered in conjunction with the increase distance to clear an offshore wind farm:

- Schedules: Existing schedules are developed to maintain consistent arrival and departure times per 24-hour period. This may not be achievable with increased transit time on some routes
- Increased fuel: Increased transit distance necessitates an increase in fuel burn which has a direct additional cost to operators. Furthermore, this would increase the environmental impact of their operations through increased emissions
- Hours of Rest: The Maritime Labour Convention requires 10 hours of rest in any 24-hour period, in a maximum of 2 periods, of which at least 6 hours must be uninterrupted. Existing schedules enable this requirement to be met, but increased transit duration could make compliance with the convention impossible without compromising schedules or hiring additional crew
- Turn-around times: Turn-around times within ports are constrained to enable safe loading and unloading. During busy periods, it may not be possible to reduce this duration to make up lost time due to increased transit duration
- Berth/port constraints are also an additional constraint. Several ports have clear operational constraints where delays might result in missing crucial arrival windows
    - Heysham – Has a tight entrance, which in combination with strong tides and wind conditions, makes berthing challenging. The harbour is also dredged but occasionally arrival at spring low tides is not achievable with sufficient UKC, requiring amendments to timetables
    - Douglas – Berthing in certain wind conditions is challenging and may result in cancellations
    - Warrenpoint – Is also tidally constrained
    - Belfast – There is a limitation on berths given the number of vessels operating on a route
    - Liverpool – Constrained by lock timings and other vessel movements
    - Dublin – Relocation of freight terminals further from the seaward entrance would increase transit duration.

Ferry routeing in normal conditions

1.8.3.2 Passenger or freight ferry services have been identified operating within the shipping and navigation study area (see section 1.6.3). Therefore, where these routes intersect the Mona Array Area, deviations would be necessary. It is recognised that previous offshore wind projects in the Irish Sea (Barrow, Ormonde, Walney and West of Duddon Sands) have each impacted upon ferry routeing since 2004 (Anatec, 2016). Operators have necessarily had to adjust their passage plans to accommodate previous projects and the nature of these projects has not made any existing routes unviable.

1.8.3.3 During navigation simulations, it was demonstrated that the waters around the Mona Array Area could be safely navigated in typical weather conditions and in the absence of other traffic (Appendix E). However, it was recognised that additional transit time was necessary as a result of deviated passage plans.

1.8.3.4 Figure 1.42 shows the anticipated outline routes that operators would take were the Mona Offshore Wind Project in place. These were developed following a review of the current passage plans provided by each operator and a review of the potential impacts of the Mona Offshore Wind Project upon them. Each revised passage plan was developed by the Applicant’s consultant project team, including master mariners, and incorporate existing decision making principals (such as passing at least 1.5 nm from a wind turbine) that were obtained during consultation with operators and the navigation simulation sessions.

1.8.3.5 Based on these anticipated routes, Table 1.25 summarises the additional transit distance and time as a result of passing clear of the Mona Array Area, given their average vessel speed taken from the 2022 AIS data. All four ferry operators’ have routes which pass adjacent to the Mona Array Area, with only the Stena Liverpool to Belfast routes that travel west of the Isle of Man (both east and west of the Liverpool Bay TSS) directly intersecting the site.

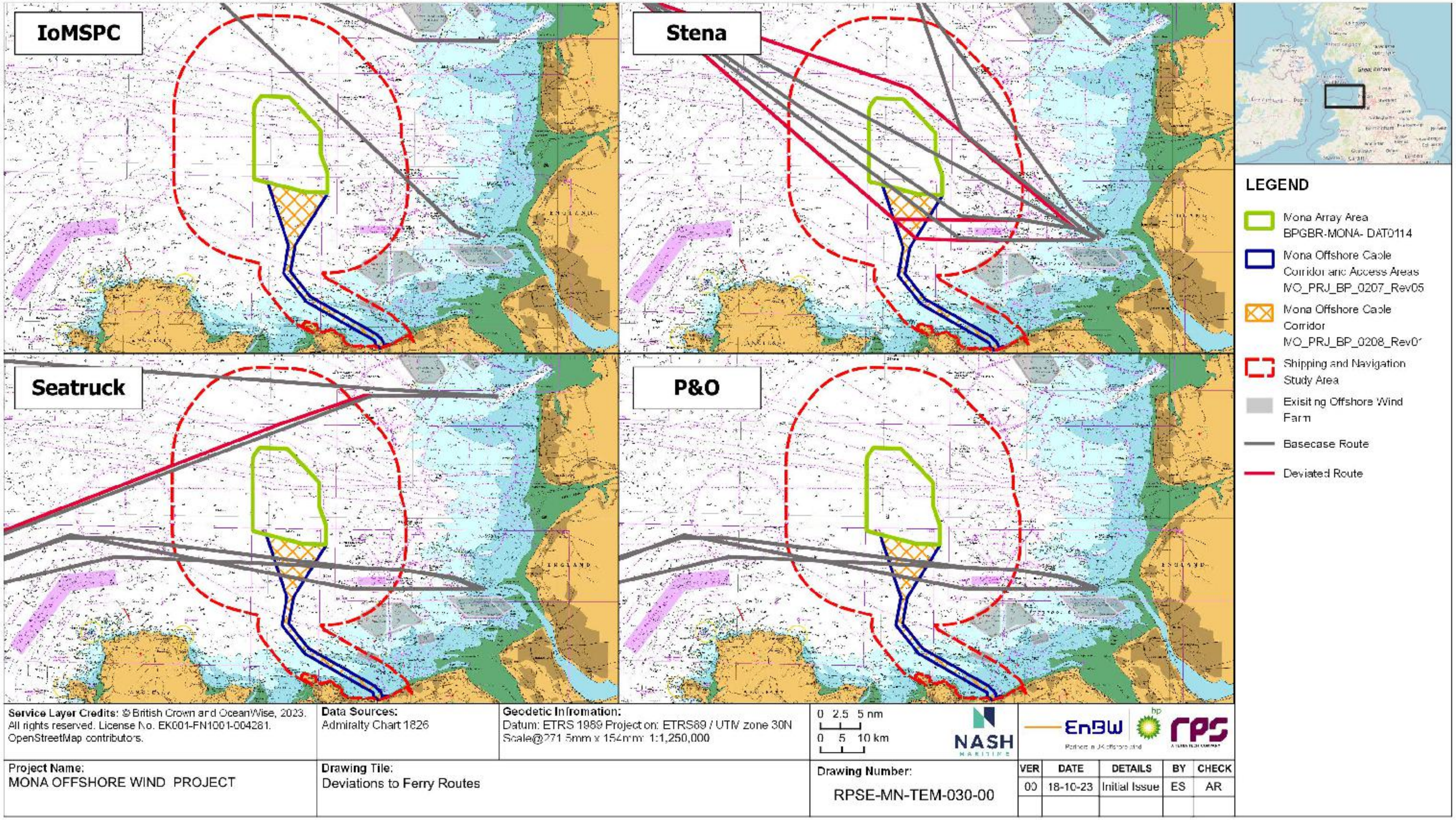

Figure 1.42: Deviations to ferry routes.

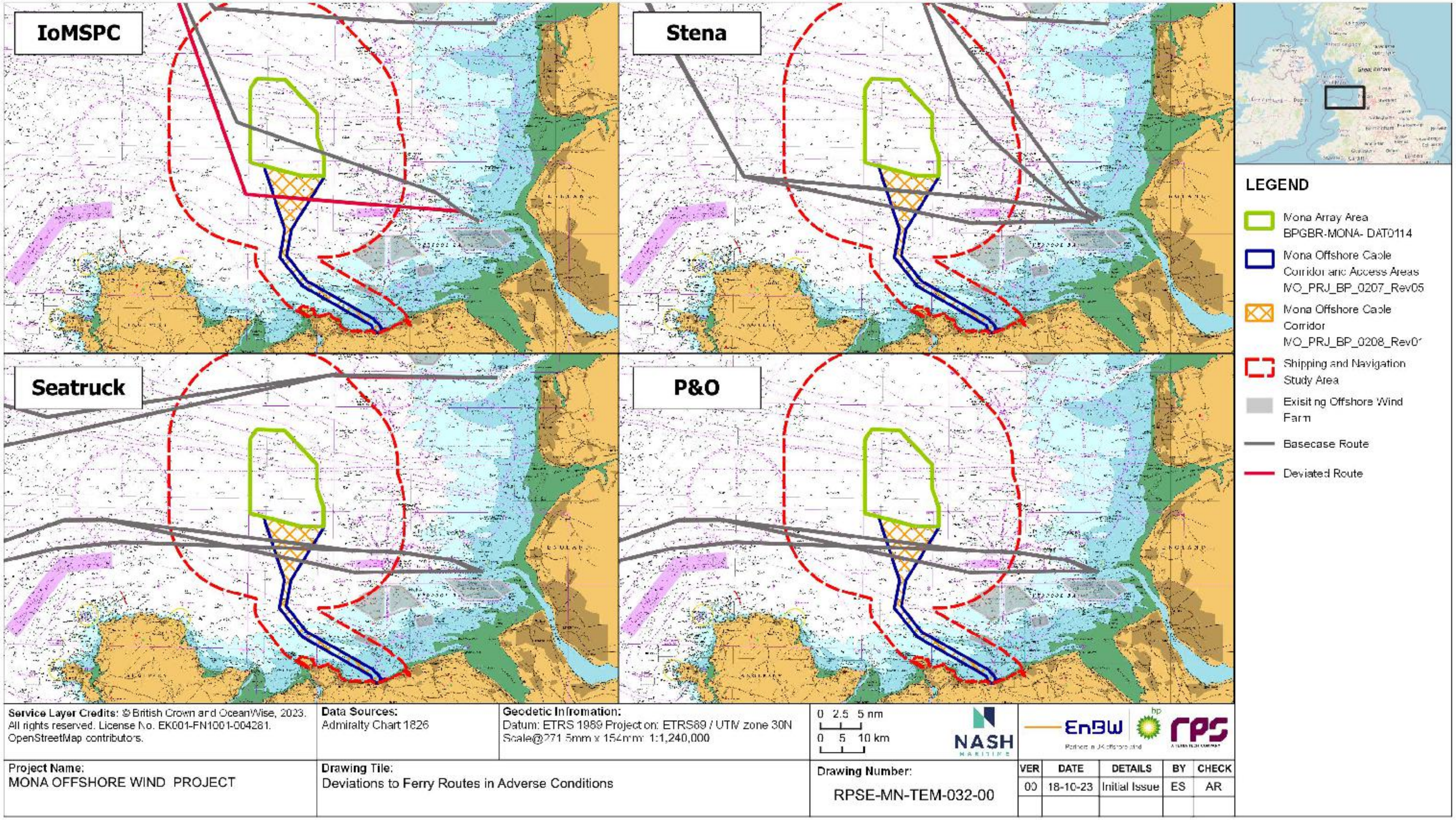

Figure 1.43: Deviations to ferry routes in adverse conditions.

1.8.3.6 Stena Line operate a route between Liverpool and Belfast, and whilst there are several routes out of Liverpool, the most frequent route passing to the west of the Isle of Man directly intersects the central Mona Array Area. A revised passage plan was developed that passes to the east and north of the Mona Array Area. Vessels would depart Liverpool as they currently do before heading more north northwest than at present, passing 1.5 nm from the Hamilton North Gas Field and single buoy mooring, before turning to port 1.5 nm from the northeast boundary of Mona in order to clear Chicken Rock on the Isle of Man at their existing waypoint.

1.8.3.7 Given this passage plan, vessels on the Stena Liverpool to Belfast route would necessarily transit an additional 1.1 nm and 3.4 minutes. The advertised service is eight hours, with AIS analysis suggesting that the average crossing duration (limited to the extent of the east Irish Sea) is 260 minutes. There is some variation in transit time but 72% of 2022 trips were within 20 minutes of the average. Therefore, given the crossing duration of several hours, a natural variation in crossing of up to 20 minutes and natural variation in turn around times within port, between four and seven minutes of additional transit time is not considered to render this service unviable but will increase operational pressures and fuel consumption.

1.8.3.8 A small proportion of Stena Line vessels on passage between Liverpool and Belfast choose to take the TSS when departing or arriving in Liverpool. A revised passage plan would take them further west, past the Mona Array Area, before turning north. This would necessitate an additional four to seven minutes of transit (depending on direction). An alternative route for Stena Line is passing to the east of the Isle of Man, which passes clear of the Mona Array Area.

1.8.3.9 Seatruck operate a route between Heysham and Dublin which passes within 1.2 nm of the northern boundary of the Mona Array Area. In order to pass more than 1.5 nm, a minor deviation of 0.1 nm is required which would result in an additional 20 seconds of transit time on an eight hour journey and is considered negligible.

1.8.3.10 All other ferry routes pass more than 1.5 nm clear of the Mona Array Area.

Table 1.25: Impact on ferry routeing.

Parameter	Stena LIV-BEL-W	Stena LIV_BEL_W (TSS)	Seatruck HEY_DUB
Example Vessels (2019 to 2022)	Stena Edda/Stena Embla/Stena Estrid/Stena Foreteller	Stena Edda/Stena Embla/Stena Forecaster/Stena Foreteller	Seatruck Pace/Seatruck Panorama
Approximate Annual Crossings (2022)	1,098	392	606
Baseline Distance (nm)	113.3	W: 115.2 E: 115.9	109.3
Baseline Time (Minutes)	480	480	480
Service Speed (Knots)	18.7	18.7	15.0
Deviated Distance (nm)	114.4	W: 117.3 E: 117.1	109.4
Additional Time with Mona Array Area (Minutes)	+3.4	W: +6.8 E: +3.9	+0.3

Ferry routeing in adverse weather

1.8.3.11 Where significant adverse weather is encountered, ferries take less direct routes to take advantage of lees from land masses, avoiding dangerous sea states or minimising the motions onboard. The navigation simulations demonstrated that without being able to adequately weather route, excessive roll was experienced that posed a hazard to the vessel and made controlling the vessel more challenging (Appendix E).

1.8.3.12 Figure 1.43 shows anticipated adverse weather routeing with and without the Mona Offshore Wind Project in situ. The 2022 AIS data has been used to estimate the impact on vessel routes in adverse weather (Table 1.26). Each revised passage plan was developed by the Applicant's consultant project team, including master mariners, and incorporates existing decision making principles and passage plans provided by operators (such as passing at least 1.5 nm from a wind turbine) that were obtained during consultation with operators and the navigation simulation sessions. All four ferry operators' have adverse weather routes which pass adjacent to the Mona Array Area, with only IoMSPC Liverpool to Douglas and Stena Liverpool to Belfast (west of the Isle of Man) routes intersecting the Mona Array Area.

1.8.3.13 The IoMSPC route between Liverpool and Douglas, primarily using the high speed ferry Manannan, typically weather routes to the southwest to more sheltered water and may choose to reduce speed to minimise slamming experienced in rough seas. Typically, at the time of writing, there is between a 10 and 33 minute delay per crossing in adverse weather. With the Mona Array Area in place, the master may choose to more frequently pass to the southwest of the Mona Array Area and will need to pass a greater distance than they normally do. This may account for an additional increase in transit time of 13 minutes, and therefore a total delay of between 23 and 46 minutes per crossing. It was noted that on occasion, the Manannan currently chooses to take an adverse weather route that avoids the area of sea where the Mona Array Area would be, as whilst this is extra distance, the sheltered water offer an opportunity to maintain full speed to compensate.

1.8.3.14 The Stena Line route between Liverpool and Belfast, whilst it typically intersects the Mona Array Area, chooses a similar action as to the IoMSPC, taking advantage of the lee of the Welsh coast. Therefore, on the majority of occasions, the Stena adverse weather route clears the Mona Array Area and no additional impact on transit duration as a result of the construction is anticipated. It is however recognised that masters may need to more frequently choose an adverse weather route should they wish to avoid passing east and north of the Mona Array Area.

Table 1.26: Impact on ferry routeing in adverse weather.

Parameter	IOMSPC LIV-DOUG
Principal Vessels (2019 to 2022)	Manannan
Approximate Annual Crossings with Significant Deviation (2022)	30 of 600
Base Case Adverse Weather Distance (nm)	61.2
Base Case Time (Minutes)	165
Total Delay Base Case (Minutes)	+10 to +33
Service Speed (knots)	26
Additional Distance due to Mona Array Area (nm)	4.5
Additional Time due to Mona Array Area (Minutes)	+12.5
Approximate Delay with Mona (Minutes)	+22.5 to +45.5

1.8.3.15 During adverse weather, some sailings are delayed or inevitably cancelled irrespective of the presence of the Mona Array Area. However, with the presence of the Mona Offshore Wind Project, where sailings are safe to take place, they may be required to route a greater distance and duration (Table 1.26). Over the course of a day, the aggregation of these delays would result in the potential for additional sailings to be cancelled where constraints such as hours of rest are exceeded. Such effects are already experienced by operators, but the presence of the Mona Offshore Wind Project could exacerbate this.

Summary

1.8.3.16 The assessment of impacts of the Mona Array Area on ferry vessel routing has shown that existing services would not be considered unviable in normal weather conditions. However, in adverse weather, the reduced sea room and increased duration would necessitate additional operational constraints and potential cancellations to these services.

1.8.4 Impact to cargo/tanker vessel routeing

1.8.4.1 Offshore wind farms can impact on vessel routeing by creating an obstacle in otherwise navigable waters that requires a deviation of their route. For cargo/tanker vessels this has the potential to result in a significant increase in costs or make schedules unviable. Furthermore, impacts on routeing may result in increased risks of collision or allision, which are considered elsewhere in section 1.8.6 and 1.8.7.

Cargo/tanker routeing in normal conditions

1.8.4.2 Figure 1.44 shows the anticipated changes in cargo/tanker ship routeing. Table 1.27 shows the increased distance transited for each of the identified routes in order to clear the Mona Array Area. Each revised passage plan was developed by the Applicant's consultant project team, including master mariners, and account for existing decision making principals (such as passing at least 1.5 nm from a wind turbine).

1.8.4.3 The most significant shipping routes in the shipping and navigation study area (>1 vessel per day) are between Off Skerries TSS and Liverpool Bay TSS and into the Port of Liverpool. These are relatively unaffected by the Mona Offshore Wind Project with no additional transit duration. The routes from the west of the Isle of Man and Liverpool Bay TSS would necessitate a minor deviation around the southwest corner of the Mona Array Area, however this would be less than 2 nm per movement.

1.8.4.4 Less trafficked routes are more dispersed within the shipping and navigation study area and therefore greater deviations are encountered in response to the Mona Array Area. The majority of other affected routes are of similarly low intensity and typically are routeing to the north of the Mona Array Area into Heysham. Some routes have minor reductions in distance where less direct routes (routinely used to avoid traffic or weather) are no longer possible. Furthermore, this necessitates greater course changes to pass around the Mona Array Area, or as is the case for Routes 7 and 8, necessitates not utilising the Off-Skerries TSS when they previously would have.

1.8.4.5 Given the low intensity of the most impacted routes, their greater distance travelled and the lower criticality of their schedules, the impacts identified are unlikely to make their operations unviable.

Table 1.27: Increase in distance for impacted cargo/tanker routes.

ID	Route	Approximate annual crossings (2022)	Baseline distance (nm)	Total distance due to Mona (nm)	Additional project distance (nm)	Total additional distance/year (nm)
6	Off Skerries TSS to Heysham(E)	23	59.9	62.9	+3	+69
7	Off Skerries TSS to Barrow (W)	4	72.7	73.2	+0.5	+2
8	Heysham to Off Skerries TSS (W)	7	62.0	64.5	+2.5	+17.5
13	Liverpool Bay TSS to W IoM (W)	533	67.6	69.3	+1.7	+906.1
18	Liverpool to W IoM	153	66.3	68.8	+2.5	+382.5
19	Douglas to Liverpool Bay TSS (E)	9	67.4	70.9	+3.5	+31.5
22	Douglas to Liverpool Bay TSS	8	59.8	58.4	-1.4	-11.2
26	Liverpool Bay TSS to Northern Irish	55	65.2	65.6	+0.4	+22
27	Douglas to Liverpool	6	58.9	58.4	-0.5	-3

Cargo/tanker routeing in adverse weather

1.8.4.6 Analysis of adverse weather routeing (section 1.6.3) during 2019 and 2022 named storms did not identify any particular changes to typical routes. There was a greater demand for the anchorages along the Welsh coast, and no discernible impacts of the

Mona Offshore Wind Project are identified for the availability of anchorages for vessels to seek shelter in adverse weather. Some vessels were recorded loitering both to the west and within the Mona Array Area, likely riding the conditions before they could berth. There is sufficient clear sea room to the west of the Mona Array Area for this practice to continue.

Adverse weather pilotage

1.8.4.7 During strong northwesterlies, pilots may be overcarried or boarded at Douglas on the Isle of Man using the lee of the island. This activity can result in convoys of multiple cargo/tanker vessels navigating between Douglas and Liverpool. The 2019 AIS data indicated that half of these identified transits navigated through the Liverpool Bay TSS and therefore would naturally pass to the west of the Mona Array Area.

1.8.4.8 If cargo/tanker vessels were to navigate through the TSS and to the west of the Mona Array Area, this would increase their transit distance by approximately 7 nm which would equate to an additional transit time of approximately 30 minutes. This may have commercial impacts on the ports provision of pilots, albeit this occurs relatively infrequently and the requirement for pilots to transfer between Douglas and Liverpool (before or after the pilotage movement) would be a more significant constraint on time.

Summary

1.8.4.9 Cargo/tanker shipping routes are concentrated into the Port of Liverpool, and therefore minor deviations around the Mona Array Area are required. Minor routes with fewer than three vessels per week would have greater deviations but this is not considered to make such operations unviable.

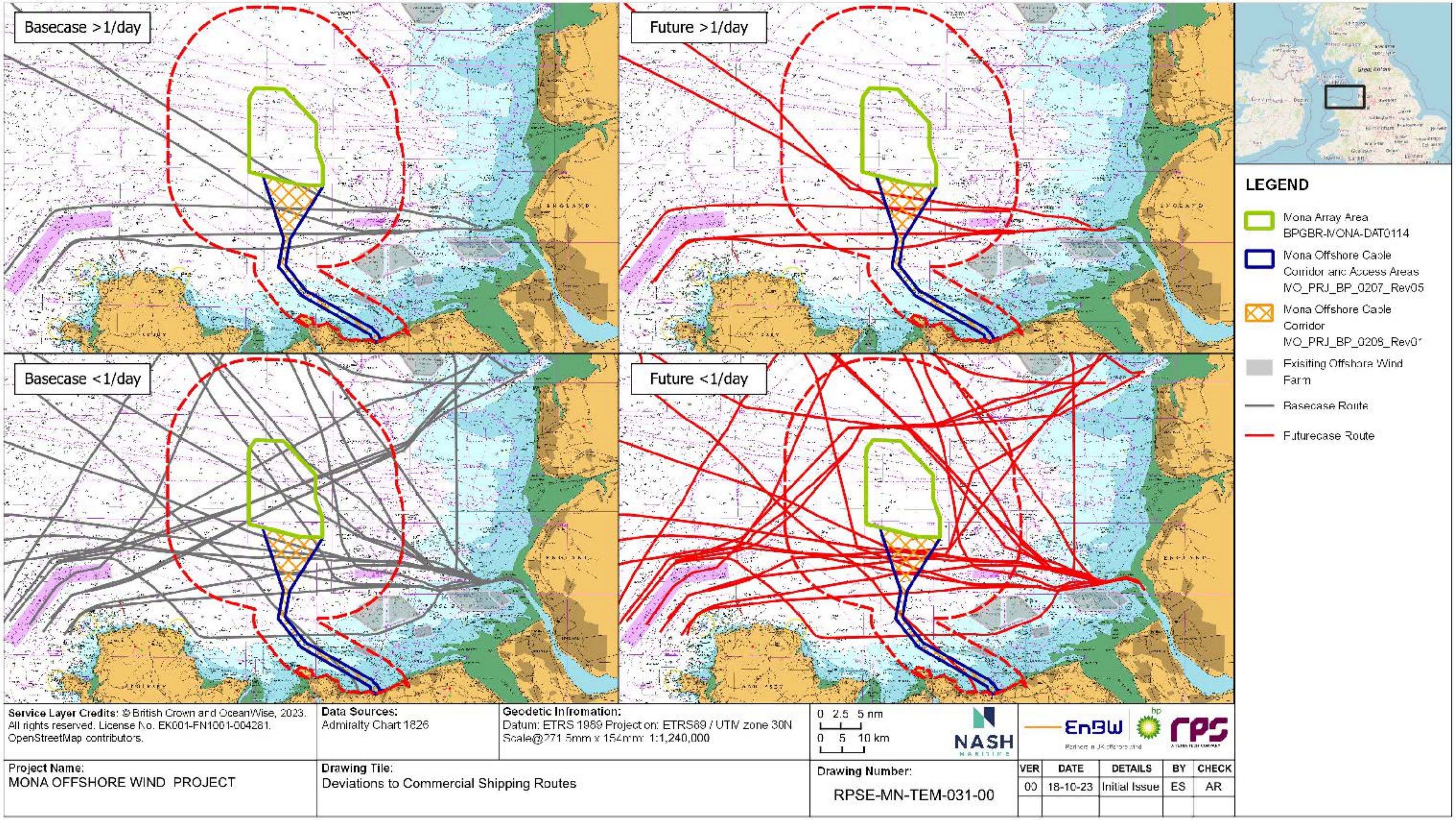

Figure 1.44: Deviations to commercial shipping routes.

1.8.5 Impact to small craft navigation and safety

Recreational

1.8.5.1 The analysis of recreational vessel transits presented in section 1.6.3 identified relatively few cruising routes running across or adjacent to the Mona Array Area; most are concentrated near shore and/or clear of the Mona Array Area. The shipping and navigation study area also shows a low density of AIS tracks compared to adjacent waters, with the exception of the south section of the study area towards Conwy that shows low to moderate recreational activity.

1.8.5.2 During consultation with the RYA, it was noted that recent evidence from AIS data suggests that yachts avoid transiting through an offshore wind farm less than previously thought based on responses to surveys. The 2022 AIS data show that 79% of cruising vessels that sail between Morecambe and Douglas avoided transiting through the existing offshore windfarms (Walney and West of Duddon Sands) by taking a longer southerly route. Much of this evidence has been collected from earlier Round 1 and 2 offshore wind farms, where turbines were generally closer together. The greater turbine spacing for the Mona Offshore Wind Project may promote greater navigation through the Mona Array Area.

1.8.5.3 Vessels sailing along the identified offshore routes would be able to avoid transiting through the Mona Array Area without significantly increasing the passage time or distance. However, this may increase the number of recreational crafts navigating through busier commercial routes, albeit that the density of recreational traffic near to the Mona Array Area is low. The cruising route connecting Liverpool and Douglas runs adjacent to the northeast boundary. The wind turbine structures could impact upon the annual LYC Isle of Man Midnight race from Liverpool to Douglas, which usually has around 10 vessels participating, but had 40 vessels in 2019 (100th anniversary of race).

Fishing

1.8.5.4 A number of commercial fisheries operate within the shipping and navigation study area, with boats based across Welsh, English, Scottish, Northern Irish and Isle of Man harbours, as well as several internationally based vessels (see section 1.6.3 and Volume 6, Annex 6.1: Commercial fisheries technical report).

1.8.5.5 A recent study by the National Federation of Fishermen's Organisations (NFFO) and Scottish Fishermen's Federation has highlighted the potential loss of fishing grounds which offshore wind farms might cause, referred to as 'Spatial Squeeze' (NFFO, 2022). Such an effect may result in boats currently fishing within the footprints of the Mona Offshore Wind Project being offset into the adjacent routes, interacting with other passing traffic and increasing the risk of collision.

1.8.5.6 Fishing boats operating in the shipping and navigation study area of greater than 10 m in length are generally small enough to transit through the Mona Array Area with 1,400 m spacing when on passage to fishing grounds, as evidenced by both their existing passages between turbines within the Irish Sea. The 2022 AIS data was reviewed to identify what fishing activities take place in the existing offshore wind farms, for example, Walney Extension and Gwynt y Môr with less searoom between wind turbines (see Figure 1.22). This may offer greater potential for fishermen to work mobile gear within the Mona Array Area than has been the case historically. It was clear that there is extensive fishing taking place in both of these offshore wind farms. Except during construction or major maintenance, whereby Safety Zones are required, there is no restriction on the ability of fishermen to use mobile or static gear within an offshore wind farm. Skippers would need to consider any hazards, particularly snagging of subsea cables, or risk of allision with wind turbines or collision with CTVs.

1.8.5.7 The majority of the fishing activity in the area is carried out using static gear, which requires less space than mobile gear, which is actively towed and may require the vessel to manoeuvre between each turn. Furthermore, during consultation with fishermen, there is an expectation that fishermen would continue to fish within the Mona Array Area boundaries during the operational phase. The Mona Offshore Wind Project are also working with fishermen to develop mitigation and design principles to facilitate coexistence as far as possible (see Outline Fisheries Liaison and Co-existence Plan, Document reference J13).

1.8.5.8 Current fishing activity described in section 1.6.3 is reflective of where the most favourable fishing areas are located. Fishermen strategically target known fish-rich areas in order to optimise their catch potential and ensure efficient utilization of their time and resources. Upon the completion of the wind farm projects, it is expected that fishermen will continue to fish in the same areas as before, as these areas have been identified as productive fishing grounds. This has been supported through consultation with fishing representatives. If fishing activities are displaced from the wind farm areas, it is unlikely that fishermen will concentrate their efforts adjacent to the Mona Array Area, as these locations are already being targeted and there is a need not to overfish the stocks. Furthermore, for static fishermen, placing gear in navigational routes may result in greater loss of gear which is costly to replace.

1.8.5.9 Fishing activity in areas adjacent to the Mona Array Area is anticipated to remain low, with limited numbers of vessels operating at a low speed (i.e., less than two knots). Furthermore, it has been demonstrated through navigation simulations that there would be sufficient sea room to enable passing distances of more than 1 nm from fishing vessels. As a result, there is abundant space available for other marine users, in particular ferries, to navigate and avoid potential conflicts with the fishing operations in these areas.

Tug and Service

1.8.5.10 Vessels operating between O&M bases and O&G platforms may pass near to the Mona Array Area. In most cases, with the exception of where decommissioning activities will take place, there is at least 1 nm of suitable clearance between turbines and platforms such that the Mona Offshore Wind Project does not impede this activity.

1.8.5.11 The routes to be taken by Mona Offshore Wind Project construction and O&M vessels are not known. Historical incident analysis at other projects suggests that an allision between a CTV and a wind turbine occurs more frequently than other incident types. These risks can be managed through the application of existing risk control measures.

1.8.5.12 A clear additional risk of the Mona Offshore Wind Project are the additional vessel movements supporting O&M and their interaction with other traffic. In particular, it is likely that multiple CTVs will cross between the Mona Array Area and interact with other passing traffic, including ferries and fishing boats. These can be managed through implementation of a Vessel Traffic Management Plan (Document Reference J.14) and other applied risk controls (see section 1.4.8).

1.8.6 Impact on vessel encounters and collision avoidance

Development of realistic traffic scenarios

1.8.6.1 Given the changes to passage plans, consultation and vessel traffic surveys, realistic traffic scenarios have been developed to inform the risk assessment in Table 1.28. These were used as inputs to the navigation simulation and help inform the likelihood that two vessels might meet one another.

Commercial vessel meeting situations

1.8.6.2 A key factor in the risk of collision is the frequency at which two vessels would meet within the same areas of sea at the time, necessitating some action to be taken by the vessels. By modelling how vessel routes may change with the Mona Array Area, and taking into account vessel timetables, the concurrent frequency of two commercial vessels meeting can be calculated. For example, were a vessel to depart Liverpool, the presence of the Mona Array Area could require a deviation to the south through the TSS, resulting in new meeting situations which would not have previously occurred.

1.8.6.3 The analysis is conducted for the waters between the Liverpool Bay TSS south of the Mona Array Area. Given the low proportion of fishing and recreational vessels which carry AIS, only cargo, tankers and passenger vessels (including ferries) have been included in this analysis. Furthermore, as this analysis focusses on ship routes, non-direct transits such as loitering or pilot boarding have not been captured.

1.8.6.4 All commercial vessel tracks within the 2022 AIS data were processed and deviated around the Mona Array Area. For every minute of the year, a count was performed of the number of vessels present in each region. Over the total year, the percentage of time in which zero, one, two or more vessels were counted is then given.

1.8.6.5 For the route with the TSS south of the Mona Array Area, no commercial vessels are predicted for 35% of the time and 65% of the time there would be one or more vessels navigating this gap. 31.6% of the time there would be two or more vessels be within this route, 12.2% there would be three or more and 3.8% there would be four or more. The Mona Array Area could result in vessel traffic approaching Liverpool from the west of the Isle of Man entering this route earlier. Therefore, whilst the absolute numbers of commercial vessels in this region does not increase, they would spend longer transiting within the TSS and its approaches, potentially encountering more traffic.

1.8.6.6 Whilst vessels may converge more often in the regions to the north and east of the Mona Array Area, the absolute numbers of vessels would not change substantially.

Table 1.28: Realistic traffic scenarios.

Area	Scenario	Potential traffic situation	Justification
South of Mona	Reasonable Day to Day Situation (<50% transits)	2 Ferry, 3 Cargo/tanker Ships, 1 Service and 1 Fishing	Ferries: Confluence of Stena/P&O routes, likely to meet another ferry, albeit separated between routes from Anglesey/Isle of Man. Cargo/tanker: Major shipping route through TSSs. Likely to meet multiple ships. Tug and Service: Movement of tug and service craft into Liverpool or between the O&G fields may be encountered. Fishing: Occasional fishing around project sites. Radar survey recorded up to two fishing boats during summer survey in the Mona Array Area. Recreational: Radar surveys showed relatively few recreational vessels in central Irish Sea, concentrated inshore to the south of the Mona Array Area. Up to two recreational craft crossing through site per day from summer surveys (noting negligible during winter survey). Likely to keep clear of shipping lanes, and further inshore. Mona Offshore Wind Project vessels: Mona traffic likely to cross route or transit through it, generally together or in a convoy. Likely that passage does not coincide with this activity.
	Unlikely but Occasional Situation (<10% transits)	2 Ferry, 5 Cargo/tanker Ships, 1 Tug and Service, 1 Fishing, 1 Recreational and 6 Project Vessels Crossing	
	Reasonable Worst Credible (<1% transits)	3 Ferry, 8 Cargo/tanker Ships ,1 Tug and Service, 2 Fishing, 2 Recreational and 6 Project Vessels Crossing	
North of Mona	Reasonable Day to Day Situation (<50% transits)	2 Ferry and 1 Fishing	Ferries: Reasonable likelihood of meeting another ferry (Seatruck/IoMSPC/Stena). Potential for up to three ferries to converge. Cargo/tanker: Anticipated to take TSS and pass southwest of Mona. Some small general cargo vessels <150 m may occasionally navigate to the east, but infrequently. Some small shipping is bound for Heysham and Douglas. Tug and Service: Repositioning of standby vessels possible. Fishing: Occasional fishing around project sites. Radar survey recorded up to two fishing boats during summer survey in the Mona Array Area. Recreational: Radar surveys showed relatively little recreational vessels in central Irish Sea. Up to two recreational craft crossing through Mona Array Area per day from summer surveys (noting no recreational craft during winter survey). Mona Offshore Wind Project Vessels: Not anticipated.
	Unlikely but Occasional Situation (<10% transits)	2 Ferry, 1 Tug and Service and 1 Fishing	
	Reasonable Worst Credible (<1% transits)	2 Ferry, 1 Cargo/tanker, 1 Tug and Service, 2 Fishing and 2 Recreational	
East of Mona	Reasonable Day to Day Situation (<50% transits)	2 Ferry and 1 Tug and Service	Ferries: Reasonable likelihood of meeting another ferry (IoMSPC/Stena). Reasonable potential for up to two ferries to converge.

Area	Scenario	Potential traffic situation	Justification
	Unlikely but Occasional Situation (<10% transits)	2 Ferry, 1 Cargo/tanker, 2 Tug and Service, 1 Fishing and 1 Recreational	Cargo/tanker: Anticipated to take TSS and pass SW of Mona. Some small general cargo <150 m may occasionally navigate to the east of Mona, but infrequently. Tug and Service: Repositioning of standby vessels possible and loitering around existing Hamilton/Conwy fields southeast of Mona. Fishing: Occasional fishing around project sites. Radar survey recorded up to two fishing boats during summer survey in the Mona Array Area. Recreational: Radar surveys showed relatively little recreational vessels in central Irish Sea. Up to two recreational craft crossing through site per day from summer surveys (noting no recreational craft during the winter survey). Mona Offshore Wind Project Vessels: Not anticipated.
	Reasonable Worst Credible (<1% transits)	2 Ferry, 2 Cargo/tanker, 2 Tug and Service, 2 Fishing and 2 Recreational	

Increased vessel encounters

1.8.6.7 Encounter modelling was undertaken to compare the number of meeting situations before and after the construction of the Mona Array Area. A key advantage of encounter modelling is including the temporal element to vessel timetables that are not normally assessed in conventional quantitative maritime risk models. The model uses the concept of a "ship domain", an area of water around a vessel which the master wishes to keep clear. Where a vessel breaches this domain, an encounter occurs, and whilst not necessarily a near miss, could reasonably interpreted to indicate a potential risk of collision. By comparing the number of encounters before and after the construction of an offshore wind farm, an appreciation of the greater frequency of meeting situations is derived.

1.8.6.8 The ship domain model was developed based on a combination of academic research and a review of existing passing arrangements between vessels within the shipping and navigation study area. A dynamic domain was developed that included speed and vessel length. A vessel travelling faster would maintain a greater area clear ahead to respond to a collision situation. A larger vessel may be less manoeuvrable so would maintain a greater clearance from other vessels to give adequate time to respond.

1.8.6.9 The domain was formed of an oval consisting of a forward domain of three minutes modified by vessel size and a port/starboard/aft domain of a function of both speed and length.

1.8.6.10 Figure 1.45 shows an example of the base case encounter model, with different sized domains reflective of different vessel sizes and speeds. For example, a 187 m ferry travelling at 18 knots would have a domain of 2.3 nm by 0.7 nm whereas a small workboat travelling at a similar speed would have a domain of 0.5 nm by 0.1 nm. A stationary vessel has a domain equal to twice the vessel length.

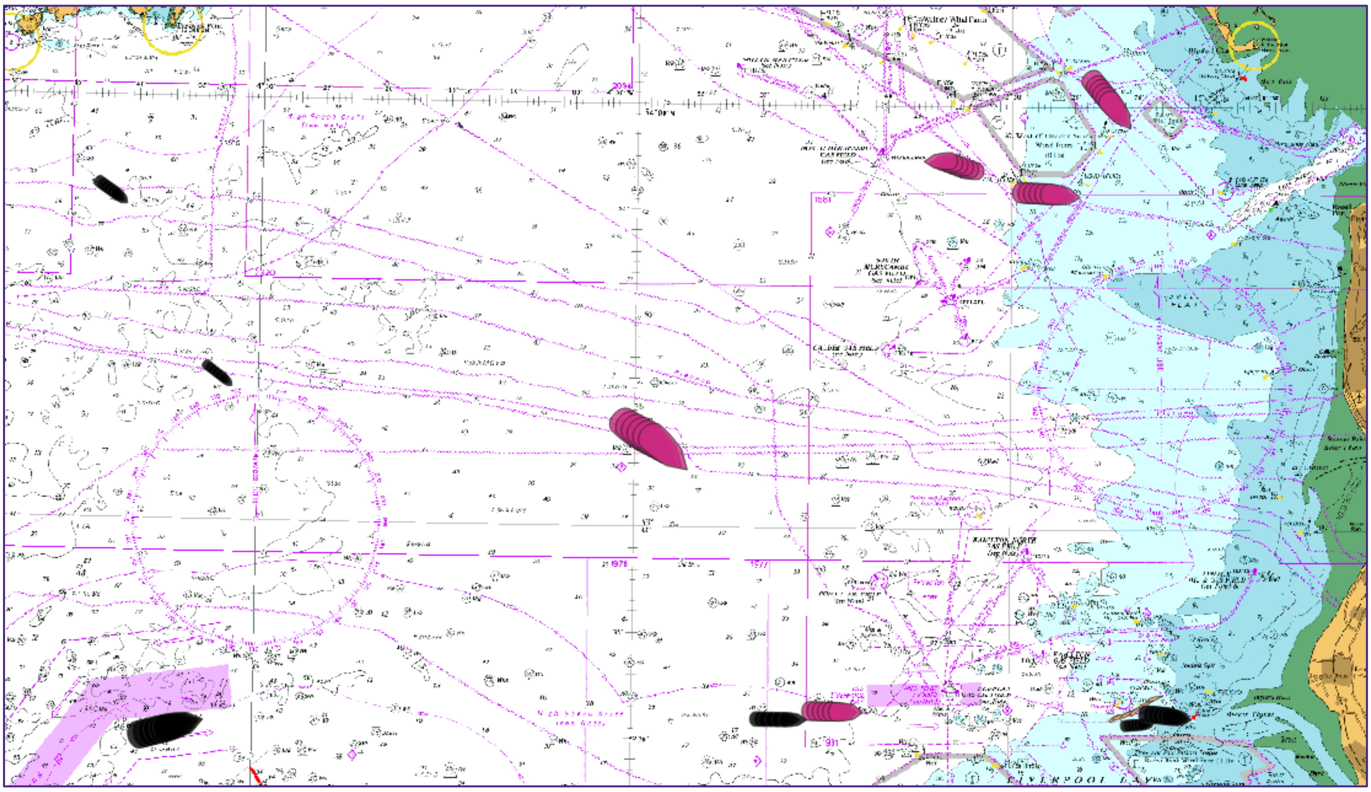

Figure 1.45: Example ship domain model.

1.8.6.11 Many encounter situations between vessels, such as overtaking, may occur over several minutes. To avoid multiple counting of the same encounter event, only the position at which the encounter with the Closest Point of Approach (CPA) was retained. The modelling was limited to the shipping and navigation study area of 10 nm around the Mona Array Area, and therefore excludes the constrained waterways in harbours/approach channels where vessels naturally come close together (e.g. the Mersey).

1.8.6.12 For the base case scenario, without the Mona Array Area in place, the model was run and the number of encounters between vessels assessed. Future case route modelling was used to develop the future case scenario and the assessment repeated (with revised boundaries). All re-modelling was conducted on 2022 AIS data and therefore has the potential to underrepresent with small craft. Further discussion of collision risk involving small craft is contained in section 1.8.5.

1.8.6.13 Across the shipping and navigation study area, in total, 2,137 encounters were recorded during the 2022 base case (5.8/day). Of these, 43% involved large commercial vessels encountering other commercial vessels. Three quarters occurred south of the Mona Array Area within the approaches to Liverpool or to the east as vessels converge north of the TSS Liverpool Bay. Risk controls have been adopted (such as TSS/pilotage) to manage this risk in these busy locations. Less than 10% occurred within the boundaries of the Mona Array Area.

1.8.6.14 With the future case scenario, a total of 2,105 encounters occurred, less than a 2% difference to the base case. This constitutes:

- Ferry encountering ferry/cargo/tanker exhibited a 26% increase
- Cargo/tanker encountering cargo/tanker exhibited a 7% increase
- Ferry/cargo/tanker encountering a small craft exhibited a 27% decrease
- Small craft encountering small craft exhibited a 0% increase.

1.8.6.15 Figure 1.46 shows the change in encounters across the shipping and navigation study area. This demonstrates that whilst hot spots are identified to the south and northeast of the Mona Array Area, these are largely offsetting existing meeting situations which currently occur within the footprint of the Mona Array Area adjacent sea area. These largely involve ferries with other ferries or other large commercial vessels.

1.8.6.16 Whilst there is a 26% increase in encounters involving ferries, this is primarily due to converging routes at the extremities of the Mona Array Area, particularly the north corner. During the navigation simulations it was demonstrated that there was sufficient sea room here to take appropriate action to avoid a crossing or meeting situation.

1.8.6.17 The decrease in collisions between large vessels and small craft is the result of modelling deviating ships away from the Mona Array Area whilst assuming that small craft can continue to operate between the wind turbines. Therefore, the potential meeting situations are reduced.

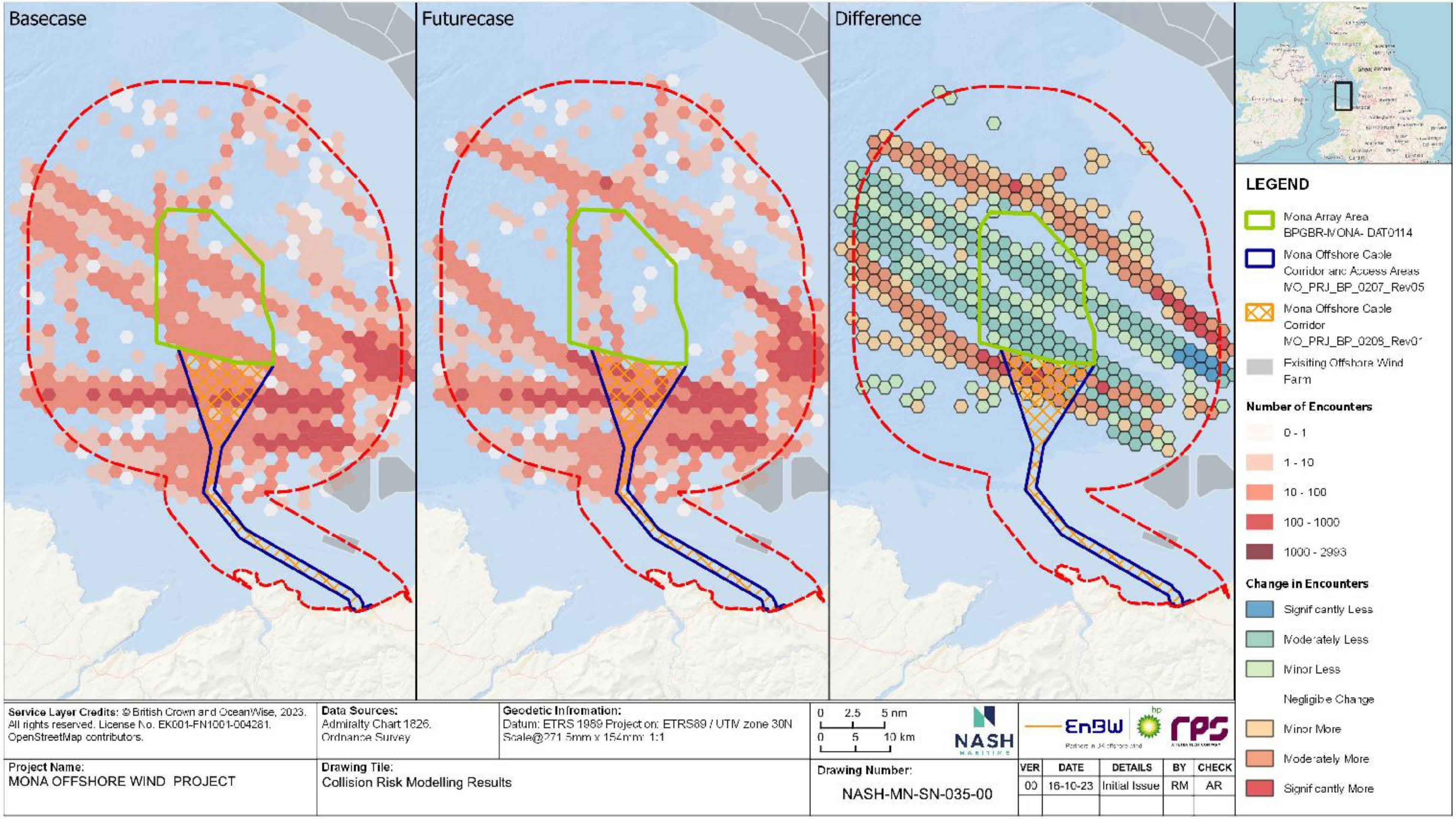

Figure 1.46: Collision risk modelling results.

Impacts of project on visual navigation and collision avoidance

1.8.6.18 MGN654 notes that an offshore wind farm could block or hinder the view of other vessels or any navigational feature such as the coastline or AtoNs. This may result in 'blind spots' between vessels which could increase the risk of collision by reducing the capability for early and effective collision avoidance.

1.8.6.19 Firstly, each individual wind turbine is approximately 10 m in diameter and whilst vessels transit past the site, any two vessels may come in and out of visibility temporarily. Furthermore, there may be challenges identifying the vessels through radar (see section 1.8.11) and targets would be visually less distinct amongst the turbines. Assuming that most prudent mariners would pass more than 1 nm from the boundary of an offshore wind farm, the likely meeting situations are described in Figure 1.47. For a small craft, such as fishing boat or yacht transiting at 6 knots, from emergence from the offshore wind farm, it would take 10 minutes for the vessels to meet. For a high-speed craft such as CTV, transiting at 25 knots, this is less than three minutes. The latter vessel type is highly likely to carry AIS which will improve their visibility to other vessels. This would provide some opportunity to avoid a collision, however, would be significantly reduced beyond what would be the case pre-construction in open sea. Such challenges currently exist for the established Irish Sea offshore wind farms but are being successfully managed with no reported collisions as a direct result of reduced visibility of emerging vessels.

1.8.6.20 Secondly, the geometries of the offshore wind farms would reduce the visible appreciation of other vessels, particularly where routes converge or the corners of sites. For example, two vessels proceeding north to the west and east of Mona Array Area might not have visual sight of one another until they are relatively near one another. The COLREGs describe obligations for collision avoidance and the appreciation of navigational lights (port/starboard) are necessary in determining the correct response to crossing, overtaking and head-on situations. However, larger vessels would be identifiable from AIS and therefore passing arrangements could be agreed.

1.8.6.21 Thirdly, concerns were raised by stakeholders about collision appreciation during night navigation, particularly as a result of vessel navigational lights lost amongst the turbine backscatter. Rule 22 of the COLREGs describe the minimum visibility of lights with vessels under 12 m requiring masthead/sternlights of greater than 2 nm and for vessels over 12 m (but less than 50 m) having 5 nm and 2 nm respectively. Therefore, it is reasonable that vessels within an offshore wind farm that would have previously been visible to passing vessels may be obscured or would be less prominent amongst the offshore wind farm lighting. In particular, masthead lights for approaching vessels, or single red lights displayed on yachts may be less conspicuous amongst white AtoNs fixed to the wind turbines, and this may to some extent contribute to an increased risk of collision. This impact was tested through the navigation simulations which demonstrated that vessels could still be identified within and adjacent to the Mona Array Area. Such impacts have been successfully managed at existing offshore wind farms, elsewhere in the UK, with similar passing vessel numbers and vessels would still be identifiable through other means.

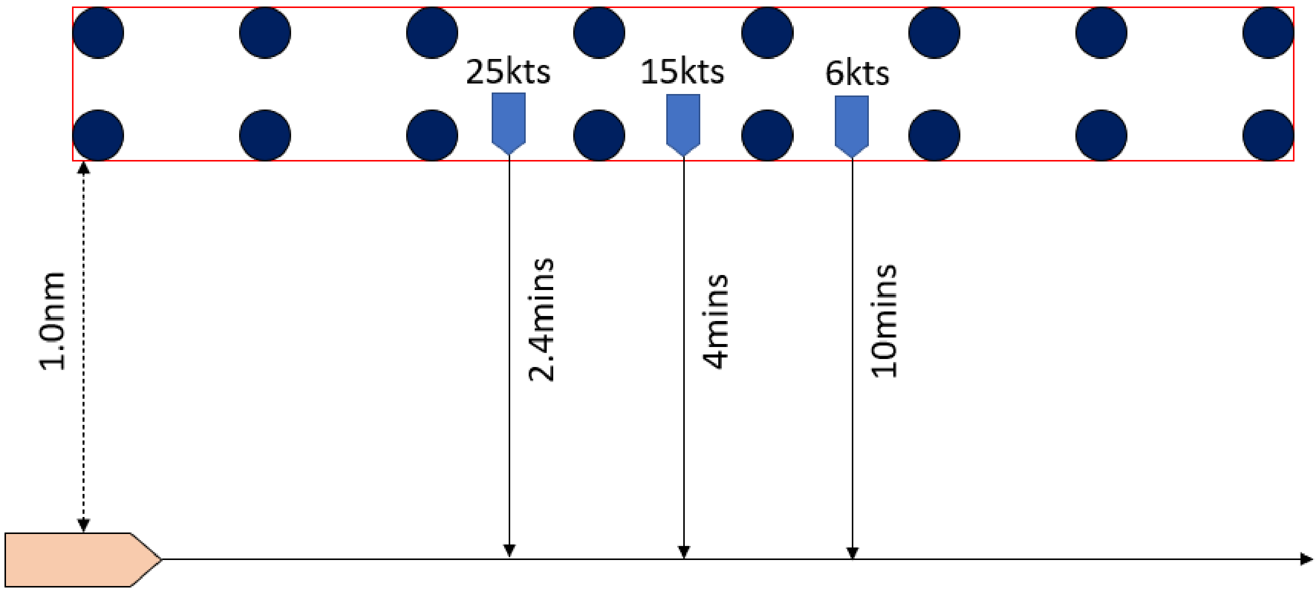

Figure 1.47: Calculated meeting times for vessels emerging from an offshore wind farm.

Vessel interaction in the approaches to Liverpool

1.8.6.22 The navigation simulations and traffic modelling identified that crossing situations can develop between southeast bound traffic to Liverpool Bay TSS and westbound vessels departing TSS (Appendix E). Given the volume of traffic concentrated in this area, it would be expected that such situations may also occur with multiple vessels.

1.8.6.23 In such situations, the westbound vessel is the Give-Way vessel under the Collision Regulations and should turn to starboard to avoid a collision. The presence of the Mona Array Area could impede westbound vessels (particularly when positioned within the northern portion of the traffic lane who have the intention of proceeding to the northwest) having sufficient sea room to turn to starboard. However, it was demonstrated in the simulations that a 2.1 nm lateral separation with the TSS was sufficient to deconflict these situations. Furthermore, vessels could slow down to enable the southeast bound vessels to cross.

1.8.7 Impact on modelled collision and allision risk

Introduction and methodology

1.8.7.1 The presence of the Mona Array Area could result in increased vessel meeting situations or transits closer to infrastructure which would increase the risk of collision and allision respectively. These risks have been quantitatively assessed in this section.

1.8.7.2 The IALA Waterway Risk Assessment Program (IWRAP Mk II) is a quantitative tool for calculating the frequency of collisions, groundings and allisions for navigating vessels in a given waterway. The tool was developed by IALA to support coastal states in conducting risk assessments to address obligations under SOLAS Chapter V. The tool has been presented at the IMO (e.g. NAV 52/17/2 and SN.1/Circ.296) and used by Coastal States (including UK, Denmark and Sweden) to support the assessment of new routeing measures (e.g. NCSR 5/INF.3). The tool has also had widespread use in assessing risk, both in the UK, Norway and elsewhere. IALA (2017) Guideline G1123 contains guidance on implementing the tool and the underlying mechanics are presented in Friis-Hansen (2008).

1.8.7.3 IWRAP modelling has a number of stages:

- Data preparation:
  - Vessel traffic legs are created that represent shipping routes and data is used to determine the volume and types of traffic, and distribution across that leg
  - These legs are connected into a network with waypoints where legs cross or join together
  - Other hazards, such as bathymetry and fixed installations are inputted into the model
- Risk calculation:
  - Where these legs intersect with one another or obstructions (such as wind turbines), the proportion of traffic on that leg which might interact with the obstacle is calculated
  - To account for the ability of the crew to avoid these hazards, a causation factor is used (in the order of 1 in 10,000) to represent the probability of human error or mechanical failure leading to an incident. The default causation probabilities which are lower for passenger vessels have been changed to consistent values to allow a direct comparison between ferries and other commercial vessels, reflecting a more precautionary approach given the stringent standards to which passenger vessels must operate and their enhanced redundancy.

1.8.7.4 The IWRAP risk modelling tool has been utilised to assess the likelihood of collision and allision within the shipping and navigation study area. Table 1.29 and Figure 1.48 show the modelling results. Given future traffic projections discussed in section 1.7, the likelihood with a 15% estimated increase in traffic is given.

Results

1.8.7.5 The 2022 AIS data was used to develop the base case (with existing routes and infrastructure) and future case (with modified routes and additional structures) models. Table 1.29 and Figure 1.48 summarise the modelling results for both collision and allision. Collisions in IWRAP are modelled as head-on or overtaking collisions on legs, or crossing collisions where legs meet. The likelihood of collision increases where routes are compressed between obstructions or where more traffic is added to legs, both of which increase the frequency at which vessels meet and therefore collision.

1.8.7.6 It should be noted that IWRAP models the likelihood of a collision or allision, and as noted in section 1.6.4, the majority of these would result in minor consequences. Furthermore, given underrepresentation of small craft using AIS, these respective return periods have not been presented on an individual basis and are discussed in section 1.8.5.

1.8.7.7 The modelling indicates that within the shipping and navigation study area the risk of collision would increase from once 421 years to once in 330 years. The increase in ferry to ferry collisions, from once in 1,926 to once in 1,320 years, is driven by the conflation of ferry routes as they route around the Mona Array Area which increase the likelihood of meeting situations. The increase in cargo/tanker-ferry collisions, from once in 716 to once in 601, is driven by the greater proportion of time that ferries are navigating within the shipping routes to the south of the Mona Array Area. An increase in cargo/tanker vs cargo/tanker collisions, is largely accounted for by the increased time that cargo/tanker vessels would spend interacting within the approaches to Liverpool in order to clear the south boundary of the Mona Array Area, however the return periods are low with >1,000 years likelihood. The TSS are acting to deconflict commercial vessel traffic which results in relatively low likelihood scores.

1.8.7.8 Figure 1.48 shows the distribution of collision likelihood in the base case and future case scenarios. It is noted that the areas of highest collision probabilities in both the base case and future case models were located in the approaches to Liverpool and the TSS and were relatively unaffected by the impacts of the developments.

1.8.7.9 Allisions can occur in one of two ways. Firstly, due to mechanical breakdown such as steering or engine failure a vessel may become disabled and drift towards the turbines. For a vessel in the centre of a 5 nm route, this would allow a 2.5 nm drift before an allision would occur. High side vessels such as ferries could drift in excess of two knots and therefore there would be less than an hour to take action. This could include conducting repairs or deploying an anchor. Such hazards exist for vessel routes adjacent to pre-existing offshore wind farms such as Walney, West of Duddon Sands and Gwynt y Môr amongst others. Secondly, due to human error with vessels failing to appreciate the available sea room in proximity to the wind turbines due to fatigue or failing to keep a proper lookout. For larger vessels, and in particular ferries who would have significant experience of operating these routes, this is less likely that might be the case for smaller craft. Allisions between small craft such as yachts and fishing boats with wind turbines is known to occur on other project sites, with these vessel types potentially less familiar with the hazards. Whilst the Mona Offshore Wind Project does not necessarily increase the risk of human error, the greater number of turbines provide more obstacles for which an allision could occur.

1.8.7.10 The IWRAP modelling suggests that the likelihood of allision could increase from once in 4,715 years to once in 338 years. Whilst this increase is considerable, this is principally as there are relatively few structures within the shipping and navigation study area which could be allided with in the base case scenario. Both ferries and cargo/tanker allision likelihoods increase by similar amounts, but the significant proximity of large cargo/tanker vessels close to the Mona Array Area and the high redundancy of passenger vessels modelling in IWRAP have resulted in lower ferry allision scores.

1.8.7.11 Figure 1.48 shows the distribution of allision probability between the base case and future case scenarios. The base case allision probability is greatest on the north structures of the existing offshore wind farms adjacent to Liverpool and the existing

O&G platforms where there is the greatest traffic density. The addition of the Mona Array Area shows that the most southerly wind turbines of the Mona Array Area, adjacent to the main shipping routes have the greatest likelihood of allision.

1.8.7.12 With an estimated 15% increase in traffic, the resultant likelihoods increased from once in 421 to once in 287 years for collision and once in 4,715 to once in 294 years for allision.

Table 1.29: IWRAP modelling results (return periods in years).

Hazard	Vessel	Base case	With Mona Array Area	With 15% traffic uplift
Collision	Ferries vs Ferries	1,926y	1,320y	1,148y
	Cargo/tanker vs Ferries	716y	601y	522y
	Cargo/tanker vs Cargo/tanker	3,225y	2,356y	2,048y
	Total	421y	330y	287y
Allision	Ferries	46,209y	2,891y	2,514y
	Cargo/tanker	6,616y	412y	358y
	Total	4,715y	338.4y	294y

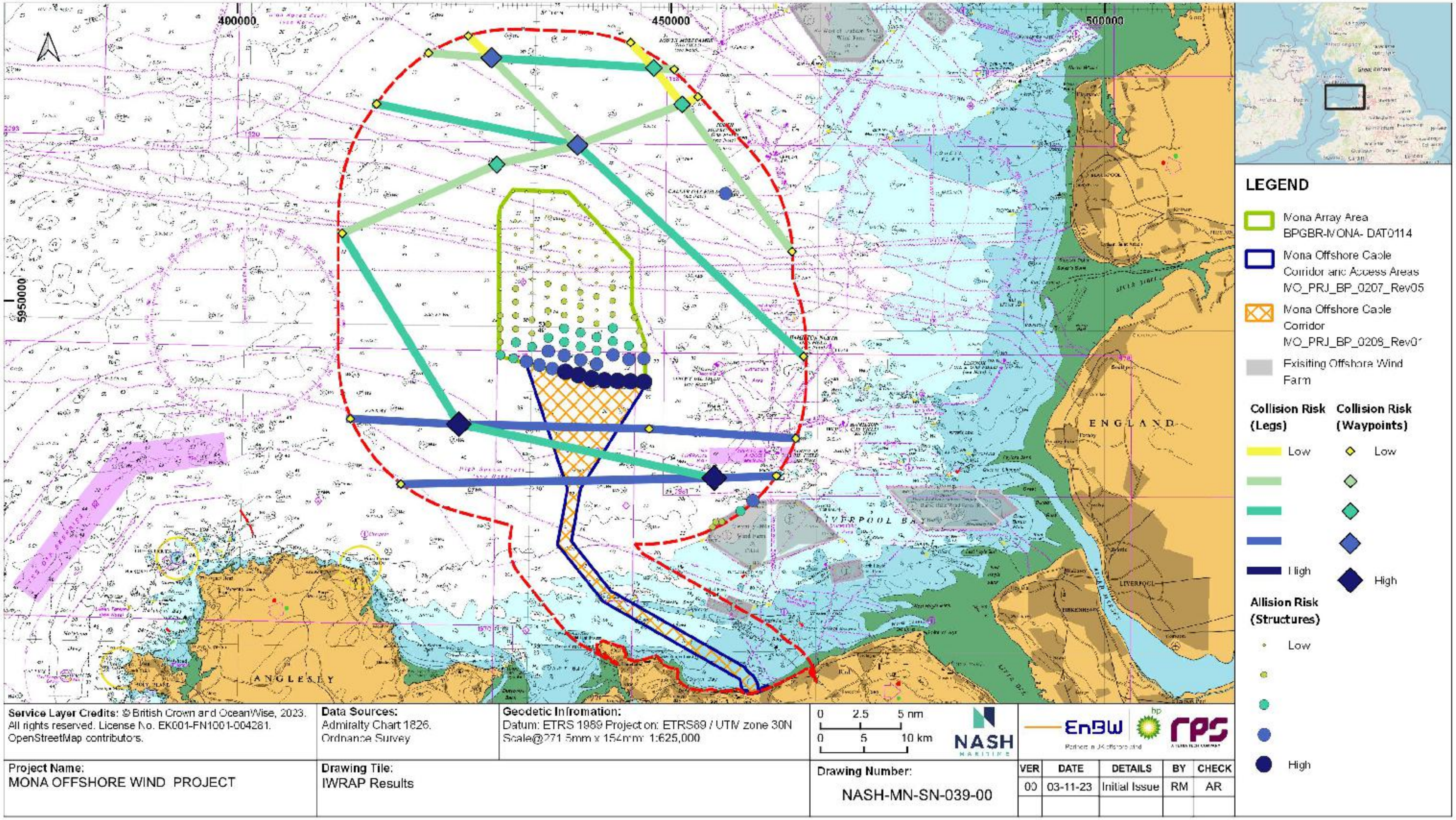

Figure 1.48: IWRAP results.

1.8.8 Impact to vessel emergency response

1.8.8.1 Impacts of the Mona Offshore Wind Project on vessel emergency response were identified amongst consultees, such as the ability to manage cargo shift scenarios, fire or man overboard situations.

Vessel rolling and cargo shift

1.8.8.2 During adverse weather, with large waves and strong winds, vessels can roll so excessively as to cause cargo to break free from its securing's and result in injuries to passenger or crew. This is particularly the case when the seas are directly on the vessel's beam, hence the requirement for variation in vessel course observed in section 1.6.3 to mitigate the ship's heading to the seas. With the Mona Offshore Wind Project in place, the capability for vessels to alter course to safely manage this could be reduced.

1.8.8.3 The navigation simulations (see Appendix E) tested the safety of transits in adverse weather. It was noted that the prevailing southwesterlies necessitated near beam on navigation across the conditions given the orientation of routes between Liverpool and the northwest. As a result, without undertaking weather routeing, in several runs Marginal or Fail scores were reached in gale and storm force conditions due to excessive rolling, exceeding 20 degrees. This was considered both to be uncomfortable and hazardous to passengers, but also have the potential to shift cargo and cause damage.

1.8.8.4 Given this conclusion, it would be reasonable to expect ferries to take a more circuitous route around the Mona Array Area rather than passing on a more constrained route, as described in section 1.8.3. However, in marginal conditions where a master does not choose to take an adverse weather route, were the conditions to deteriorate, there is less opportunity for the master to mitigate those conditions. Therefore, as excessive roll starts to be experienced, the master may for instance turn into wind, but in doing so will increase the risk of allision with the offshore wind farm.

1.8.8.5 Cargo shift situations have occurred within the shipping and navigation study area, most notably the ro-ro cargo vessel Riverdance in January 2008. This occurred in adverse weather and resulted in the grounding on the Shell Flats and total constructive loss but without injuries.

Responding to vessel emergencies

1.8.8.6 Concerns were raised by stakeholders relating to the ability of vessels to conduct emergency manoeuvres around the Mona Array Area. During the navigation simulations, two types of scenarios were tested and discussed with ferry Masters. Firstly, medical emergencies are relatively common on-board passenger ferries and there may be a requirement for a vessel to conduct a helicopter transfer which necessitates the vessel taking a defined course for a period of time. It was concluded that the minimum time between launching an HMCG helicopter and arriving on scene, was significantly greater than the transit time a vessel would spend in the vicinity of the Mona Array Area. Furthermore, the likely first course of action of the Master would be to make best speed towards the closest harbour given that it is not guaranteed that an HMCG helicopter would be available to respond. This gives the master the opportunity to reposition the vessel clear of any hazards.

1.8.8.7 Secondly, some emergencies on board, particularly fire or a man overboard, require immediate action by the bridge teams. For example, during fire, it may be necessary to turn the vessel into the wind such that the smoke does not blow across the passenger decks, or action may be needed to reduce the roll of the vessel to make it easier for the crew to respond. Whilst the Mona Array Area does not necessarily impact upon the likelihood that fire may occur, their presence constricts the sea room to perform these manoeuvres, and may increase the resulting consequences. The ability to hold a heading may be hampered in adverse weather conditions such as a large sea state or wind speed, particularly where the vessel needs to maintain a minimum speed to ensure steerage or control.

1.8.8.8 Consultation has identified that these incidents infrequently occur on board ferries in the shipping and navigation study area (in the order of less than once a year to once in ten years). The likelihood of these incidents occurring, during strong adverse weather and it also occurring during a temporary transit of the routes (which makes up less than 5% of most routes), is highly unlikely. Furthermore, whilst the sea room is reduced, at least several nautical miles would exist to undertake some degree of mitigation, greater than vessels would have available elsewhere such as the approaches to ports for example. In addition, the vessels could in an emergency enter the offshore wind farm given that there is at least 1,400 m spacing between wind turbines which may offer a contingency of last resort.

1.8.9 Impacts to search and rescue

1.8.9.1 In the unlikely event of an incident, SAR assets are required to access the site or surrounding area without risk to themselves. In particular, wind turbines can pose a hazard to SAR helicopters and therefore the design of the wind farm should be such to enable helicopter access and therefore safeguard HMCG obligations to SAR within the UK SAR Region. An ERCOP is required to facilitate information sharing regarding the offshore wind farm and SAR organisations. The principals of SAR access for offshore wind farms are contained in MGN654 Annex 5 (MCA, 2021c), and can be summarised as:

- Lines of Orientation – developers should maintain two lines of orientation unless a safety case is produced, and additional mitigation is proposed, that one line of orientation is tolerable. This allows multiple directions for aircraft entry and improves access, whilst a linear regular grid is both more efficient and safer for conducting SAR
- SAR Lanes – to be of sufficient width to enable safe transit of an SAR helicopter between the turbines. MGN654 Annex 5 recommends turbine spacing (blade tips to blade tips) of greater than 500 m
- Helicopter Refuge Areas – in larger developments (>10 nm width), a refuge area clear of turbines may be required to enable aircrews to reorientate themselves and change direction safely
- Turbine Preparation – to support winching of a casualty, the wind turbine needs to be configured to a specific position as requested by the SAR crew. This might include rotating the nacelle to 90 degrees from the wind, and both locking and positioning the blades to facilitate SAR access (e.g. Y configuration - see MGN654 Annex 5).

1.8.9.2 Several trials have been conducted by HMCG and MCA in SAR at offshore wind farms (see MCA, 2005; 2019). They found that searching within an offshore wind farm is more complex than in open sea and there may be a delay for entry into an offshore wind farm whilst the crew familiarise themselves with the site and layouts. During poor visibility, the importance of linear SAR lanes of sufficient width was identified as of great importance. When transiting through an offshore wind farm, all communications and navigation equipment was reported to be operated successfully with wind turbines identifiable through radar. Unfamiliarity with transiting and winching in vicinity of wind turbines results in slower speeds and delays which increases fuel consumption and may make searches less effective. Concerns have also been raised regarding visual identification of casualties as wind turbines block the view, particularly during rough weather.

1.8.9.3 The Mona Offshore Wind Project have committed to two lines of orientation and the spacing between turbines and OSPs will be at least 1,400 m Therefore, there would be sufficient space for SAR helicopter access through the sites, and far greater space than existing offshore wind farms in the Irish Sea. The Mona Offshore Wind Project design should also enable surface SAR assets (such as RNLI lifeboats) to safely navigate through the site and between the wind turbines. The final design will be subject to approval by NRW in consultation with the MCA and Trinity House and is secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.

1.8.9.4 A review of DfT SAR helicopter data between 2015 and 2023 showed that the SAR base at HMCG Caernafron responded to 90% of all casualties recorded within the shipping and navigation study area, although HMCG helicopters from other regions were recorded on occasion in the area. Assuming a 30 minute response time (to raise the alarm and launch the SAR asset), and the S-92 SAR helicopters transit speed, it would take approximately 45 minutes for the SAR helicopter to reach the Mona Array Area.

1.8.9.5 Similarly, a review of the RNLI data between 2008 and 2022 showed that incidents within Mona were responded to by Moelfre, Fleetwood and Llandudno. Each of these stations have all weather lifeboats capable of transiting at 25 knots (either Shannon, Mersey or Tamar Class). Assuming a 30 minute response time (to raise the alarm and launch the SAR asset), and the estimated time to reach a casualty within the Mona Array Area, it could take between 80 and 90 minutes before an RNLI lifeboat could be on scene to assist a casualty.

1.8.9.6 Given the above, it should be noted that the Mona Array Area is a considerable distance from shore and so the response time from conventional SAR assets is likely to be longer from other vessels within the Irish Sea. Therefore, in many cases it is likely that the first responders to any casualty will be from the Mona Offshore Wind Project (such as CTVs) which are well equipped with rescue apparatus and therefore may offer immediate casualty care until other SAR assets arrive on scene.

1.8.10 Impact to oil and gas activities

1.8.10.1 The Mona Array Area is located to the west of several O&G platforms. The Mona Offshore Wind Project could impact the risk to these operations, such as altering traffic flows and increasing the risk of allision. A contact between a ferry or other large vessel and a platform carries the potential for a far greater consequence than with a wind turbine. Some platforms are manned which increases the potential for loss of life but also the potential pollution outcomes.

1.8.10.2 The Conwy platform is 4.5 nm to the east of the Mona Array Area. The presence of the Mona Offshore Wind Project would likely deviate shipping and ferry routes further from the platform, reducing the risk of allision. 4.5 nm is considered sufficient distance to facilitate any maintenance or future decommissioning operations at Conwy.

1.8.10.3 All other platforms are of sufficient distance that the direct impacts of the Mona Offshore Wind Project are minimal, with sufficient sea room to enact collision avoidance. Furthermore, whilst there is significant uncertainty regarding timescales, it is likely that several of these platforms will be decommissioned prior to the 2035 scenario and therefore the risk will be removed.

1.8.11 Impacts of project on communications, radar and positioning systems

1.8.11.1 MGN654 and its annexes notes that an offshore wind farm may have adverse impacts on the equipment used for navigation, collision avoidance or communications (MCA, 2021a). A significant body of work has been conducted to examine these impacts in detail, and reference is made to the following studies:

- QinetiQ (2004). Results of the electromagnetic investigations and assessments of marine radar, communications and positioning systems undertaken at the North Hoyle wind farm by QinetiQ and the MCA
- BWEA (2007). Investigation of Technical and Operational Effects on Marine Radar Close to Kentish Flats Offshore Wind Farm
- Ocean Studies Board’s Division on Earth and Life Studies (2022). Wind Turbine Generator Impacts to Marine Vessel Radar.

1.8.11.2 Table 1.30 provides a summary of these potential impacts, with further consideration of the impacts on marine radar explored in section 1.8.11.

Table 1.30: Summary of impacts on equipment.

Impact on	Overview
VHF	VHF is essential for the communication between vessels and shore. VHF radio waves could be blocked or interfered with by the presence of turbines. The 2004 QinetiQ study found no noticeable effect on VHF communications both ship-shore and ship-ship within or adjacent to the wind farm. A trial aboard SAR helicopters (MCA, 2005) also determined no significant impact on VHF direction finding capabilities. Therefore, no significant impact on VHF communications is anticipated
AIS	AIS enhances the identification between vessels for collision avoidance. AIS signal could be blocked or interfered with by the presence of turbines. The QinetiQ study found no noticeable effect on AIS reception. Therefore, no significant impact on VHF communications is anticipated.
GNSS	Global Navigation Satellite Systems (GNSS) such as the Global Positioning System (GPS) is used for satellite positioning systems and navigation. Satellite reception could be impacted by the presence of turbines. The QinetiQ study found no noticeable effect on GPS reception, even in very close proximity to the wind turbines. Therefore, no significant impact on GPS is anticipated
Shore Radar	Similar to marine radars, shore radars could be impacted by the wind turbines. Mona is clear of any ports and harbours, and any Vessel Traffic Services (VTS) coverage.
Noise	The sound generated by the turbines could mask navigational sound signals from vessels or AtoNs. Whilst turbines make an audible sound whilst rotating, the low density of shipping and distance to other navigational marks makes this potential impact negligible. Furthermore, maritime regulations for audibility of a ship’s whistle are well in excess of the typical wind turbine sound emissions even at very close range. Therefore, no significant impact on navigation safety from increased noise is anticipated.

Impact on	Overview
Compass	Compasses are used for vessel navigation. These are potentially impacted by electromagnetic interference from the wind turbines or cables. The degree of this impact is related to the depth of water, cable design and alignment with the earth's magnetic field. Whilst this has impact has not been directly observed in studies, it is possible that small vessel compasses could be impacted near to cable landfall. However, it is considered likely that small craft would navigate visually near to cable landfall and therefore the impact on navigation safety is reduced. Therefore, no significant impact on navigation safety from electromagnetic interference is anticipated.

Marine radar interference

1.8.11.3 Marine radar is used for both collision avoidance and vessel navigation. Wind turbines, like other structures, can result in spurious returns such as side lobes, echoes, reflections and blanketing. These effects were studied extensively in both the QinetiQ (2004) and BWEA (2006) studies. Both studies determined that the reduced capability to track small vessels within offshore wind farms and the risk of losing acquired targets should be considered by mariners navigating adjacent to offshore wind farms. Some of these effects can also be mitigated by careful adjustment of radar controls, such as Gain.

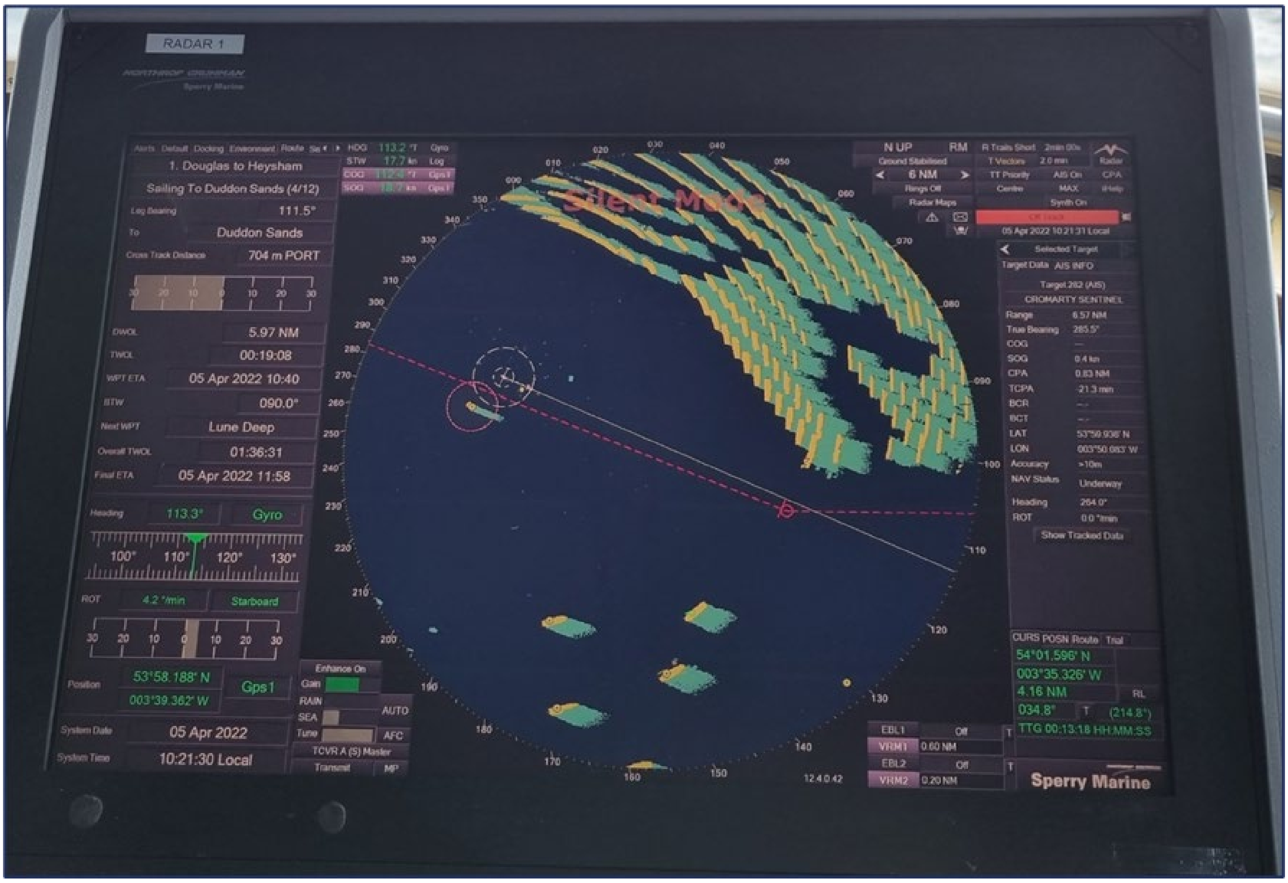

Figure 1.49: Radar screen of the Ben My Chree (source: Applicant's project team 05 April 2022).

1.8.11.4 Based on this, the MCA (2021a) developed a shipping route template (MGN654) that placed the extent of these effects at up to 1.5 nm, increasing as the vessels transit closer to the turbines. Intolerable impacts may be experienced up to 0.5 nm from the offshore wind farm. Historical evidence suggests that most vessels pass more than 0.5 nm from an offshore wind farm and therefore these effects are lessened. Figure 1.50 shows how the Mona Array Area relates to the region of potential radar effects.

1.8.11.5 Several routes, including the commercial routes through the Liverpool Bay TSS and ferry routes from Heysham and Liverpool could pass within 1.5 nm of the Mona Array Area and therefore this could impact the risk of collision. However, existing routes pass as close to other existing offshore wind farms such as West of Duddon Sands and Gwynt y Môr. Therefore, regular runners should be familiar with these effects.

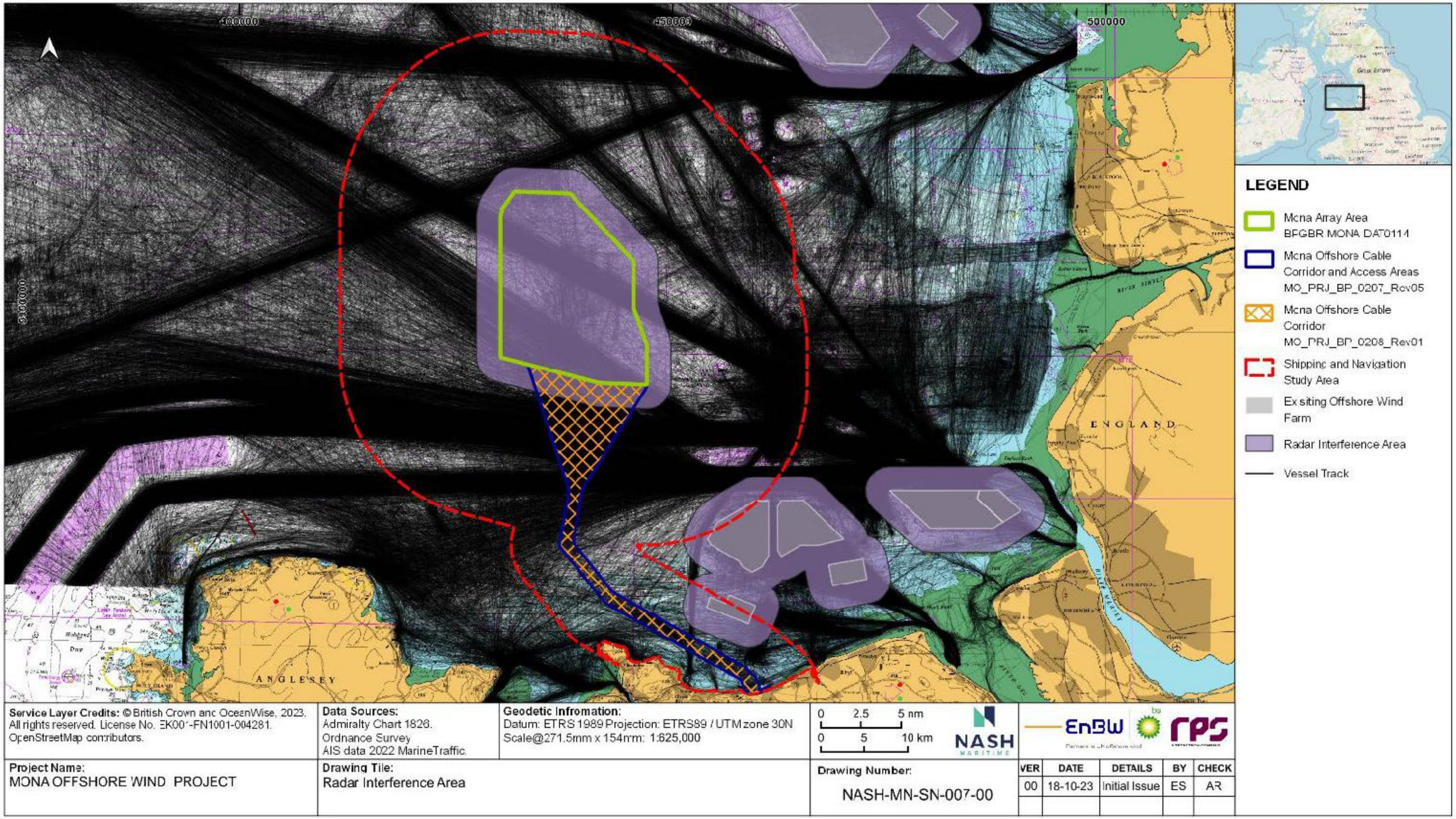

Figure 1.50: Radar interference areas.

1.8.11.6 The Mona Offshore Wind Project is outside of all port limits, VTS and pilotage areas and therefore whilst shore-based radar may have partial coverage of the sites, it would not be actively monitored. Therefore, the presence of the Mona Offshore Wind Project would not compromise vessel traffic monitoring obligations.

1.8.12 Impact on risk of snagging

1.8.12.1 The Mona Offshore Cable Corridor route passes south across the TSS before turning southeast towards landfall on the north Welsh coast. The cable is intended to be buried, to a depth of at least 0.5 m. Where burial is not possible, cable protection may be required up to a height of 3 m. A CBRA will be undertaken to determine the appropriate level of protection. This will be secured as part of the CSIP within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.

1.8.12.2 Subsea cables are both at risk of anchor or fishing gear strikes and can pose a hazard to navigating vessels were gear attached to the vessel to become snagged.

1.8.12.3 Analysis of anchoring activity is contained within section 1.6.3. An anchorage used by cargo/tanker ships is located approximately 4 nm to the west of the Mona Offshore Cable Route. During adverse weather with prevailing westerlies it is feasible that ships could drag their anchor across the cable route, albeit there is sufficient separation between the anchorage and cable route to enable remedial action by the ship to take place.

1.8.12.4 Commercial ships may choose to deploy an anchor in an emergency, and whilst uncommon, this could result in cable snagging. The greater ship density across the Mona Offshore Cable Route to the west of the Liverpool Bay TSS, would increase the likelihood of occurrence.

1.8.12.5 Small recreational and fishing boats may choose to anchor near to cable landfall, however, there is limited evidence that this is commonplace. Given adequate protection, it is unlikely that a yacht’s anchor would either snag or damage the cable.

1.8.12.6 Limited evidence of fishing activity was identified along the Mona Offshore Cable Route. Were a fishing vessel to snag the cable, the most likely outcome is loss of gear and potentially minor damage to the cable. A worst credible outcome however is the loss of the fishing vessel as it capsizes, and potential fatalities.

1.8.12.7 Cable burial would mitigate the risk of snagging, and a cable burial risk assessment is recommended to ensure these risks are adequately addressed for the types of gear used within the shipping and navigation study area. Where the cable is buried, it will be periodically inspected and where necessary remedial action taken. An outline FLCP has been submitted with the application (Document Reference J13) and a CSIP will be prepared to minimise the risk of gear snagging along the cable route.

1.8.13 Impact on under keel clearance and grounding risks

1.8.13.1 Where the export cable is protected by other means, such as rock protection/armouring, this may reduce the depth of water, UKC and increase the risk of grounding. The MCA and RYA recommend that any protection should not reduce the depth of water (referenced to Chart Datum) by more than 5%.

1.8.13.2 The maximum cable protection within the MDS is 3 m, and therefore this would exceed 5% of water depth in regions where the depth of waters is less than 60 m which accounts for the entire cable route. The majority of vessels greater than 5 m draught pass to the north of Gwynt y Môr where the depth of water is in excess of 25 m. Therefore, it is considered that a safety case could be made for exceeding 5% of water depth for protection, provided that unrestricted deep draught access could be made into the Port of Liverpool.

1.8.13.3 Some vessels between 3.5 m and 6 m of draught transit across the cable corridor near to landfall in order to access Raynes Jetty. The last 3 nm to cable landfall are in depths of water of less than 5 m, therefore a 5% threshold would be 0.25 m of protection.

1.8.13.4 Given the shallow depths and access required for commercial ships, it is important that cable protection is minimised so as not to interfere with commercial vessel operations. A CSIP and CBRA will be required to ensure that adequate and suitable cable protection is in place across the Mona Offshore Cable Route, once further geophysical and engineering studies are conducted.

1.8.14 Impacts during construction and decommissioning activities

1.8.14.1 The laying of the export cable, and any major maintenance, can be disruptive to other navigating vessels, in particular if an advisory safety zone is used around the cable laying vessel.

1.8.14.2 The most likely potential disruption would be to activities at Raynes Jetty. Given the infrequent calls to the jetty and unrestricted searoom either side of the Mona Offshore Cable Route, coordination between parties during construction can deconflict these operations.

1.9 Mona Offshore Wind Project NRA

1.9.1 Introduction

1.9.1.1 The NRA has been produced in accordance with MGN654 and follows the IMO's FSA (see section 1.2.2). The MGN654 requires that the NRA contain a hazard log of shipping and navigation hazards caused or changed by the Mona Offshore Wind Project which includes an assessment of risk with applied controls in place (those controls designed and included in the Mona Offshore Wind Project which are commonly accepted as industry good practice - see section 1.4.8 for a list of applied risk controls), and an assessment of risk for the Mona Offshore Wind Project with possible additional risk controls in place if they are warranted (section 1.9.7).

1.9.1.2 The development of the NRA, hazard log and associated risk scoring process is based on the following data, analysis, modelling and expertise of the Applicant's consultant project team:

- Project description (see section 1.4)
- Overview of baseline environment (see section 1.5)
- Description of existing marine activities (see section 1.6)
- Future case vessel traffic profiles (see section 1.7)
- Potential impact assessment (see section 1.8).

1.9.1.3 In addition to the above, a key component of the NRA is engagement with regulators and local stakeholders to confirm baseline shipping and navigation characteristics and elicit judgement on the levels of navigation risk with the Mona Offshore Wind Project in place.

1.9.1.4 The risk assessment methodology employed for the Mona Offshore Wind Project is the IALA SIRA process, which follows both the MCA MGN654 guidance (MCA, 2021a) and is also endorsed by the IMO via SN.1/Circ.296 in December 2010. The following sections outline:

- The overarching methodology of the risk assessment
- The details of the hazard workshop
- The details of the process of hazard identification
- Specified risk control measures (applied or designed in) for which the assessment of risk is undertaken against
- The details of possible additional risk control measures to reduce risk to acceptable levels.

1.9.1.5 The risk assessment project methodology follows the IMO FSA and is based on the principles set out in IALA Guidelines 1018 and 1138 which are endorsed by the IMO in SN.1/Circ.296 and the IMO's FSA and is as shown in Figure 1.1. Navigation hazards are identified through, consultation and data analysis, before being assessed in terms of their likelihood and consequence. A risk matrix is then utilised to identify the significance of each hazard with possible additional risk controls identified based on the resultant risk score to reduce the risks to acceptable levels.

1.9.1.6 A description of the FSA process is as follows:

1. FSA Step 1: HAZID: The project team identifies navigation hazards related to defined and agreed assessment parameters, such as geographic areas, marine operation, or vessel type. This is achieved using a suite of quantitative (e.g. statistical vessel traffic analysis) and qualitative (e.g. consultation with stakeholders) techniques which enables an evidentially robust identification of navigation hazards
2. FSA Step 2: Risk Analysis: A detailed investigation of the causes, including the initiating events, and consequences of the hazards identified in Step 1 is undertaken. This is completed using a risk matrix, and enables ranking of hazards based on navigation risk, and a determination of hazard acceptability tolerability. This process allows attention to be focused upon higher-risk hazards enabling identification and evaluation of factors which influence the level of risk
3. FSA Step 3 & 4: Risk Controls: The identification of existing risk controls measures (which are assumed to be included in the assessment of navigation risk), and the identification of possible additional risk controls, not currently in place for the assessment parameters is undertaken. Possible additional risk control measures are identified based on prioritising mitigation of higher-risk hazards. During this stage risk control measures may be grouped into a defined and thought-out risk mitigation strategy
4. FSA Step 5: Findings: The assessment findings are developed and documented into a technical report and then presented to the relevant decision makers in an auditable and traceable manner. The findings are based upon a comparison and a ranking of all hazards and their underlying causes; the comparison and ranking of possible additional risk control options as a function of associated costs and benefits; and the identification of those options which mitigate hazards to acceptable or ALARP.

1.9.2 Scoring criteria

1.9.2.1 Having identified all relevant impacts and hazards as a result of the Mona Offshore Wind Project, a hazard log is constructed as described in MGN654 Annex 1 (MCA, 2021b) (see Appendix A). Whilst there is no generally accepted standard for risk matrices, the following is proposed as suitable for the Mona Offshore Wind Project as it meets IMO and IALA guidance and is consistent with industry best practice.

1.9.2.2 Each hazard is scored based on its predicted frequency of occurrence (Table 1.31) and consequence (Table 1.32) for two scenarios, the 'most likely' and 'worst credible. Severity of consequence with each hazard under both scenarios is considered in terms of damage to:

- People – hazards may result in injuries or fatalities
- Property – hazards may result in damage or loss of vessels or structures
- Environment – hazards may result in environmental pollution such as oil spills
- Commercial and reputation – hazards may result in loss of economic output, impact on vessel routes, interruption of supply/generation capacity and adverse media coverage.

1.9.2.3 This NRA assumes that vessels will be compliant with international (e.g. Convention on the International Regulations for Preventing Collisions at Sea and Standards of Training, Certification and Watchkeeping for Seafarers), and National regulations and Guidance (e.g. UK Merchant Shipping Act 1995, and MCA MGNs) regulations.

Table 1.31: Frequency of occurrence criteria.

Rank	Title	Description	Definition
1	Remote	Remote probability of occurrence at project site and few examples in wider industry.	<1 occurrence per 10,000 years
2	Extremely unlikely	Extremely unlikely to occur at project site and has rarely occurred in wider industry.	1 per 100 – 10,000 years
3	Unlikely	Unlikely to occur at project site during project lifecycle and has occurred at other offshore wind farms.	1 per 10 – 100 years
4	Reasonably probable	May occur once or more during offshore wind farm lifecycle.	1 per 1 – 10 years
5	Frequent	Likely to occur multiple times during offshore wind farm lifecycle.	Yearly

Table 1.32: Severity of consequence categories and criteria.

Rank	Description	People	Property	Environment	Business
1	Negligible	Minor injury.	Less than £10,0000	Minor spill no assistance required.	Minimal impact on activities.
2	Minor	Multiple minor injuries.	£10,000-£100,000	Tier 1 Local assistance required	Local negative publicity. Short term loss of revenue or interruption of services to ports/offshore wind farm/O&G/ferries and other marine users.

Rank	Description	People	Property	Environment	Business
3	Moderate	Multiple major injuries.	£100,000-£1 million	Tier 2 Limited external assistance required	Widespread negative publicity. Temporary suspension of activities to ports/offshore wind farm/O&G/ferries and other marine users.
4	Serious	Fatality.	£1 million-£10 million	Tier 2 Regional assistance required	National negative publicity. Prolonged closure or restrictions to ports/offshore wind farm/O&G/ferries and other marine users.
5	Major	Multiple fatalities.	>£10 million	Tier 3 National assistance required	International negative publicity. Serious and long-term disruption to ports/offshore wind farm/O&G/ferries and other marine users.

1.9.3 Risk Matrix

1.9.3.1 The combination of the frequency and consequence scores for each scenario are then combined to produce an overall risk score, which is used to assign hazard risk rating in the risk matrix (Table 1.33). The methodology utilised was discussed with stakeholders during the hazard workshop and is consistent with other NRAs submitted for other offshore wind farms in the UK.

1.9.3.2 The assessment of risk is calculated eight times for each identified hazard; four times for the 'realistic most likely' occurrence for each consequence category and four times for the 'realistic worst credible' outcome for each consequence category. An overall risk score is then calculated using an averaging function weighted to the highest risk score for the 'realistic most likely' and the highest risk score for the 'realistic worst credible'. The weighted averaging calculation is an average of:

- Average of all the 'realistic most likely' risk scores
- Average all the 'realistic worst credible' risk scores
- Highest individual score from the 'realistic most likely' scores
- Highest individual score from the 'realistic worst credible' scores.

1.9.3.3 The tolerability of these hazard risk scores with regards to significance and acceptability with or without further action are shown in Table 1.34.

1.9.3.4 MGN654 Annex 1 (MCA, 2021b) notes that 'There is no generally accepted standard for a risk matrix therefore developers will be expected to define the following as appropriate to the OREI development:

- Likelihood/frequency of incident scenarios
- Severity/consequence of incident scenarios
- Risk matrix
- Tolerability matrix scores'.

1.9.3.5 The assessment criteria, including frequency and consequence bandings, are consistent with previous offshore wind farm NRAs submitted and approved by the

MCA. Furthermore, reference has been made to Intolerable/ALARP/Negligible bandings defined in IMO FSA studies, such as the FSA for RoPax Vessels (MSC 85 INF3). For example, a fatality every 10 years, or multiple fatalities every 100 years within the RoPax FSA was defined as the threshold between Unacceptable and ALARP, this translates to a score between 12 to 16 and 10 to 15 respectively on the risk matrix. Similarly, the same study determined that a fatality every 1,000 years, or multiple fatalities every 10,000 years was defined as the threshold between ALARP and Negligible, this translates to a score between four to eight and five to 10 respectively on the risk matrix. The risk matrix presented in Table 1.33 is therefore consistent with the FSA for RoPax Vessels (MSC 85 INF3).

1.9.3.6 Hazards are then defined as either Broadly Acceptable, with existing mitigation, or Unacceptable. MGN654 Annex 1 (MCA, 2021b) states that were risks are scored as Medium Risk, ‘Further risk control options must be considered to the point where further risk control is grossly disproportionate (i.e. the ALARP principle) and an ALARP justification and declaration made.’ Therefore, hazards scored as Medium Risk can only be Tolerable if ALARP is met.

Table 1.33: Risk matrix.

Risk Matrix							
Severity of consequences	Major	5	5	10	15	20	25
	Serious	4	4	8	12	16	20
	Moderate	3	3	6	9	12	15
	Minor	2	2	4	6	8	10
	Negligible	1	1	2	3	4	5
			1	2	3	4	5
			Remote	Extremely unlikely	Unlikely	Reasonably probable	Frequent
			Likelihood of Occurrence				

Table 1.34: Tolerability and risk ratings

Hazard Score	Tolerability	Description
Negligible Risk (1 to 4)	Broadly Acceptable	Generally regarded as not significant and adequately mitigated. Additional risk reduction should be implemented if reasonably practicable and proportionate
Low Risk (4.1 to 6)		
Medium Risk (6.1 to 12)	Tolerable if ALARP	Generally regarded as within a zone where the risk may be tolerable in consideration of the Mona Offshore Wind Project. Requirement to properly assess risks, regularly review and implement risk controls to maintain risks to within ALARP where possible.
High Risk (12.1 to 20)	Unacceptable	Generally regarded as significant and unacceptable for project to proceed without further risk controls.
Extreme Risk (20.1 to 25)		

1.9.4 Hazard workshop

1.9.4.1 The first hazard workshop conducted for the PEIR was held in Liverpool on 11 October 2022 to review the navigational hazards of the Mona Offshore Wind Project. It was attended by representatives from ferry operators, regulators, commercial bodies, O&G, ports, fishing community and recreational users.

1.9.4.2 All stakeholders were provided with a pre-read pack that described the existing marine environment, project description, predicted impacts of the Mona Offshore Wind Project and NRA methodology. In addition, copies of the draft risk assessment produced by the Applicant's project team were provided to each stakeholder and invited to review and pre-score. A webinar was undertaken on 03 October 2022 to discuss the pre-read material.

1.9.4.3 At the workshop, the Applicant's project team introduced the material and methodology before stakeholders were invited to describe their key concerns regarding the Mona Offshore Wind Project. From this, the NRA team identified hazards to focus the hazard workshop discussions. These generally relate to collisions between ferries and other ships as well as collisions with small craft, although other hazards such as allisions were discussed. For each hazard, stakeholders were provided an opportunity to discuss the hazards in small groups and provide scorings, and then a discussion was held in the wider room about the variation in scoring for each hazard and where differences lay. Stakeholders were encouraged to fill out the comments section of each hazard to provide a higher level of description regarding their scores. At the end of the day, a summary was held to discuss the key impacts identified and some potential mitigation options. The hazard scores were updated after the workshop by the Applicant's project team for inclusion within the NRA.

1.9.4.4 At the first hazard workshop to inform the PEIR, it was concluded that there was insufficient sea room between the Mona Array Area and ship traffic in the approaches to Liverpool and therefore that unacceptable risks to navigation existed. The findings of the first workshop and associated NRA submitted as part of the PEIR are summarised in Mona Offshore Wind Project (2023). In particular, the workshop concluded that two hazards were High Risk – Unacceptable, namely Collision – Ferry/Passenger in collision with (ICW). Cargo/Tanker or Ferry Passenger and Collision – Ferry/Passenger or Cargo/Tanker ICW. Small Craft. Many other hazards were scored towards the high end of the Medium Risk – Tolerable if ALARP category.

1.9.4.5 Following the boundary changes made post-PEIR to the Mona Potential Array Area, a second hazard workshop was held in Liverpool on the 29 September 2023 in order to inform the Environmental Statement. This workshop followed an identical structure and methodology to the first workshop and was attended by many of the same stakeholder groups. A full summary of the workshop is available in Appendix B. In total, six hazards were reviewed as a group as part of the Mona workshop, however, the findings of the cumulative workshop conducted the day before, during which ten hazards were assessed, were carried forward.

1.9.4.6 A full summary of the workshop is available in Appendix B.

1.9.4.7 During the hazard workshop, consensus was not reached on the specific scoring of several hazards, with a range of scores provided between the project teams and amongst stakeholders. However, a consensus was reached that all hazards associated with the Mona Offshore Wind Project previously identified as High Risk – Unacceptable were now Medium Risk – Tolerable if ALARP. To derive the final scores for the NRA, the findings of the workshop were therefore considered with the analysis and wider assessment undertaken by the Applicant's consultant project team (see Appendix A).

1.9.5 Hazard Identification

1.9.5.1 An NRA should consider all identified hazards of the Mona Offshore Wind Project on shipping and navigation receptors. In developing the hazard log, consideration was given to project phases, areas, hazard types and vessel types.

1.9.5.2 Six hazard types were assessed:

- Collision - Collision between two vessels underway (also includes striking of an anchored or moored vessel)
- Allision – Vessel makes contact with Fixed or Floating Object (FFO) (e.g. wind turbines/substation etc.). A separate hazard was included following the hazard workshop for O&G allisions
- Grounding – Vessel makes contact with the seabed/shoreline or underwater assets
- Snagging – Fishing Gear or anchors coming fast on subsurface infrastructure such as cables
- Vessel Emergency – Emergency onboard vessel that requires SAR response. This could include fire, explosion, flooding or capsize
- Adverse Vessel Motions – Vessel experiences a dangerous degree of roll or other motions that cause damage to cargo or injuries.

1.9.5.3 The vessel types in Table 1.35 were identified.

1.9.5.4 Three areas were identified:

- Within 10 nm of Mona Array Area
- Within 3 nm of export cable corridor
- Route from O&M base to offshore wind farm.

1.9.5.5 Three phases were considered, construction (C), O&M (O), and decommissioning (D). To be concise, and reflect similar impacts during construction and decommissioning, these two categories were combined in all cases. Similarly, where hazards were deemed to have similar risk scores between construction and O&M, they were combined into a single hazard.

Table 1.35: Vessel types.

ID	Description	Definition
1	Ferry or Passenger Vessel	Passenger Ferry/Freight Ferry/Cruise Ship
2	Cargo Vessel or Tanker	Cargo (Container, Bulk, Reefer, General etc.)/Tanker (Oil, Chemical etc.)
3	Tug and Service Vessels	Tugs/Offshore Supply Ships/Standby Rescue Vessels/Pilot Boats/Non-Project CTVs/Other Service Vessels
4	Fishing	Trawlers/Fishing Boats
5	Recreational	Yachts/Pleasure Boats
6	Small Project Vessels	CTVs/Survey Vessels/Workboats
7	Large Project Vessels	Jackup Barges/Cable Layer/Heavy Lift Vessels

1.9.5.6 Based on the Mona Offshore Wind Project phases, vessel types, hazard types and hazard areas, a total of 28 hazards were identified.

1.9.6 Results

Risk assessment summary

1.9.6.1 The results of the NRA for the Mona Offshore Wind Project, based on the approach as described above shows that in total:

- Zero hazards were assessed as High Risk – Unacceptable
- 20 hazards were assessed as Medium Risk – Tolerable (if ALARP)
- Eight hazards were assessed as Low Risk – Broadly Acceptable.

1.9.6.2 The full hazard log is available in Appendix A. Table 1.36 describes the top 10 hazards identified in the NRA.

Table 1.36: Top 10 hazards.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
5	1	C/O/D	Mona Array Area + 10 nm	Allision - Ferry/Passenger	10.0	Medium Risk - Tolerable (if ALARP)
8	2	C/O/D	Mona Array Area + 10 nm	Allision - Fishing	9.6	Medium Risk - Tolerable (if ALARP)
1	3	C/O/D	Mona Array Area + 10 nm	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	9.2	Medium Risk - Tolerable (if ALARP)
2	4	C/O/D	Mona Array Area + 10 nm	Collision - Cargo/Tanker ICW. Cargo/Tanker	8.9	Medium Risk - Tolerable (if ALARP)
3	5	C/O/D	Mona Array Area + 10 nm	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	8.8	Medium Risk - Tolerable (if ALARP)
6	6	C/O/D	Mona Array Area + 10 nm	Allision - Cargo/Tanker	8.7	Medium Risk - Tolerable (if ALARP)
20	7	C/O/D	Mona Array Area + 10 nm/Cable Corridor/O&M	Vessel Emergency - Ferry/Passenger or Cargo/Tanker or Large Project Vessel	7.8	Medium Risk - Tolerable (if ALARP)
27	8	C/O/D	Mona Array Area +10 nm	Adverse Vessel Motions - Ferry/Passenger or Cargo/Tanker	7.5	Medium Risk - Tolerable (if ALARP)
24	8	C/D	Mona Array Area + 10 nm/Cable Corridor	Collision - Large Project Vessel ICW. Cargo/Tanker	7.5	Medium Risk - Tolerable (if ALARP)
10	8	C/O/D	Mona Array Area + 10 nm/Cable Corridor	Snagging - Fishing	7.5	Medium Risk - Tolerable (if ALARP)

Risk of collision

1.9.6.3 Four of the top 10 hazards are collision hazards, particularly involving large commercial vessels such as ferries, cargo and tankers. The third and fourth highest hazards are a collision between a Ferry/Passenger vessel with another Ferry/Passenger or Cargo/Tanker, and between a Cargo/Tanker and Cargo/Tanker respectively. As noted in section 1.6.3 and section 1.8.6, the area to the south of the Mona Array Area is already a busy area where vessels encounter one another. Whilst concerns were raised about the proximity of the Mona Array Area to the traffic bound for Liverpool through the TSS, through navigation simulations, it was demonstrated that there was sufficient searoom for crossing traffic to take suitable action to comply with the COLREGs without being impeded by the proximity of the Array Area. In addition, vessels meeting to the north of the Mona Array Area converge and there is an increased risk of collision (section 1.8.6).

1.9.6.4 These vessels include ferries and other large commercial ships travelling in excess of 20 knots and therefore there was a relatively high potential for injuries and major damage were a collision to occur. Furthermore, the consequences of collisions involving ferries could result in multiple loss of life consequences, and that the most likely consequences could involve multiple major injuries (see section 1.6.4). Further, it was asserted during the hazard workshop by the IoMSPC that its vessel the Manannan (a high-speed craft) had a low survivability in a collision event given its speed and design. However, as this accounts for only a single vessel, that predominantly deployed seasonally in summer months, a realistic “most likely” scenario would be for a conventional ferry to be involved in the collision.

1.9.6.5 Consensus was reached during the navigation simulations and hazard workshop that suitable amendments had been made to the boundaries of the Mona Array Area such that the likelihood of this occurring was unlikely and therefore both were Medium Risks.

1.9.6.6 The fifth highest hazard relates to a Ferry/Passenger or a Cargo/Tanker IWC a small craft such as a fishing, recreational or CTV. The compression of traffic around the Mona Array Area, transited by large vessels with small fishing boats and other small vessels within them, reduces the ability to avoid a collision. In addition, there is some scope for existing fishing activity to be offset from the Mona Array Area, known as spatial squeeze. Furthermore, emergence of small craft from the offshore wind farms with reduced visibility due to radar interference or visual obscuration could exacerbate these risks (section 1.8.11), particularly CTVs which may be operating at higher speeds.

1.9.6.7 Some stakeholders asserted that any such collision might involve loss of life, however, comparative historical incidents suggests this is unlikely, with multiple injuries a more credible outcome (section 1.6.41.6.4). However, the loss of the small craft with multiple loss of life was agreed as a worst credible outcome.

1.9.6.8 Following additional data gathering and assessment of the impacts on fishing, it was concluded at the hazard workshop (and discussed in section 1.8.5) that there was sufficient sea room and spacing within the Mona Array Area to mitigate these risks and to avoid small craft, hence the likelihood was agreed to be unlikely and the resultant risk was Medium.

1.9.6.9 The risk of collision between small craft was scored as Medium Risk. These include fishing boats, recreational craft, tug and service or CTVs. The presence of the Mona Array Area could increase the likelihood of this occurrence by concentrating or offsetting small craft traffic into more dense areas (section 1.8.5). Collisions involving small craft occur routinely throughout the UK and it is rare that a fatality occurs (see section 1.6.4), however, this is still considered a realistic worst-case scenario. Small craft inherently have a lower potential for damage and pollution is inherently lower than for other large vessels, and the scoring reflects this.

1.9.6.10 Several risk controls have been applied by the Mona Offshore Wind Project to mitigate the risks of collision (see section 1.4.8):

- Promulgation such as Notice to Mariners and site marking and charting issued to warn vessels of the presence of the Mona Offshore Wind Project and facilitate passage planning
- Marine operating guidelines and standards for Mona Offshore Wind Project vessels
- Emergency response capabilities including an ERCOP, MPCP, periodic exercises to minimise the consequences of any incident.

Table 1.37: Risks of collision.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
1	3	C/O/D	Mona Array Area + 10 nm	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	9.2	Medium Risk - Tolerable (if ALARP)
2	4	C/O/D	Mona Array Area + 10 nm	Collision - Cargo/Tanker ICW. Cargo/Tanker	8.9	Medium Risk - Tolerable (if ALARP)
3	5	C/O/D	Mona Array Area + 10 nm	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	8.8	Medium Risk - Tolerable (if ALARP)
4	13	C/O/D	Mona Array Area + 10 nm	Collision - Small Craft ICW. Small Craft	6.7	Medium Risk - Tolerable (if ALARP)

Risk of allision

1.9.6.11 Three of the top ten hazards, including the top two, are allision hazards. The highest hazard was assessed to be the risk of allision between a Ferry/Passenger and the wind turbines or substations. It was noted that numerous ferry routes will transit in close proximity to the Mona Array Area, including in already congested waters (section 1.8.3 and section 1.8.6). Through avoidance of other traffic, mechanical failure or human error, an allision could result. Whilst ferries have high redundancy and familiarity with the shipping and navigation study area, there is a greater potential for mass loss of life in comparison to other vessel types and major damage to both the vessel and the wind turbine. It was noted during the hazard workshops that ferries already transit in close proximity to existing structures and that such allisions had not occurred to date (see section 1.6.4). Through both the modelling results (section 1.8.7) and hazard workshop it was agreed that such incidents were unlikely and therefore was scored as Medium Risk.

1.9.6.12 The allisions of small craft including fishing, recreational and tug/service vessels was scored as Medium Risk and is consistent with the majority of stakeholder feedback. Within the central Irish Sea, there are relatively few recreational routes (section 1.6.3), but fishing, and tug and service activity can be prolific. The proposed spacing between turbines is greater than in existing Irish Sea offshore wind farms and there is an expectation that small craft will continue to be able to both transit and fish within the boundaries of the Mona Array Area. The high density and specific activities of fishing, manoeuvring with gear deployed, was judged to be the most likely allision type to occur. This close navigation raises the likelihood of allision due to human error or mechanical failure. Such incidents have occurred within the UK, but resulted in only minor damage and injuries, but a worst credible potential for a fatality exists.

1.9.6.13 Cargo/tanker shipping account for a higher potential for pollution were they to be involved in an allision than other vessel types. Whilst such an incident is more likely on the south boundary of the Mona Array Area (see section 1.8.7), these were similarly scored as unlikely and therefore a Medium Risk.

1.9.6.14 Project vessels spend a greater proportion of time in close proximity to wind turbines but would be likely to be operating at comparatively low speeds. There are few historical examples of ship allisions with turbines (section 1.6.4), and none involving existing offshore wind farms in the shipping and navigation study area.

1.9.6.15 Allision risks between a large ship and an O&G facility were also assessed as a result of deviating shipping routes towards such facilities. The Mona Array Area is located near to several manned and unmanned platforms (see section 1.8.10), however, deviated shipping routes are judged not to pass any closer to existing platforms as the base case (section 1.8.3). Unlike the risks involving wind turbines, an allision with a platform carries a far greater risk of catastrophic consequences both in terms of loss of life and pollution. O&G infrastructure also has additional risk controls in place to manage navigation safety around them.

1.9.6.16 Several risk controls have been applied by the Mona Offshore Wind Project to mitigate the risks of allision (see section 1.4.8):

- Promulgation such as Notice to Mariners and site marking and charting issued to warn vessels of the presence of the Mona Offshore Wind Project
- Design of the structures including installation of AtoN, lines of orientation and air draught clearances
- Emergency response capabilities including an ERCOP, MPCP, periodic exercises to minimise the consequences of any incident.

Table 1.38: Risks of allision.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
5	1	C/O/D	Mona Array Area + 10 nm	Allision - Ferry/Passenger	10.0	Medium Risk - Tolerable (if ALARP)
8	2	C/O/D	Mona Array Area + 10 nm	Allision - Fishing	9.6	Medium Risk - Tolerable (if ALARP)
6	6	C/O/D	Mona Array Area + 10 nm	Allision - Cargo/Tanker	8.7	Medium Risk - Tolerable (if ALARP)
9	13	C/O/D	Mona Array Area + 10 nm	Allision - Recreational	6.7	Medium Risk - Tolerable (if ALARP)
7	13	C/O/D	Mona Array Area + 10 nm	Allision - Tug/Service & Small Project Vessels	6.7	Medium Risk - Tolerable (if ALARP)
28	18	C/O/D	Mona Array Area + 10 nm/O&M	Allision (O&G) - Ferry/Passenger or Cargo/Tanker or Large Project Vessel	6.3	Medium Risk - Tolerable (if ALARP)

Risk of snagging and grounding

1.9.6.17 Snagging of inter-array, interconnector or export cables by fishing gear are scored as a Medium Risk. Fishing using mobile and static gear is shown to occur throughout the shipping and navigation study area and therefore there is potential for these activities to occur in the future both within the Mona Array Area and Mona Offshore Cable

Corridor. Cable burial or protection, in combination with promulgation and marking of the routes would mitigate this risk. Snagging of gear is likely to result in gear damage in the most likely instance but could result in the vessel coming fast and capsizing with the potential for loss of life.

1.9.6.18 Snagging by vessel anchors is relatively less likely, but could carry a greater potential for damage, particularly by commercial ship anchors which have far greater penetration depths and potential for damage. The presence of the anchorage to the west of the Mona Offshore Cable Corridor (section 1.6.3) poses a risk of anchor dragging during prevailing southwesterlies across the route. Anchors may also be deployed in an emergency although this is relatively unlikely, but the potential would be greatest where the density of shipping is greatest. The consequences of snagging are relatively low for the vessel but would result in a significant impact to the Mona Offshore Wind Project. Snagging by small craft is unlikely to cause significant damage and therefore has relatively low risk scores.

1.9.6.19 The Mona Offshore Cable Corridor routes to the north Welsh coast and crosses several routes used by both large shipping and small craft. It may be necessary in some locations to use cable protection rather than burial and this may reduce the depth of navigable water that increases the risk of grounding (section 1.8.13). Given the depths of water, this is likely to occur south of the main shipping routes into Liverpool. Most vessels near to landfall are small and have a shallow draught making them less susceptible to a reduction in depth. However, the approaches to Raynes Jetty are used by deeper draught general cargo vessels up to 100 m in length and therefore an assessment of the impact on this route will be required once a detailed cable protection strategy is developed.

1.9.6.20 Several risk controls have been applied by the Mona Offshore Wind Project to mitigate the risks of snagging or grounding (see section 1.4.8):

- Promulgation such as Notice to Mariners and site marking and charting issued to warn vessels of the presence of the Mona Offshore Wind Project
- Fisheries liaison and co-existence plan for the export cable corridor
- Emergency response capabilities including an ERCOP, MPCP, periodic exercises to minimise the consequences of any incident
- A cable burial risk assessment will ensure adequate cable burial or protection.

Table 1.39: Risks of snagging and grounding.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
10	8	C/O/D	Mona Array Area + 10 nm/Cable Corridor	Snagging - Fishing	7.5	Medium Risk - Tolerable (if ALARP)
12	12	C/O/D	Mona Array Area + 10 nm/Cable Corridor	Snagging - Cargo/Tanker or Ferry/Passenger	7.0	Medium Risk - Tolerable (if ALARP)
11	24	C/O/D	Mona Array Area + 10 nm/Cable Corridor	Snagging - Recreational or Tug/Service	4.4	Low Risk - Broadly Acceptable
13	26	C/O/D	Cable Corridor	Grounding - Cargo/Tanker or Ferry/Passenger	3.7	Negligible Risk - Broadly Acceptable
14	26	C/O/D	Cable Corridor	Grounding - Fishing	3.7	Negligible Risk - Broadly Acceptable

Risks due to vessel motions or emergency response

1.9.6.21 As described in section 1.8.3, during adverse weather ferries will route to maintain a comfortable heading to the conditions and take advantage of any available lee from the shore. A passage to the east of the Mona Array Area would require vessels to navigate beam on to the prevailing conditions, which is not considered seamanlike in adverse weather. This may result in cargo shift occurrence that causes minor injuries and property damage, a finding that was supported during the navigation simulations (Appendix E). On occasions, cargo shift can be more significant and a fatality with significant damage to the vessel is possible. Whilst it is likely that in extreme conditions, masters would choose to route to the south of the Mona Array Area and avoid passing the less favourable side, in marginal conditions, they may be committed to such passage but unable to weather route. This may result in cargo shift occurrence that causes minor injuries and property damage.

1.9.6.22 Section 1.8.8 describe the potential impacts of the Mona Offshore Wind Project on SAR and vessel emergency response. It is noted that the presence of the wind turbines could reduce both the ability to alter course in an emergency, such as a fire, but also reduce SAR effectiveness to conduct a rescue. It was demonstrated during the navigation simulations that both the likelihood of having to take action was low and that there remained numerous actions that a master could take to mitigate any scenario. The Mona Offshore Wind Project design (in particular to two lines of orientation) is such that recommendations on SAR access will be maintained, with minimal loss of effectiveness.

Table 1.40: Risks due to vessel motions or emergency response.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
20	7	C/O/D	Mona Array Area + 10 nm/Cable Corridor/O&M	Vessel Emergency - Ferry/Passenger or Cargo/Tanker or Large Project Vessel	7.8	Medium Risk - Tolerable (if ALARP)
27	8	C/O/D	Mona Array Area +10 nm	Adverse Vessel Motions - Ferry/Passenger or Cargo/Tanker	7.5	Medium Risk - Tolerable (if ALARP)
21	17	C/O/D	Mona Array Area + 10 nm/Cable Corridor/O&M	Vessel Emergency - Fishing or Recreational or Tug/Service or Small Project Vessel	6.5	Medium Risk - Tolerable (if ALARP)

Risks specific to construction and decommissioning

1.9.6.23 During construction and decommissioning, additional large vessels will be present within and navigating to the Mona Array Area and Offshore Cable Corridor. These could include jack-ups and heavy lift vessels. Their necessary proximity to constructed and partially constructed wind turbines or foundation structures increases the risk of allision and damage, albeit likely to occur at lower speed and therefore the realistic worst credible scenario would not be as significant as for other commercial shipping.

1.9.6.24 Whilst the consequences of collision could be similar to other commercial vessel types, the relative infrequent movements of large construction vessels result in a lower likelihood of collision and therefore a lower risk score. Additional risks may be posed during cable laying operations across the approaches to Liverpool and near to landfall (section 1.8.14).

1.9.6.25 Snagging by construction vessels of a partially laid or unburied cable could occur, however, both the consequences and likelihood are considered to be relatively low.

1.9.6.26 Several risk controls have been applied by the Mona Offshore Wind Project to mitigate the risks during construction and decommissioning (see section 1.4.8):

- Promulgation such as Notice to Mariners and site marking and charting issued to warn vessels of the presence of the Mona Offshore Wind Project
- Use of 500 m safety zones from platforms/wind turbines
- A buoyed construction area using cardinal marks
- Guard vessels
- Operational management of Mona Offshore Wind Project vessels including guidelines, standards, training and compliance
- Emergency response capabilities including an ERCOP, MPCP, periodic exercises to minimise the consequences of any incident
- Marine coordination of site activities including site monitoring (continuous watch and vessel traffic monitoring).

Table 1.41: Risks specific to construction and decommissioning.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
24	8	C/D	Mona Array Area + 10 nm/Cable Corridor	Collision - Large Project Vessel ICW. Cargo/Tanker	7.5	Medium Risk - Tolerable (if ALARP)
22	18	C/D	Mona Array Area + 10 nm/Cable Corridor	Snagging - Project Vessel	6.3	Medium Risk - Tolerable (if ALARP)
26	20	C/D	Mona Array Area + 10 nm	Allision - Large Project Vessel	6.2	Medium Risk - Tolerable (if ALARP)
23	23	C/D	Mona Array Area + 10 nm/Cable Corridor	Collision - Large Project Vessel ICW. Ferry/Passenger	5.3	Low Risk - Broadly Acceptable
25	25	C/D	Mona Array Area + 10 nm/Cable Corridor	Collision - Large Project Vessel ICW. Fishing or Recreational or Tug/Service	4.1	Low Risk - Broadly Acceptable

Risks involving operations and maintenance activities

1.9.6.27 The O&M route used by vessels is not yet known for the Mona Offshore Wind Project, however, assumptions are made that the route is likely to cross busy shipping lanes. Therefore, there is a risk of collision between Project vessels, namely CTVs, and other navigating vessels. This is exacerbated where they may emerge from within an offshore wind farm at high speed, on a boundary that is immediately adjacent to a shipping route (see section 1.8.6). CTVs carry multiple persons and a realistic worst credible hazard outcome could involve multiple loss of life. Furthermore, given the high transit speeds, most likely outcomes could result in multiple major injuries.

1.9.6.28 Consultees referred to previous near misses occurring with Irish Sea offshore wind farm CTVs, although no collision has been reported or documented. Furthermore, allision or grounding of these vessels, particularly within the O&M base occurs for other UK offshore wind farms and therefore is reasonably probable to occur in the shipping and navigation study area, albeit likely to have a lower consequence. Assumptions regarding CTV movements and risk profile will be reviewed following finalisation of the proposed passage plans.

1.9.6.29 Several risk controls have been applied by the Mona Offshore Wind Project to mitigate the risks during O&M activities (see section 1.4.8) such as operational management of Mona Offshore Wind Project vessels including guidelines, standards, training and compliance and emergency response capabilities.

Table 1.42: Risks involving O&M activities.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
16	11	O	O&M route	Collision - Small Project Vessel ICW. Cargo/Tanker or Ferry/Passenger	7.4	Medium Risk - Tolerable (if ALARP)
17	13	O	O&M route	Collision - Small Project Vessel ICW. Fishing or Recreational or Tug/Service	6.7	Medium Risk - Tolerable (if ALARP)
18	21	O	O&M route	Allision - Small Project Vessel	5.8	Low Risk - Broadly Acceptable
19	21	O	O&M route	Grounding - Small Project Vessel	5.8	Low Risk - Broadly Acceptable

1.9.7 Potential additional risk control options

1.9.7.1 During the hazard workshop in 2022, a number of potential, additional risk control options were identified for further reducing the risk scores and their utility discussed. Many of these risk controls were proposed in the context of the cumulative effects of the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets. Some of these were subsequently adopted by the Mona Offshore Wind Project for inclusion in this NRA. These risk controls were then reviewed at the hazard workshop for the Environmental Statement in September 2023 and two additional risk controls were proposed by participants. The details of these additional risk controls and their status are described in in Table 1.43.

Table 1.43: Potential additional risk control options.

ID	Title	Description	Status
Proposed at October 2022 workshop			
1	Layout Design	To increase manoeuvring space and reduce impact on operators, revision of the south boundary of Mona Array Area and maintain a minimum 2 nm offset from the Liverpool Bay TSS	Adopted by Mona Offshore Wind Project and assessed within this Environmental Statement.
2	Ship Routeing	Extension of Liverpool Bay TSS to the west, enabling direct route for traffic from West of Isle of Man to the TSS, clearing Mona.	Not adopted - this was discussed at both hazard workshops, and it was concluded by the participants that these were not required as they would offer little benefit for organizing traffic and the high complexity of establishing new ship routeing measures would be disproportionate.
3	Site Layout	Two lines of orientation to support internal navigation (and reduce likelihood of small traffic displacement into the routes/areas outside of the offshore wind farm's) and SAR.	Adopted by Mona Offshore Wind Project (Two Lines of Orientation)
4	CTV Passage Planning	Develop coordinated passage plans for CTVs that minimises impact on other traffic, could include: • Specified crossing points • Agreed passing protocols/CPA for interactions with commercial shipping • Crossing protocols to be established prior to crossing traffic routes • Dissemination of information and liaison with regular runners and ferry services • Restricted visibility and night time protocols.	Adopted by Mona Offshore Wind Project (through Vessel Traffic Management Plan Document Reference J14)
5	Continued Engagement	Maintain a navigation engagement forum to facilitate information sharing and management/identification of additional risk controls: • Identify near misses and investigate incidents, disseminating learnings • Coordinate construction activities.	Adopted by Mona Offshore Wind Project (through continuation of MNEF)
6	Reporting Notification	Consider reporting procedures for vessels navigating adjacent to Mona Array Area. VHF Channel 16 broadcasts of vessel details and direction of travels.	Not adopted - this was discussed at both hazard workshops, and it was concluded by the participants that these could not be implemented under existing legislation, could not be easily managed and would therefore not be appropriate.

ID	Title	Description	Status
7	Master Training	Provision of enhanced master training, such as simulator sessions, for safe navigation adjacent to Mona Array Area.	Not adopted - this was discussed at both hazard workshops, and it was concluded by the participants that master training was sufficient to appropriately manage navigation safety with the revised boundaries.
8	Construction Scheduling	Managing construction activities to deconflict with other marine activities.	Adopted by Mona Offshore Wind Project (through Vessel Traffic Management Plan Document Reference J14)
Proposed at September 2023 workshop			
9	Exclusion from Array Areas	Exclusion of non-Project vessel traffic from the Mona Array Area, as is the case elsewhere in the world to minimize the risk of allision and collision with Project vessels.	Not adopted - this was discussed at both hazard workshops, and it was concluded by the participants that this would adversely impact freedom of navigation, could increase risk by offsetting small craft into adjacent shipping lanes and was inconsistent with the approach taken by the MCA.
10	Emergency Towage Vessel (ETV)	Introduction of an ETV in the Irish Sea to respond to any disabled vessel which was drifting towards the Mona Array Area. Existing towage in the Irish Sea would be ill suited to respond to such an emergency and therefore a dedicated ETV, as is more commonly the case in Europe could respond to these situations.	Not adopted - this was discussed at both hazard workshops and given that vessel allisions were scored as Medium Risk and relatively unlikely, therefore the very high cost of procuring and operating at ETV was disproportionate.

1.9.8 Summary

1.9.8.1 The NRA has brought together significant analysis, consultation, navigation simulations and the findings of both hazard workshops to determine the navigational risks associated with the Mona Offshore Wind Project. The study has concluded that following the changes to the Mona Potential Array Area made post-PEIR, all hazards associated with the Mona Offshore Wind Project have been reduced to either Medium Risk – Tolerable if ALARP or Broadly Acceptable. Whilst it was recognised that the construction of an offshore wind farms in otherwise navigable waters would increase the risks of collision and allision for navigating vessels, a consensus was reached with stakeholders that these risks were Tolerable if ALARP or Broadly Acceptable. In particular, the increase in sea room around the Mona Array Area provides sufficient space for vessels to safely manoeuvre in complex realistic traffic situations and adverse weather in full compliance with the COLREGs and the practice of good seamanship. The results of the cumulative risk assessment are presented in section 1.10.

1.9.8.2 Appropriate risk controls were considered to be embedded in the Mona Offshore Wind Project's design and whilst additional risk control options were discussed (such as ship routeing or ETVs), it was agreed that these were disproportionate to the reduction in risk they might achieve. Therefore, the NRA has also concluded that where risks are scored as Medium they can be considered ALARP therefore Tolerable without the need for additional risk control measures.

1.10 Cumulative assessment

1.10.1 Introduction

1.10.1.1 During early consultation for the Mona Offshore Wind Project, stakeholders raised concerns regarding the potential cumulative impacts of the Mona Offshore Wind Project, the Morgan Offshore Wind Project Generation Assets and the Morecambe Offshore Windfarm Generation Assets (the Projects). In particular, it was noted that the presence of all three Projects would result in routes between them that had greater impacts on navigation safety and commercial operations than each project would have in isolation.

1.10.1.2 In reference to this, the developers (EnBW, bp, Cobra Instalaciones Servicios, S.A. and Flotation Energy plc) jointly commissioned the development of a Cumulative Regional NRA (CRNRA). The objective of the CRNRA was to enable stakeholders to engage with and understand the potential cumulative effects of the proposed Projects. Adopting a regional (collaborative) approach to assessment enabled individual Projects to quantify and manage the cumulative impacts in a coordinated, consistent and efficient manner. This was undertaken at an earlier stage in the assessment than usual to ensure that the potential impacts of all three schemes are understood as early in the process as possible.

1.10.1.3 The CRNRA primarily assesses the impacts of the O&M phase of the three Project array areas on vessel navigation and safety. The focus of the CRNRA was to enable a detailed assessment of the key concerns of stakeholders, principally the formation of routes between the array areas. Firstly, the potential impacts of the construction and decommissioning phases are assessed within the Environmental Statement chapters for the respective projects and are largely consistent with operational impacts given the necessary exclusion of traffic from the construction areas. Secondly, the transmission assets (such as the export cables) have not been included within the

CRNRA. Export cables have minimal impact on surface navigation, impacts are highly localised to the specific cable routes and rarely have significant cumulative effects on shipping and navigation receptors. The potential impact of transmission assets on shipping and navigation is considered separately within the assessment chapters for the individual projects.

1.10.1.4 The shipping and navigation study area of the CRNRA is defined as the region of the east Irish Sea bounded by the Isle of Man to the northwest and the Welsh and English coasts to the south and east respectively (Figure 1.51).

1.10.1.5 The CRNRA assumed the consenting and construction of the Awel y Môr offshore wind farm and decommissioning of some O&G structures. Due to insufficient information at the time of the assessment given the early stage in development, the Isle of Man offshore wind farm (subsequently named Mooir Vannin) is not included in the main body of the CRNRA but the potential cumulative impact is considered separately within an addendum to the CRNRA.

1.10.1.6 The CRNRA that accompanied the PEIR concluded that there was insufficient sea room between the Projects' three array areas and existing offshore wind farms in the Irish Sea for safe navigation and therefore unacceptability high risks would result. In particular, collision risk was shown to be high for ferries ICW other large commercial vessels and with small craft operating between the Projects' three array areas and existing offshore wind farms in the Irish Sea. Furthermore, it was concluded that the Projects would necessitate appreciably large deviations during normal and adverse weather conditions to impact on operator schedules and timetables.

1.10.1.7 Following a review of these findings and Section 42 consultation responses, all three Projects made commitments to address these impacts, primarily through changes to their array area boundaries as well as other measures such as increasing the lines of orientation. The CRNRA that accompanies this Environmental Statement was updated through additional data collection, navigation simulations and a hazard workshop to account for these changes. The CRNRA is presented in a separate report (Appendix E). The section below provides a high-level summary of the key findings.

1.10.2 Summary of cumulative impact on vessel routeing

1.10.2.1 The CRNRA noted additional cumulative impacts on ferry routeing above those described in section 1.8.3.

1.10.2.2 With regards to the IoMSPC routed, minor deviations of less than three minutes would be required to pass clear of both the Mona and Morgan Offshore Wind Projects. During adverse weather, the presence of the Mona Array Area would impact upon the Liverpool to Douglas route (see section 1.8.3), increasing transit time by a further 13 minutes on top of an existing delay of between 10 and 23 minutes. The Morgan Array Area would impact upon on the Heysham to Douglas route, increasing transit time by a further 24 minutes on top of an existing delay of between 10 and 33 minutes. Neither route is substantially impacted by the three Projects collectively, as opposed to the impacts of each project in isolation.

1.10.2.3 With regards to the Seatruck routes between Heysham and Ireland, the presence of the Mona and Morgan Array Areas would compress traffic through this gap. The impact on the Heysham to Dublin route was negligible and on the Heysham to Warrenpoint route, a deviation of less than five minutes would be required. During adverse weather routeing which typically occurs further west at present, the impacts would be negligible.

1.10.2.4 With regards to the Stena routes between Liverpool and Belfast, the route to the west of the Isle of Man would be impacted by the Mona Array Area, but passage plans would not be materially impacted by the two other cumulative Projects and therefore the impacts described in section 1.8.3 are consistent. The passage to the east of the Isle of Man would, however, necessitate a route around both the Morecambe Offshore Windfarm Generation Assets and Morgan Offshore Wind Project Generation Assets of an increase of up to 15 minutes. During adverse weather, this would necessitate an additional 70 minutes of transit between the three Projects, likely making the east route less favourable.

1.10.2.5 Impacts on the P&O route between Liverpool and Dublin were assessed as negligible given that they pass clear of all three Projects.

1.10.2.6 The CRNRA concluded that the cumulative impacts of the three Projects on ferry passage planning in normal weather conditions was minor, given the total transit time, existing variation in timetables and turnaround times in port was significantly greater than the necessary deviations around the Projects. However, during infrequent adverse weather, the additional deviations around the Projects to maintain safe transit would increase the number of cancellations as services would be materially impacted.

1.10.2.7 The impacts on cargo/tanker vessel routeing were less. The principal routes in the Irish Sea into Liverpool would route to the southwest of the Mona Array Area in a similar manner between the individual assessment and cumulative assessments (section 1.8.3.16). Minor cargo/tanker routes with less than one vessel a day would be deviated through the routes between the three Projects, but the increase in distance would not be large given the length of voyages these vessels undertake.

1.10.2.8 The impacts on small craft routeing would be greater where their activities are offset from the array areas were they to choose not to navigate through the wind farms. However, the spacing between wind turbines in all three Projects is likely to be sufficient to enable safe internal navigation by small craft.

1.10.3 Summary of cumulative impact on navigation safety

1.10.3.1 It was noted that the three projects increased the constraint on routes between them, but that each route was of sufficient width to comply with guidance:

- Mona Array Area and Morgan Array Area route at 6.0 nm wide by 5.5 nm in length
- Mona Array Area and Morecambe Array Area route at 5.7 nm wide by 5.0 nm in length
- Morgan Array Area and Walney Array Area route at between 4.5 nm and 5.3 nm wide by 11.5 nm in length.

1.10.3.2 Analysis of vessel concurrency demonstrated that, with the exception of the route south of the Mona Array Area, the likelihood of two commercial vessels meeting between the Array Areas was relatively low (<25% of transits). More than two vessels meeting was modelled to be less than 3% for all routes. Whilst there was shown to be an increase in meeting situations, this was not judged to be significant.

1.10.3.3 Through additional navigation simulation sessions conducted with the Irish Sea ferry companies during 2023, the amendments to the boundaries of the three array areas was tested. It was concluded that collision risk whilst navigating between and around the Projects was manageable with existing operational procedures in complex, worst credible traffic situations. Vessels could maintain desired CPAs from other vessels and structures.

1.10.3.4 Other impacts such as to emergency response, visual navigation, shipboard equipment, and O&G are largely consistent with the findings contained within the Mona Offshore Wind Project NRA and described above.

1.10.3.5 A cumulative hazard workshop was held on the 28 September 2023 and attended by representatives from ferry companies, regulators, commercial bodies, O&G operators, ports and the fishing community. The methodology and attendees were largely the same as that described in section 1.9. However, the assessment concentrated on the risks associated with the routes between the array areas of the three projects and existing offshore wind farms, particularly collision and allision risks. By scoring hazards differently between areas, and focusing on key hazard types, a total of 56 hazards were highlighted.

1.10.3.6 A consensus was reached that all of these hazards were either Medium Risk – Tolerable if ALARP or Low Risk – Broadly Acceptable.

1.10.3.7 The highest scoring hazards related to allisions involving Ferry/Passenger vessels between Morgan-Walney and Mona-Morgan, and allisions involving fishing boats. The navigation simulations and had demonstrated that changes to the boundaries had significantly mitigated the collision risk for vessels transiting between the Projects.

1.10.3.8 Whilst additional risk control measures were identified, some of these (such as ship routeing or emergency towing vessels) were not adopted as it was concluded they were disproportionate to the risk reduction and therefore all hazards could be determined to be ALARP without the need for additional mitigation.

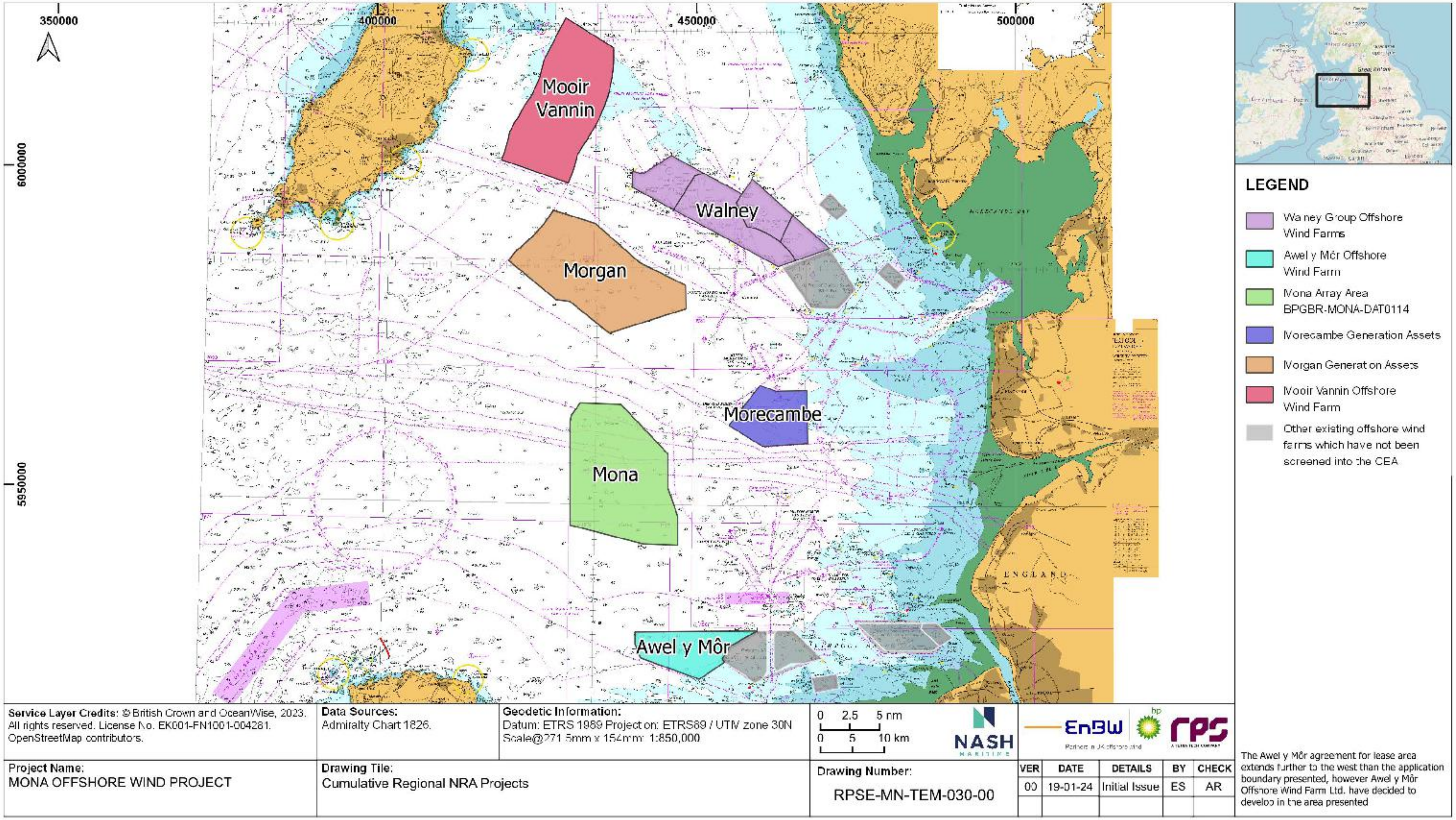

Figure 1.51: Cumulative regional NRA projects.

1.11 Conclusions

1.11.1.1 The NRA has been conducted in compliance with all relevant legislation, policy and guidance (section 1.2 and 1.3).

1.11.1.2 The Mona Offshore Wind Project would comprise up to 96 wind turbines and four offshore substations within the Irish Sea, as well as an export cable to the Welsh coast.

1.11.1.3 The shipping and navigation study area includes numerous AtoNs, pilot stations, ports and harbours, anchorages and two TSSs (section 1.5.1 and 1.5.2). Furthermore, there are extensive existing activities including O&G, offshore wind and aggregate extraction.

1.11.1.4 The shipping and navigation study area has predominately southwesterly wind and wave conditions (section 1.5.3). Annual adverse weather events can exceed 4.2 m significant wave height and 50 knots. Reduced visibility might occur up to 24 days/year dependent on location within the shipping and navigation study area.

1.11.1.5 SAR facilities, including RNLI stations and helicopter stations are located immediately adjacent to the shipping and navigation study area throughout the Welsh, English and Isle of Man coastlines (section 1.5.4).

1.11.1.6 Analysis of historical vessel traffic data (section 1.6) identified:

- Commercial cargo and tanker shipping predominately passes into the Port of Liverpool from the northwest or west. This includes deep draught vessels over 300 m in length. Some smaller vessels may pass between other ports across the shipping and navigation study area, but at far fewer transits
- There is significant passenger vessel activity across the shipping and navigation study area, including ferry services between Liverpool, Heysham and Douglas with the island of Ireland. Cruise ship transits also occur, to a lesser extent, between Douglas and Liverpool
- Recreational vessel traffic is concentrated inshore, particularly along the Welsh coast and the Isle of Man. Cruising routes exist between Liverpool and Douglas, Heysham and the Welsh coast, and the Welsh Coast and Douglas.
- There is static and mobile gear across the shipping and navigation study area, including both local and international based boats
- Service vessels associated with existing offshore wind farms and O&G infrastructure account for a large proportion of vessel movements within the shipping and navigation study area
- Analysis of adverse weather routeing demonstrates that vessels may deviate from their usual routes frequently throughout the year (section 1.6.3)
- Anchorages exist to the east of Anglesey and adjacent to the approaches to Liverpool (section 1.6.3). There is evidence of loitering by commercial ships between the Welsh coast and the Isle of Man
- Mostly small craft are to be found near to cable landfall, with the exception of general cargo ships bound for Raynes Jetty.

1.11.1.7 Analysis of historical incident data identified that the majority of incidents within the shipping and navigation study area occurred inshore, and adjacent to the approaches to the key ports (section 1.6.4). There were few collisions in vicinity of the Mona Array Area and most incidents were mechanical failures aboard vessels. Analysis of incidents at other offshore wind farms around the UK show that most accidents involve project vessels contacting wind turbines or having incidents in transit between the array areas and O&M base.

1.11.1.8 An assessment of the future traffic profile within the shipping and navigation study area (section 1.7) determined that an increase in commercial vessel numbers of 15% by 2035 would be a reasonable assumption. There was little evidence of large changes to recreational or fishing vessel numbers. It is anticipated that O&G decommissioning would reduce vessel numbers, although there is uncertainty around the timing at which this would occur.

1.11.1.9 An assessment of the impacts of the Mona Offshore Wind Project on recognised sea lanes essential to international navigation determined that access to the TSSs in the shipping and navigation study area would be maintained.

1.11.1.10 An assessment of the impacts of the Mona Offshore Wind Project on ferry vessel routeing determined that there would be necessary deviation of Stena and Seatruck routes around the Mona Array Area. This deviation in normal conditions would be less than seven minutes. Existing passages are up to eight hours (dependent on route), with existing services having significant variation in turnaround times and transit times of greater than 25 minutes. The increase associated with the Mona Offshore Wind Project is unlikely to have make these services unviable.

1.11.1.11 During adverse weather, the assessment determined that the IoMSPC routes may be required to pass to the southwest of the Mona Array Area to minimise adverse vessel motions. This would increase the schedule impacts by approximately a further 15 minutes. The Stena Line Liverpool to Belfast routes in adverse weather is largely clear of the Mona Array Area but the frequency at which masters may choose to take this route could increase. This effect is unlikely to necessitate increased cancellations of services but increases operational pressure.

1.11.1.12 An assessment of the impacts of the Mona Offshore Wind Project on cargo/tanker ship routeing determined that the principal shipping routes into Liverpool would necessitate a deviation to the southwest of the Mona Array Area, but this was not so great as to threaten the viability of Liverpool as a port. Less trafficked routes into Heysham and Douglas would necessitate minor deviations, which are unlikely to make such services unviable.

1.11.1.13 An assessment of the impacts on small craft routeing determined that there is sufficient spacing between turbines to facilitate safe navigation for fishing and recreational craft. There may be some effect of offsetting these vessels into adjacent routes where vessel choose not to do so.

1.11.1.14 An assessment of the impacts of the Mona Offshore Wind Project on the likelihood of collision determined that an increase in risk was likely given the concentration of routes to the north and south of the Mona Array Area. However, through risk modelling and navigation simulations, it was concluded that there was sufficient searoom for masters to take action in compliance with the COLREGs and good seamanship such that the risk was not significant.

1.11.1.15 The commitments of the Mona Offshore Wind Project to two lines of orientation is likely to address impacts on SAR access into the Mona Array Area.

1.11.1.16 The layout of the Mona Offshore Wind Project, in relation to shipping routes, and accounting for decommissioning activities, would not substantially increase the risk to O&G activities.

1.11.1.17 An assessment of the impacts of the Mona Offshore Wind Project on communications, radar and positioning systems determined that most impacts are negligible. Impacts to radar are inherent when navigating adjacent to offshore wind farms and it is likely that these effects will be experienced in the vicinity of the Mona Array Area.

1.11.1.18 A risk assessment was undertaken, supported through a hazard workshop attended by representatives from ferry operators, regulators, commercial bodies, O&G, ports and fishing community. The risk assessment, with applied risk controls concluded that:

- Twenty eight hazards were identified, split across different hazard types, vessel types and areas
- At the Mona Offshore Wind Project hazard workshop to inform the Environmental Statement, a consensus was reached amongst stakeholders that all hazards were Medium Risk or below. In particular, it was noted that the amendments to the boundaries of the Mona Array Area substantially reduced risks which were previously unacceptable
- Twenty hazards were assessed as Medium Risk, including the risk of collision, allision , snagging and adverse vessel motions. Several of these hazards were scored to represent the multitude of vessel movements in close proximity to the site and therefore the inherent risk of interaction between them and the turbines, following mechanical failure or human error
- A further eight were assessed as Low Risk – Broadly Acceptable.

1.11.1.19 A cumulative regional NRA was updated to assess the impacts of the amended array area boundaries of the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets on shipping and navigation. The study concluded that all previously High Risk – Unacceptable hazards were now Medium Risk – Tolerable if ALARP.

1.11.1.20 Appropriate risk controls were considered to be embedded in the Mona Offshore Wind Project's design, but additional risk controls were identified as part of the hazard workshops (such as ship routeing and emergency towage vessels). It was agreed with stakeholders that these were disproportionate to the reduction of risk they would achieve. Therefore, the NRA concludes that where risks are scored as Medium, they can be considered to be ALARP and therefore Tolerable without the need for additional risk control measures.

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Appendix A: Hazard log

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
1	3	C/O/D	Mona Array Area + 10 nm	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	Reduced Searoom Between offshore wind farms; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	3	Significant loss of life; Constructive Loss; Serious pollution (Tier 2); International adverse publicity. Ferry out of service.	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)
2	4	C/O/D	Mona Array Area + 10 nm	Collision - Cargo/Tanker ICW. Cargo/Tanker	Reduced Searoom Between offshore wind farms; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Vessel requires drydock.	2	3	2	3	3	Single fatalities; Constructive Loss; Major pollution incident (Tier 3); National adverse publicity.	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
3	5	C/O/D	Mona Array Area + 10 nm	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	Reduced Searoom Between offshore wind farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; ERCOP; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	3	Multiple fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)
4	13	C/O/D	Mona Array Area + 10 nm	Collision - Small Craft ICW. Small Craft	Reduced Searoom Between offshore wind farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
5	1	C/O/D	Mona Array Area + 10 nm	Allision - Ferry/Passenger	Presence of wind turbines; Reduced Searoom Between offshore wind farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; AtoN; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Repairs to wind turbines; Short term interruption to ferry services.	3	3	2	4	3	Multiple fatalities; Serious damage to vessel; Serious pollution (Tier 2); International adverse publicity; Loss of wind turbines; Ferry out of service.	5	5	3	5	2	10.0	Medium Risk - Tolerable (if ALARP)
6	6	C/O/D	Mona Array Area + 10 nm	Allision - Cargo/Tanker	Presence of wind turbines; Reduced Searoom Between offshore wind farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; AtoN; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; No pollution; Widespread adverse publicity; Repairs to wind turbines.	2	3	1	3	3	Single fatalities; Drydock required; Serious pollution incident (Tier 2); National adverse publicity; Loss of wind turbines.	4	5	4	5	2	8.7	Medium Risk - Tolerable (if ALARP)

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
7	13	C/O/D	Mona Array Area + 10 nm	Allision - Tug/Service & Small Project Vessels	Presence of wind turbines; Reduced Searoom Between offshore wind farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; AtoN; Air Draught Clearance; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to wind turbines.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to wind turbines.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
8	2	C/O/D	Mona Array Area + 10 nm	Allision - Fishing	Presence of wind turbines; Reduced Searoom Between offshore wind farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; Safety Zones; Fishing Liaison Plan; ERCOP; Periodic Exercises; Incident Investigation and Reporting; AtoN; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to wind turbines.	2	2	1	2	4	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to wind turbines.	4	4	3	4	3	9.6	Medium Risk - Tolerable (if ALARP)

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
9	13	C/O/D	Mona Array Area + 10 nm	Allision - Recreational	Presence of wind turbines; Reduced Searoom Between offshore wind farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; AtoN; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to wind turbines.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to wind turbines.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
10	8	C/O/D	Mona Array Area + 10 nm/Cable Corridor	Snagging - Fishing	Insufficient Lookout; Inadequate Passage Planning; Human Error/Fatigue; Anchoring in an emergency; Charts not up to date.	Notice to Mariners; Site Marking and Charting; Guard Vessels; Incident Investigation and Reporting; Fishing liaison plan; Cable Burial Risk Assessment.	Minor injuries; Minor damage to gear; No pollution; Cable inspection; Minor adverse publicity.	2	2	1	2	4	Single fatalities Loss of small craft; Minor pollution; Significant cable damage.	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)
11	24	C/O/D	Mona Array Area + 10 nm/Cable Corridor	Snagging - Recreational or Tug/Service	Insufficient Lookout; Inadequate Passage Planning; Human Error/Fatigue; Anchoring in an emergency; Charts not up to date.	Notice to Mariners; Site Marking and Charting; Guard Vessels; Incident Investigation and Reporting; Cable Burial Risk Assessment.	No injuries; Minor damage; No pollution; Cable inspection; Minor adverse publicity.	1	2	1	2	3	Single fatalities Loss of small craft; Minor pollution; Significant cable damage.	4	3	2	4	1	4.4	Low Risk - Broadly Acceptable

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
12	12	C/O/D	Mona Array Area + 10 nm/Cable Corridor	Snagging - Cargo/Tanker or Ferry/Passenger	Insufficient Lookout; Inadequate Passage Planning; Human Error/Fatigue; Anchoring in an emergency; Charts not up to date.	Notice to Mariners; Site Marking and Charting; Guard Vessels; Incident Investigation and Reporting; Cable Burial Risk Assessment.	No injuries; No property damage; No pollution; Cable damage requiring repairs.	1	1	1	3	3	No injuries; Loss of the vessel's anchor No pollution; Cable out of service.	1	2	1	5	2	7.0	Medium Risk - Tolerable (if ALARP)
13	26	C/O/D	Cable Corridor	Grounding - Cargo/Tanker or Ferry/Passenger	Insufficient Lookout; Inadequate Passage Planning; Human Error/Fatigue; Poor Visibility in Area; Equipment or Mechanical Failure on Vessel; Reduced Seakeeping due to Tidal or Weather Constraints; Interaction with project vessel; Charts not up to date.	Notice to Mariners; Site Marking and Charting; AtoN; Cable burial risk assessment.	No injuries; Minor damage; No pollution; Minor adverse publicity.	1	2	1	2	2	Single fatalities; Serious damage to vessel; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	1	3.7	Negligible Risk - Broadly Acceptable
14	26	C/O/D	Cable Corridor	Grounding - Fishing	Insufficient Lookout; Inadequate Passage Planning; Human Error/Fatigue; Poor Visibility in Area; Equipment or Mechanical Failure on Vessel; Reduced Seakeeping due to Tidal or Weather Constraints; Interaction with project vessel; Charts not up to date.	Notice to Mariners; Site Marking and Charting; AtoN; Cable burial risk assessment.	No injuries; Minor damage; No pollution; Minor adverse publicity.	1	2	1	2	2	Single fatalities; Loss of small craft; Moderate pollution (Tier 1); Serious adverse publicity.	4	4	3	4	1	3.7	Negligible Risk - Broadly Acceptable

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
15	28	C/O/D	Cable Corridor	Grounding - Recreational	Insufficient Lookout; Inadequate Passage Planning; Human Error/Fatigue; Poor Visibility in Area; Equipment or Mechanical Failure on Vessel; Reduced Seakeeping due to Tidal or Weather Constraints; Interaction with project vessel; Charts not up to date.	Notice to Mariners; Site Marking and Charting; AtoN; Cable burial risk assessment.	No injuries; Minor damage; No pollution; Minor adverse publicity.	1	2	1	2	2	Single fatalities; Loss of small craft; Minor pollution; Serious adverse publicity.	4	4	2	4	1	3.6	Negligible Risk - Broadly Acceptable
16	11	O	O&M Route	Collision - Small Project Vessel ICW. Cargo/Tanker or Ferry/Passenger	Increased Project Vessel Movements; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; ERCOP; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	2	Multiple fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)
17	13	O	O&M Route	Collision - Small Project Vessel ICW. Fishing or Recreational or Tug/Service	Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
18	21	O	O&M Route	Allision - Small Project Vessel	Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	2	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	5.8	Low Risk - Broadly Acceptable
19	21	O	O&M Route	Grounding - Small Project Vessel	Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	2	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	5.8	Low Risk - Broadly Acceptable
20	7	C/O/D	Mona Array Area + 10 nm/Cable Corridor/O&M	Vessel Emergency - Ferry/Passenger or Cargo/Tanker or Large Project Vessel	Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather;	ERCOP; Periodic Exercises; Incident Investigation and Reporting; Boundary Changes.	Multiple minor injuries; Minor damage; No pollution; Minor adverse publicity.	2	2	1	2	3	Multiple fatalities; Major damage; Major pollution (Tier 3); Major adverse publicity.	5	5	5	5	2	7.8	Medium Risk - Tolerable (if ALARP)

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
21	17	C/O/D	Mona Array Area + 10 nm/Cable Corridor/O&M	Vessel Emergency - Fishing or Recreational or Tug/Service or Small Project Vessel	Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather.	ERCOP; Periodic Exercises; Incident Investigation and Reporting; Boundary Changes.	Multiple minor injuries; Minor damage; No pollution; Minor adverse publicity.	2	2	1	2	2	Multiple fatalities; Serious damage; Serious pollution (Tier 2); Serious adverse publicity.	5	4	4	4	2	6.5	Medium Risk - Tolerable (if ALARP)
22	18	C/D	Mona Array Area + 10 nm/Cable Corridor	Snagging - Project Vessel	Insufficient Lookout; Inadequate Passage Planning; Human Error/Fatigue; Poor Visibility in Area; Mechanical Failure; Charts not up to date.	ERCOP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Cable burial risk assessment; Compliance of Project Vessels.	No injuries; Minor damage; No pollution; Cable inspection; Minor adverse publicity.	1	2	1	2	3	Single fatalities Loss of small craft; Minor pollution; Significant cable damage.	4	3	2	4	2	6.3	Medium Risk - Tolerable (if ALARP)
23	23	C/D	Mona Array Area + 10 nm/Cable Corridor	Collision - Large Project Vessel ICW. Ferry/Passenger	Reduced Searoom Between offshore wind farms; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	2	Significant loss of life; Constructive Loss; Serious pollution (Tier 2); International adverse publicity. Ferry out of service.	5	5	4	5	1	5.3	Low Risk - Broadly Acceptable

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
24	8	C/D	Mona Array Area + 10 nm/Cable Corridor	Collision - Large Project Vessel ICW. Cargo/Tanker	Reduced Searoom Between offshore wind farms; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Vessel requires drydock.	2	3	2	3	2	Single fatalities; Constructive Loss; Major pollution incident (Tier 3); National adverse publicity.	4	5	5	4	2	7.5	Medium Risk - Tolerable (if ALARP)
25	25	C/D	Mona Array Area + 10 nm/Cable Corridor	Collision - Large Project Vessel ICW. Fishing or Recreational or Tug/Service	Reduced Searoom Between offshore wind farms; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Minor Injuries; Minor damage; No pollution; Minor adverse publicity.	2	2	1	2	2	Multiple fatalities; Loss of small craft; Moderate pollution; Serious adverse publicity.	5	4	3	4	1	4.1	Low Risk - Broadly Acceptable
26	20	C/D	Mona Array Area + 10 nm	Allision - Large Project Vessel	Close proximity to wind turbines; Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather.	ERCOP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple minor injuries; Moderate damage; No pollution; Moderate disruption to activities.	2	3	1	3	3	Single fatalities; Serious damage; Moderate pollution; Major disruption to operations.	4	4	3	5	1	6.2	Medium Risk - Tolerable (if ALARP)

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
27	8	C/O/D	Mona Array Area +10 nm	Adverse Vessel Motions - Ferry/Passenger or Cargo/Tanker	Reduced Searoom Between offshore wind farms; Human Error/Poor Seamanship; Adverse Weather; Avoidance of Other Traffic.	Notice to Mariners; Site Marking and Charting; ERCOP; Boundary Changes.	Minor injuries; Minor damage to vessel - some damage to cargo; No pollution; Short term interruption to ferry services.	2	3	1	2	3	Single fatality; Major damage; Minor pollution; National adverse publicity; Ferry out of service.	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)
28	18	C/O/D	Mona Array Area + 10 nm/O&M	Allision (O&G) - Ferry/Passenger or Cargo/Tanker or Large Project Vessel	Reduced Searoom Between offshore wind farms; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Moderate pollution (Tier 2); Widespread adverse publicity; Short term interruption to ferry services.	3	4	3	4	2	Significant loss of life; Constructive Loss; Serious pollution (Tier 2); International adverse publicity. Ferry out of service.	5	5	5	5	1	6.3	Medium Risk - Tolerable (if ALARP)

Appendix B: Hazard workshop summary

B.1. Hazard workshop process

B.1.1.1.1 The hazard workshop preparation consisted of the following:

1. 09 August 2023: Save the date email issued to the wider stakeholder group which provided the dates for the hazard workshop, format and location
2. 29 August 2023: Issue of letter to all stakeholders introducing the Mona Offshore Wind Project ,the commitments made post-PEIR and provided further details of the hazard workshop venue and format
3. 18 September 2023: Issue of Mona Offshore Wind Project update newsletter outlining boundary changes made to the public
4. 21 and 22 September 2023: Issue of pre-read packs to all stakeholders which contained:
5. Slide pack containing a summary of the Mona Offshore Wind Project, boundary changes, analysis, methodology and reasoning behind the hazard scoring
6. Draft hazard logs developed by the Applicant's project team
7. 29 September 2023: Hazard Workshop.

B.2. Hazard workshop

B.2.1.1.1 A hazard workshop for the Mona Offshore Wind Project was held in person on 29 September 2023 at the Mercure Atlantic Tower Hotel in Liverpool.

B.2.1.1.2 The agenda was as follows:

- 08:30 - 09:00 Coffee/Tea
- 09:00 - 09:15 Introduction and Review of CRNRA Findings
- 09:15 - 09:30 Recap of Methodology
- 09:30 - 10:45 Hazard Scoring Session
- 10:45 - 11:00 Coffee Break.

B.3. Attendees

B.3.1.1.1 The details the organisations and representatives that attended the workshop are shown in the table below (including attendees from previous day's CRNRA workshop).

Organisation	Category	Role
NASH Maritime	Applicant's Project Team	Shipping and Navigation Consultants (Mona/Morgan/Morecambe)
HR Wallingford		Consultant Master Mariner Supporting NASH Maritime
Brookes Bell		Consultant Master Mariner Supporting NASH Maritime
bp/EnBW		Developer of Mona and Morgan

Organisation	Category	Role
Flotation Energy		Developer of Morecambe
Royal Haskoning		EIA Lead for Morecambe
Anglo-North Irish Fish Producers Organization (ANIFPO)	Stakeholder	Impact on Fishing
ENI		Impact on O&G Operations
Harbour Energy		Impact on O&G Operations
Isle of Man Government		Impact on Ferry Services and Isle of Man Developments
MCA		Impact on Navigation Safety
Orsted		Impact on Existing and Planned offshore wind farms
Peel Ports		Impact on Navigation Safety and Port Operations
Scottish Whitefish Producers Association (SWFPA)		Impact on Fishing
Seatruck Group		Impact on Navigation Safety and Ferry Services
Spirit Energy		Impact on O&G Operations
Steam Packet		Impact on Navigation Safety and Ferry Services
Stenaline		Impact on Navigation Safety and Ferry Services
Tom Watson		Impact on Fishing
UK Chamber of Shipping		Impact on Navigation Safety and Commercial Operators

B.3.2 Workshop process

B.3.2.1.1 At the workshop:

- The Mona Offshore Wind project team introduced the material and methodology
- Each hazard was reviewed in turn, with each attendee invited to discuss amongst their tables and score their personalised hazard log. Stakeholders were encouraged to fill out the comments section of each hazard post workshop to provide a higher level of description regarding their scores
- Each hazard score was then reviewed as a group with differences in scoring discussed, before a consensus was sought
- Once each hazard discussion had come to a close, the summary spreadsheet was 'locked' to capture the concluding scores of the discussion
- Risk controls were reviewed and appropriate additional risk controls discussed
- Update of hazard risk scores based on the findings of the hazard workshop for inclusion in the NRA.

B.4. Results

B.4.1.1.1 During the hazard workshop, a total of sixteen hazards were reviewed as a group for the Mona Offshore Wind Project, relevant to the individual and cumulative assessments. The scores and discussion points raised by stakeholders for each of these hazards are shown in the following pages.

B.4.1.1.2 During the hazard workshop, consensus was not reached on the specific scoring of several hazards, with a range of scores provided between the project teams and amongst stakeholders. However, a consensus was reached that all hazards previously identified as High Risk – Unacceptable were now Medium Risk – Tolerable if ALARP. To derive the final scores for the NRA, the findings of the workshop were therefore considered with the analysis and wider assessment undertaken by the Applicant’s project team (see Appendix A).

Hazard ID:	1												
Hazard Title:	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger												
Area:	Mona Array Area + 10nm												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
ANIFPO	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
CoS	3	3	2	4	3	5	5	4	5	2	10.1	Medium Risk - Tolerable (if ALARP)	Realistic business increased to 4 due to negative publicity.
ENI	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
IoM Gov	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
IoMSPC	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
MCA	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Seatruck	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Spirit Energy	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Stenaline	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
SWPAL	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Tom Watson	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
WCSP	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Final Scores	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	

Hazard ID:	3												
Hazard Title:	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft												
Area:	Mona Array Area + 10nm												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
ANIFPO	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
CoS	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
ENI	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
IoM Gov	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
IoMSPC	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
MCA	3	3	2	3	3	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)	
Seatruck	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Spirit Energy	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Stenaline	3	4	2	4	3	5	3	3	4	2	9.8	Medium Risk - Tolerable (if ALARP)	
SWPAL	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Tom Watson	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
WCSP	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Final Scores	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	

Hazard ID:	6												
Hazard Title:	Allision – Cargo/Tanker												
Area:	Mona Array Area + 10nm												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	2	3	1	3	3	4	4	4	5	2	8.6	Medium Risk - Tolerable (if ALARP)	
ANIFPO	2	3	1	3	3	4	4	4	5	2	8.6	Medium Risk - Tolerable (if ALARP)	
CoS	2	3	1	3	3	4	5	4	5	2	8.7	Medium Risk - Tolerable (if ALARP)	
ENI	2	3	1	3	3	4	4	4	5	2	8.6	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	2	3	1	3	3	4	4	4	5	2	8.6	Medium Risk - Tolerable (if ALARP)	
IoM Gov	2	4	1	3	3	4	4	4	5	2	9.5	Medium Risk - Tolerable (if ALARP)	
IoMSPC	2	3	1	3	3	4	4	4	5	2	8.6	Medium Risk - Tolerable (if ALARP)	
MCA	2	3	2	3	3	4	4	4	5	2	8.8	Medium Risk - Tolerable (if ALARP)	
Seatruck	2	4	1	3	3	4	4	4	5	2	9.5	Medium Risk - Tolerable (if ALARP)	
Spirit Energy	2	3	1	3	3	4	4	4	5	2	8.6	Medium Risk - Tolerable (if ALARP)	
Stenaline	2	4	1	4	3	4	4	4	5	2	9.7	Medium Risk - Tolerable (if ALARP)	
SWPAL	2	3	1	3	3	4	4	4	5	2	8.6	Medium Risk - Tolerable (if ALARP)	
Tom Watson	2	3	1	3	3	4	4	4	5	2	8.6	Medium Risk - Tolerable (if ALARP)	
WCSP	2	3	1	3	3	4	4	4	5	2	8.6	Medium Risk - Tolerable (if ALARP)	
Final Scores	2	3	1	3	3	4	5	4	5	2	8.7	Medium Risk - Tolerable (if ALARP)	

Hazard ID:	10												
Hazard Title:	Snagging – Fishing												
Area:	Mona Array Area + 10nm/Cable Corridor												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	2	2	1	2	4	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)	
ANIFPO	3	3	1	3	4	4	4	2	4	2	9.3	Medium Risk - Tolerable (if ALARP)	ideally cables should be buried but the sea bed can move and expose cables
CoS	2	2	1	2	4	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)	
ENI	2	2	1	2	4	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	2	2	1	2	4	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)	
IoM Gov	2	2	1	2	4	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)	
IoMSPC	2	2	1	2	4	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)	
MCA	2	3	1	2	4	4	4	2	5	2	9.4	Medium Risk - Tolerable (if ALARP)	
Seatruck	2	2	1	2	4	5	4	2	4	2	8.1	Medium Risk - Tolerable (if ALARP)	
Spirit Energy	2	2	1	2	4	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)	
Stenaline	2	2	1	3	4	5	4	2	4	2	9.4	Medium Risk - Tolerable (if ALARP)	
SWPAL	3	3	1	2	4	4	4	2	5	3	11.8	Medium Risk - Tolerable (if ALARP)	
Tom Watson	2	2	1	2	4	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)	
WCSP	2	2	1	2	4	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)	
Final Scores	2	2	1	2	4	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)	

Hazard ID:	17												
Hazard Title:	Collision – Small Project Vessel ICW. Fishing or Recreational or Tug/Service												
Area:	O&M Route												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	2	2	1	2	3	4	3	3	4	2	6.6	Medium Risk - Tolerable (if ALARP)	
ANIFPO	2	2	1	2	3	4	3	3	4	2	6.6	Medium Risk - Tolerable (if ALARP)	
CoS	2	2	1	2	3	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)	
ENI	2	2	1	2	3	4	3	3	4	2	6.6	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	2	2	1	2	3	4	3	3	4	2	6.6	Medium Risk - Tolerable (if ALARP)	
IoM Gov	2	2	1	2	3	4	3	3	4	2	6.6	Medium Risk - Tolerable (if ALARP)	
IoMSPC	2	2	1	2	3	4	3	3	4	2	6.6	Medium Risk - Tolerable (if ALARP)	
MCA	2	2	1	2	3	4	3	3	4	2	6.6	Medium Risk - Tolerable (if ALARP)	
Seatruck	2	2	1	2	3	4	3	3	4	2	6.6	Medium Risk - Tolerable (if ALARP)	
Spirit Energy	2	2	1	2	3	4	3	3	4	2	6.6	Medium Risk - Tolerable (if ALARP)	
Stenaline	2	2	1	2	3	4	3	3	4	2	6.6	Medium Risk - Tolerable (if ALARP)	
SWPAL	2	2	1	2	3	4	3	3	4	2	6.6	Medium Risk - Tolerable (if ALARP)	
Tom Watson	2	2	1	2	3	4	3	3	4	2	6.6	Medium Risk - Tolerable (if ALARP)	
WCSP	2	2	1	2	3	4	3	3	4	2	6.6	Medium Risk - Tolerable (if ALARP)	
Final Scores	2	2	1	2	3	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)	

Hazard ID:	16												
Hazard Title:	Collision – Small Project Vessel ICW. Cargo/Tanker or Ferry/Passenger												
Area:	O&M Route												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
ANIFPO	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
CoS	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
ENI	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
IoM Gov	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
IoMSPC	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
MCA	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
Seatruck	3	4	2	3	2	5	4	3	4	2	8.0	Medium Risk - Tolerable (if ALARP)	
Spirit Energy	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
Stenaline	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
SWPAL	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
Tom Watson	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
WCSP	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
Final Scores	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	

Appendix C: MGN654 Checklist

MGN section	Yes/No	Comments
4. Planning Stage – Prior to Consent		
4.5 Site and Installation Co-ordinates: Developers are responsible for ensuring that formally agreed co-ordinates 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, operations and decommissioning. This should be supplied as authoritative Geographical Information System data, preferably in Environmental Systems Research Institute 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 (ETRS89) datum.		
4.6 Traffic Survey – includes		
All vessel types	✓	Analysis of all vessel types within the shipping and navigation study area is contained within section 1.6.
At least 28 days duration, within either 12 or 24 months prior to submission of the Environmental Impact Assessment Report	✓	An MGN654 compliant vessel survey (during 2021/2022) has been conducted and is described in section 1.6.2.
Multiple data sources	✓	Section 1.3.5 describes the vessel traffic, incident and secondary data sources used to inform the NRA.
Seasonal variations	✓	Seasonality has been accounted for within the 2 x 14 day traffic surveys and AIS data and is referenced throughout section 1.6.
MCA consultation	✓	Consultation with the MCA has been conducted (see section 1.3.5).
General Lighthouse Authority consultation	✓	Consultation with Trinity House has been conducted (see section 1.3.5).
Chamber of Shipping and shipping company consultation	✗	Consultation with the Chamber of Shipping and ferry companies has been conducted (see section 1.3.5/1.9.4).
Recreational and fishing vessel organisations consultation	✓	Consultation with the RYA and fishing groups has been conducted (see section 1.3.5/1.9.4).
Port and navigation authorities consultation, as appropriate	✓	Consultation with Peel Ports has been conducted (see section 1.3.5/1.9.4).
4.6.d Assessment of the cumulative and individual effects of (as appropriate):		
i. Proposed OREI site relative to areas used by any type of marine craft.	✓	Vessel traffic analysis within the shipping and navigation study area is described in section 1.6.

MGN section	Yes/No	Comments
ii. Numbers, types and sizes of vessels presently using such areas	✓	Vessel traffic analysis within the shipping and navigation study area is described in section 1.6.
iii. Non-transit uses of the areas, e.g. fishing, day cruising of leisure craft, racing, aggregate dredging, personal watercraft etc.	✓	Vessel traffic analysis within the shipping and navigation study area is described in section 1.6.
iv. Whether these areas contain transit routes used by coastal, deep-draught or international scheduled vessels on passage.	✓	Vessel traffic analysis within the shipping and navigation study area is described in section 1.6.
v. Alignment and proximity of the site relative to adjacent shipping routes.	✓	Vessel traffic analysis within the shipping and navigation study area is described in section 1.6.
vi. Whether the nearby area contains prescribed routeing schemes or precautionary areas.	✓	Navigational features are highlighted in section 1.4.8.
vii. Proximity of the site to areas used for anchorage (charted or uncharted), safe haven, port approaches and pilot boarding or landing areas.	✓	Navigational features are highlighted in section 1.5. Analysis of anchoring activity is contained within section 1.6.
viii. Whether the site lies within the jurisdiction of a port and/or navigation authority.	✓	Navigational features are highlighted in section 1.5.
ix. Proximity of the site to existing fishing grounds, or to routes used by fishing vessels to such grounds.	✓	Analysis of fishing vessel activity is contained within section 1.6.
x. Proximity of the site to offshore firing/bombing ranges and areas used for any marine military purposes.	✓	Navigational features are highlighted in section 1.5.
xi. Proximity of the site to existing or proposed submarine cables or pipelines, offshore oil/gas platform, marine aggregate dredging, marine archaeological sites or wrecks, Marine Protected Area or other exploration/exploitation sites.	✓	Navigational features are highlighted in section 1.5.
xii. Proximity of the site to existing or proposed OREI developments, in co-operation with other relevant developers, within each round of lease awards.	✓	Navigational features are highlighted in section 1.5. Future proposed OREIs are described in section 1.10.
xiii. Proximity of the site relative to any designated areas for the disposal of dredging spoil or other dumping ground.	✓	Navigational features are highlighted in section 1.5.
xiv. Proximity of the site to AtoN and/or VTS in or adjacent to the area and any impact thereon.	✓	Navigational features are highlighted in section 1.5.

MGN section	Yes/No	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.	✓	The impact on vessel routeing is assessed within section 1.8.2/1.8.3/1.8.3.16.
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.	✓	Analysis of historical incident data is contained within section 1.6.4.
xvii. Proximity of the site to areas used for recreation which depend on specific features of the area.	✓	Analysis of recreational traffic is contained within section 1.6.
4.7 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.	✓	The impact on vessel routeing is assessed within section 1.8.2/1.8.3/1.8.3.16 and the impact on allision risk is contained within section 1.8.7.
b. The width of a corridor between sites or OREIs to allow safe passage of shipping.	✓	The cumulative impacts of multiple OREIs is assessed within section 1.10.
4.8. 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.	✓	The risks of snagging on project infrastructure are assessed in section 1.8.12. Impacts on underkeel clearance are assessed in section 1.8.13.
b. Clearances of fixed or floating wind turbine blades above the sea surface are *not less than 22 metres* (above MHWS for fixed). Floating turbines allow for degrees of motion.	✓	The risk of allision with wind turbine blades is assessed in section 1.8.7 and risk controls are described in section 1.4.8.
c. Underwater devices i. changes to charted depth ii. maximum height above seabed iii. UKC	 ✓ ✓ ✓	The impact on UKC and contact risk with moorings are assessed in section 1.8.13.
d. Whether structure block or hinder the view of other vessels or other navigational features.	✓	Impacts on visual navigation and collision avoidance are considered within section 1.8.6.

MGN section	Yes/No	Comments
4.9 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).	✓	Analysis of tidal conditions are given in section 1.5.3. The impact on UKC is assessed in section 1.8.13.
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.	✓	Analysis of metocean conditions are given in section 1.5.3. Collision and allision (section 1.8.7) assessments consider the impact of metocean conditions.
c. The maximum rate tidal stream runs parallel to the major axis of the proposed site layout, and, if so, its effect.	✓	Analysis of metocean conditions are given in section 1.5.3. Collision and allision (section 1.8.7) assessments consider the impact of metocean conditions.
d. The set is across the major axis of the layout at any time, and, if so, at what rate.	✓	Analysis of metocean conditions are given in section 1.5.3. Collision and allision (section 1.8.7) assessments consider the impact of metocean conditions.
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.	✓	Analysis of metocean conditions are given in section 1.5.3. Collision and allision (section 1.8.7) assessments consider the impact of metocean conditions.
f. The structures themselves could cause changes in the set and rate of the tidal stream.	✓	No effect 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 windfarm area or adjacent to the area.	✓	Analysis of metocean conditions are given in section 1.5.3. The impact on UKC is assessed in section 1.8.13.
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.	✓	Adverse weather impacts are assessed within section 1.8.3 and 1.8.3.16.
i. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer.	✓	Analysis of metocean conditions are given in section 1.5.3. Collision and allision (section 1.8.7) assessments consider the impact of metocean conditions.
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.	✓	Analysis of metocean conditions are given in section 1.5.3. Collision and allision (section 1.8.7) assessments consider the impact of metocean conditions.

MGN section	Yes/No	Comments
4.10 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: • For all vessels • For specified vessel types, operations and/or sizes • In all directions or areas • In specified directions or areas • In specified tidal, weather or other conditions.	✓	Impacts to vessel routeing are assessed in section 1.8.2/1.8.3/1.8.3.16.
b. Navigation in and/or near the site should be prohibited or restricted: • For specified vessel types, operations and/or sizes • In respect of specific activities • In all areas or directions • In specified areas or directions • In specified tidal or weather conditions.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
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.	✓	Impacts to vessel routeing are assessed in section 1.8.2/1.8.3/1.8.3.16.
d. Guidance on the calculation of safe distance of OREI boundaries from shipping routes has been considered.	✓	Vessel routes are identified in section 1.6.3.
4.11 Search and rescue (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 offshore renewable energy installations (OREI) 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, operations and decommissioning phases of the OREI.	✓	Impacts to SAR are considered within section 1.8.8. Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.

MGN section	Yes/No	Comments
b. The MCA's guidance document *Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response* for the design, equipment and operation requirements will be followed.	✓	Impacts to SAR are considered within section 1.8.8. Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
c. A SAR checklist will be completed to record discussions regarding the requirements, recommendations and considerations outlined in the above document (to be agreed with MCA).		Impacts to SAR are considered within section 1.8.8. Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
4.12 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.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
ii. On a pre-established periodicity during the life of the development.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
ii. Post-construction: Cable route(s).	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
iii. Post-decommissioning of all or part of the development: the installed generating assets area and cable route.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
4.13 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 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.	✓	Impact on communications, radar and positioning systems are considered within section 1.8.11.

MGN section	Yes/No	Comments
b. The structures could produce radar reflections, blind spots, shadow areas or other adverse effects: i. Vessel to vessel ii. Vessel to shore iii. VTS radar to vessel iv. Racon to/from vessel.	✓	Impact on communications, radar and positioning systems are considered within section 1.8.11.
c. The structures and generators might produce sonar interference affecting fishing, industrial or military systems used in the area.	✓	Impact on communications, radar and positioning systems are considered within section 1.8.11.
d. The site might produce acoustic noise which could mask prescribed sound signals.	✓	Impact on communications, radar and positioning systems are considered within section 1.8.11.
e. Generators and the seabed cabling within the site and onshore might produce electro-magnetic fields affecting compasses and other navigation systems.	✓	Impact on communications, radar and positioning systems are considered within section 1.8.11.
4.14 Risk mitigation measures recommended for OREI during construction, operations and decommissioning. Mitigation and safety measures will be applied to the OREI development appropriate to the level and type of risk determined during the Environmental Impact Assessment (EIA). The specific measures to be employed will be selected in consultation with the Maritime and Coastguard Agency (MCA) and will be listed in the developer's Environmental Statement. These will be consistent with international standards contained in, for example, the Safety of Life at Sea (SOLAS) Convention - Chapter V, IMO Resolution A.572 (14)[3] and Resolution A.671(16)[4] and could include any or all of the following:		
i. Promulgation of information and warnings through notices to mariners and other appropriate maritime safety information dissemination methods.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
ii. Continuous watch by multi-channel VHF, including Digital Selective Calling.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
iii. Safety zones of appropriate configuration, extent and application to specified vessel.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
iv. Designation of the site as an Area to be Avoided.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
v. Provision of AtoN as determined by the GLA.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.

MGN section	Yes/No	Comments
vi. Implementation of routeing measures within or near to the development.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
vii. Monitoring by radar, AIS, CCTV or other agreed means.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
viii. Appropriate means for OREI operators to notify, and provide evidence of, the infringement of safety zones.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
ix. Creation of an Emergency Response Cooperation Plan with the MCA's SAR Branch for the construction phase onwards.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
x. Use of guard vessels, where appropriate.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
xi. Update NRAs every two years e.g. at testing sites.	N/A	N/A
xii. Device-specific or array-specific NRAs.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
xiii. Design of OREI structures to minimise risk to contacting vessels or craft.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
xiv. Any other measures and procedures considered appropriate in consultation with other stakeholders.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.

Appendix D: 2023 Vessel Traffic Survey Addendum

D.1. Introduction and Purpose

D.1.1.1.1 NASH Maritime has been commissioned to undertake an NRA for the Mona Offshore Wind Project, located in the Irish Sea.

D.1.1.1.2 The NRA has been conducted to the standards of the MCA's MGN654 (MCA, 2021a). As such, two 14-day vessel traffic surveys were undertaken to collect AIS data, radar and visual observations to inform the assessment. The results of these surveys are reported in section 1.6.2 of the NRA.

D.1.1.1.3 It is noted that MGN654 4.6b states that "For all OREI developments, subject to the planning process, the survey may be undertaken within 24 months prior to submission. If the EIA Report is not submitted within 24 months an additional 14 day continuation survey data may be required for each subsequent 12-month period".

D.1.1.1.4 The vessel traffic survey dates reported in section 1.6.2 of the NRA are:

- 05 December 2021 to 19 December 2021
- 30 June 2022 to 14 July 2022.

D.1.1.1.5 Therefore, the Mona Offshore Wind Project vessel traffic survey validity would expire in December 2023 and prior to Application. This was recognised in email correspondence with the MCA in May and June 2023.

D.1.1.1.6 To address this, a top-up vessel traffic survey was undertaken in October and November 2023 for the purposes of extending the validity of the survey data for a further 12-month period beyond the date of Application. Due to programme constraints, this is reported within an appendix to the NRA rather than within the main body of the document.

D.1.1.1.7 The objective of this appendix is twofold. Firstly, to provide a factual record of the top-up marine vessel traffic dataset. Secondly, to compare the results of this survey with the findings of the NRA to confirm whether they are consistent with previous data collection and whether any differences would have a bearing on the conclusions of the NRA. This approach was shared with the MCA in July 2023.

D.2. Marine Vessel Traffic Survey Methodology

D.2.1 Survey Area and Data Extents

D.2.1.1.1 The survey area has been defined with a 10 nm buffer of the Mona Array Area as shown in Figure 1.52. The survey area represents the zone within which vessel traffic data has been analysed in this report. The survey vessel track shows the location of the vessel throughout the survey period.

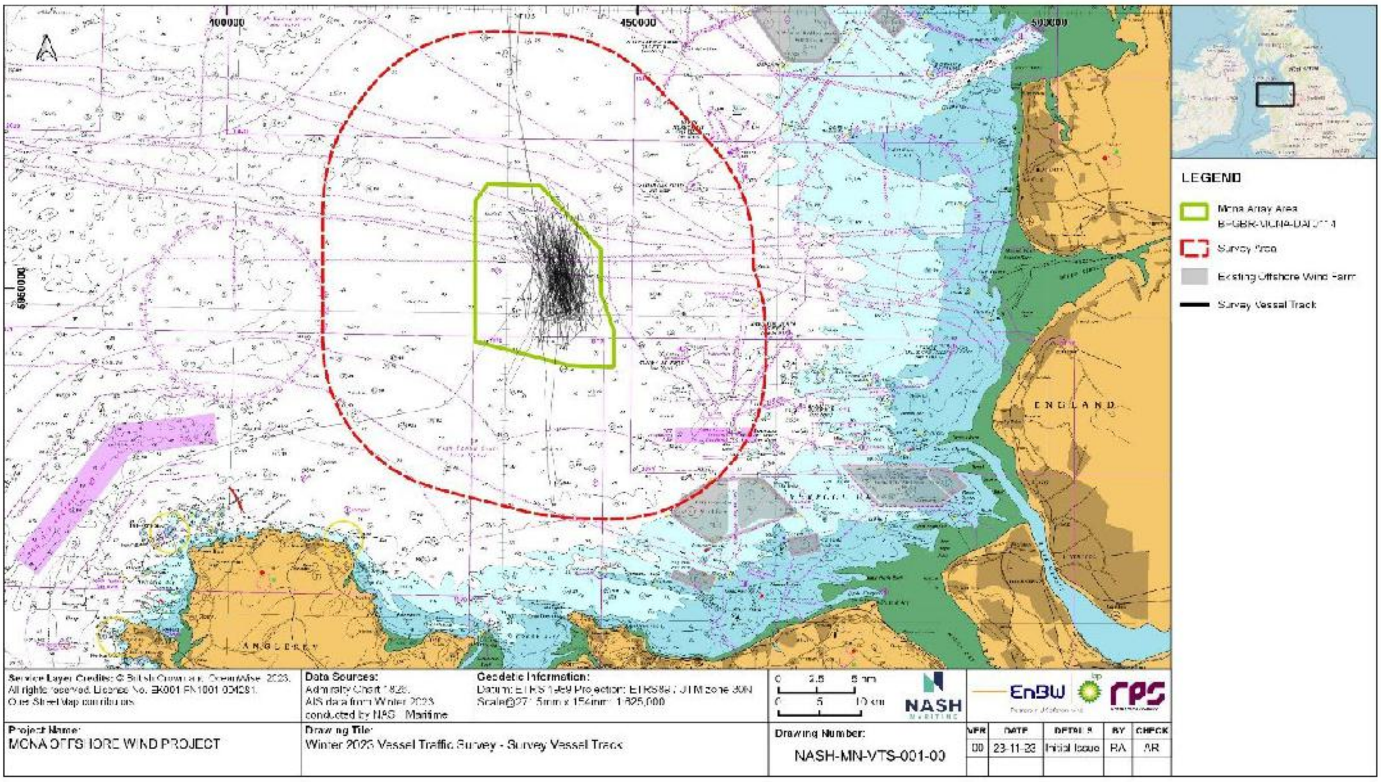

Figure 1.52: Survey area and survey vessel track.

D.2.2 Survey Vessel

D.2.2.1.1 The vessel-based marine vessel traffic survey was undertaken using the Morning Star survey vessel (see Table 1.31).

Table 1.44: MORNING STAR specifications.

Feature	Value	Feature	Value
Name	Morning Star	**Tonnage**	146 GT
Callsign	MYXY7	**Main Engine**	Caterpillar C32 500 KW
Date built	1999	**Auxiliary Engine**	Daewoo 230 KW
Hull	Steel	**Speed**	10 kts cruising 12 kts max
Length	23.0 m	**Fuel Oil Capacity**	24,000 litres
Breadth	7.0 m	**Freshwater Capacity**	15,000 litres
Depth	3.8 m		

D.2.3 Survey Period

D.2.3.1.1 The marine survey was undertaken for a duration of 14 days. The survey commenced 05:30 Universal Time Coordinated (UTC) on 26 October 2023 and completed 12:00 UTC on 11 November 2023.

D.2.3.1.2 Daily survey vessel reports were collated describing weather conditions, sea state, vessel status, equipment status and crew actions.

D.2.4 Vessel Downtime

D.2.4.1.1 During the surveys, the following downtime was incurred. Morning Star departed Mona Array Area at 06:00 UTC on 01 November 2023 for shelter due to adverse weather conditions associated with Storm Ciaran. Vessel recommenced survey at 09:30 UTC on 03 November 2023.

D.2.5 Survey Vessel Location

D.2.5.1.1 The location of the survey vessel was monitored using onboard Global Positioning Systems (GPS), and the survey vessel track is presented in Figure 1.52.

D.2.6 Weather Log

D.2.6.1.1 Weather was recorded by the survey vessel at six hourly intervals during the survey campaign.

D.2.6.1.2 The maximum wind experienced was 30 kts from the west which contributed to a moderate/rough sea state (06 November 2023).

D.2.6.1.3 Two of the six-hour intervals across the 14 days were classified as having poor visibility, the majority of days were characterised by good visibility.

D.2.6.1.4 The most common sea state recorded was Slight.

D.2.7 Data Competency

D.2.7.1.1 Quality assurance checks on the survey vessel equipment and data collection were undertaken on a continuous basis throughout the survey to ensure competency of equipment, area coverage and data collection fidelity.

D.2.7.1.2 Data outputs following post processing of data are described in section D.3.

D.3. Survey Results

D.3.1 Summary

D.3.1.1.1 Figure 1.53 and Table 1.45 provides a count of identified vessels during the survey period by vessel type. The most frequently identified vessel type during the survey period was Passenger This is largely due to the proximity of multiple ferry routes in operation within the region, primarily between Heysham, Liverpool, Ireland and the Isle of Man.

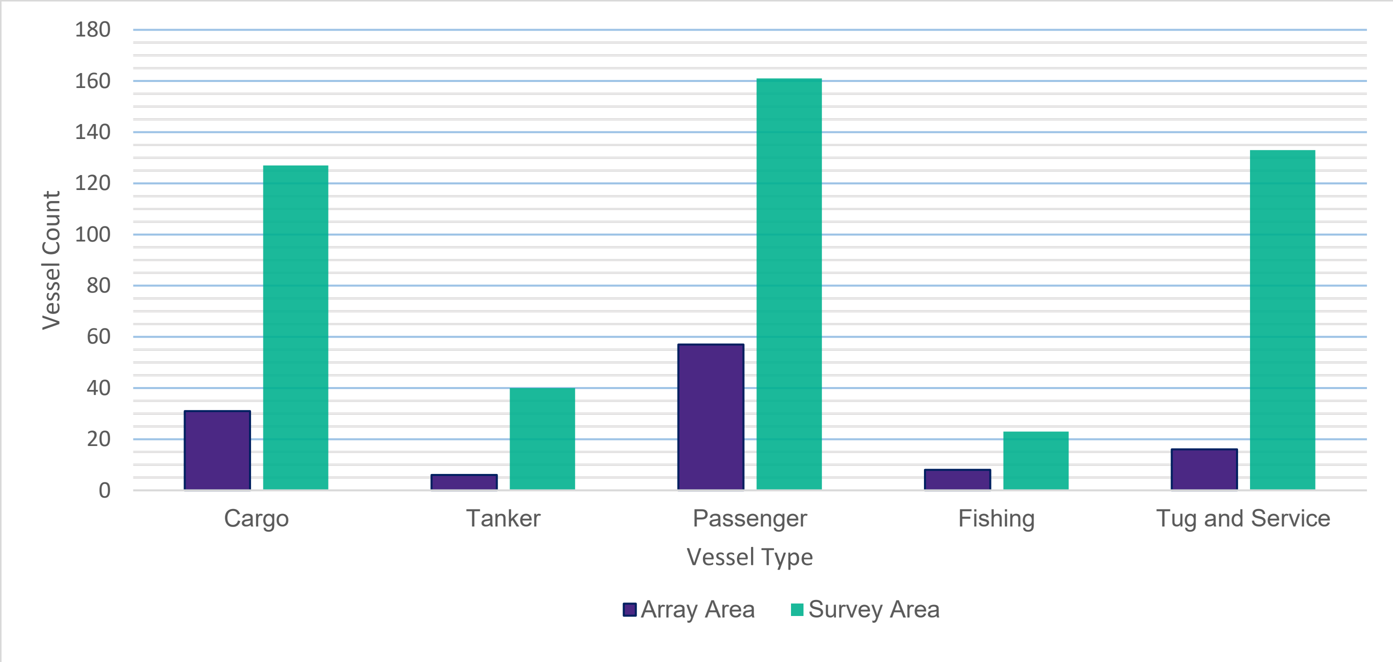

Figure 1.53: Top-up survey vessel tracks.

Table 1.45: Summary of vessel traffic survey.

Attributes	Top-Up
Vessel	Morning Star (23 m Fishing Vessel)
Dates	05:30:00 26th October 2023 to 12:00:00 11th November 2023
Downtime	06:00:00 1st November 2023 to 09:30:00 3rd November 2023
Survey Area	Mona Array Area + 10nm
Total Vessels Recorded (Mona Array Area + 10nm)	602 (43.2/day)
Total Vessels Recorded (Mona Array Area)	118 (8.4/day)
Cargo	**Mona Array + 10nm**: 158 (11.3/day) **Mona Array**: 31 (2.2/day)
Fishing	**Mona Array + 10nm**: 31 (2.2/day) **Mona Array**: 8 (0.6/day)
Passenger	**Mona Array + 10nm**: 218 (15.6/day) **Mona Array**: 57 (4.1/day)
Recreational	**Mona Array + 10nm**: 0 (0/day) **Mona Array**: 0 (0/day)
Tanker	**Mona Array + 10nm**: 46 (3.3/day) **Mona Array**: 6 (0.4/day)
Tug and Service	**Mona Array + 10nm**: 149 (10.6/day) **Mona Array**: 16 (1.1/day)

D.3.2 Cargo

D.3.2.1.1 There were 158 cargo vessel tracks identified within 10 nm of the Mona Array Area during the survey as shown in Figure 1.54. Of these, 31 tracks crossed the Mona Array Area. In the 2021 winter survey and 2022 summer survey 182 and 124 cargo vessels were identified respectively and therefore this frequency is consistent with the previous vessel traffic surveys.

D.3.2.1.2 During the survey, the largest cargo vessel was the Atlantic Sail, a 295 m container ship which was recorded transiting to the port of Halifax, Canada. Larger vessels were recorded during the previous surveys but this is consistent in characteristics.

D.3.2.1.3 The majority of cargo tracks recorded are progressing in an east-west orientation which indicates they are on passage between Liverpool and Off-Skerries TSS. Additionally, there are a small number of cargo vessels transiting northwest-southeast through the Mona Array Area. This is largely similar to the routes identified in the 2021 winter and 2022 summer surveys, albeit less were recorded transiting between the Calf of the Isle of Man and the Liverpool Bay TSS.

D.3.2.1.4 Of note is the cargo vessel activity in the southern region of the Mona Array Area, these were manoeuvres by the freight ferry vessel, Stena Forwarder. This vessel is a recent purchase by Stena and had its inaugural commercial sail on 03 November 2023, during the survey period. It is therefore likely that these manoeuvres were training exercises or equipment tests performed ahead of this vessel coming into service.

D.3.3 Tanker

D.3.3.1.1 There were 40 tanker tracks identified passing through the survey area during the survey period, shown in Figure 1.55. All tracks are in an orientation in/out of Liverpool. In total, six of the tanker tracks crossed the Mona Array Area.

D.3.3.1.2 During the survey, the largest tanker recorded was the British Engineer, a 183 m oil/chemical tanker. This vessel was identified twice during the survey.

D.3.3.1.3 The majority of tanker vessels transit on an east-west route through the Liverpool Bay TSS. Similar to cargo vessel activity, there are a small number of vessels that transit northwest-southeast through the Mona Array Area. For the most part this is similar to the routes identified in the 2021 Winter and 2022 Summer Surveys.

D.3.3.1.4 There is a sizable decrease from the 120 vessels identified in the winter 2021 survey and the 98 identified in the summer 2022 survey.

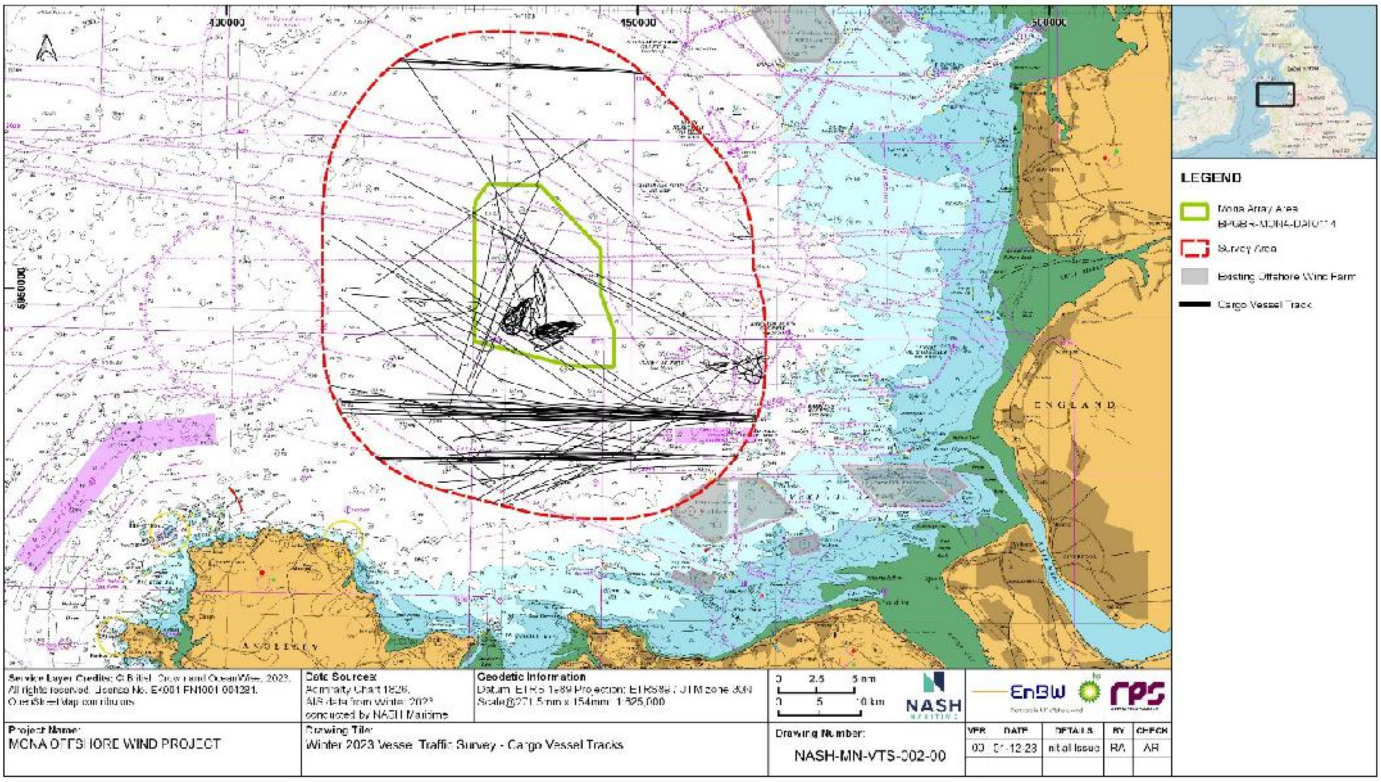

Figure 1.54: Cargo vessel tracks.

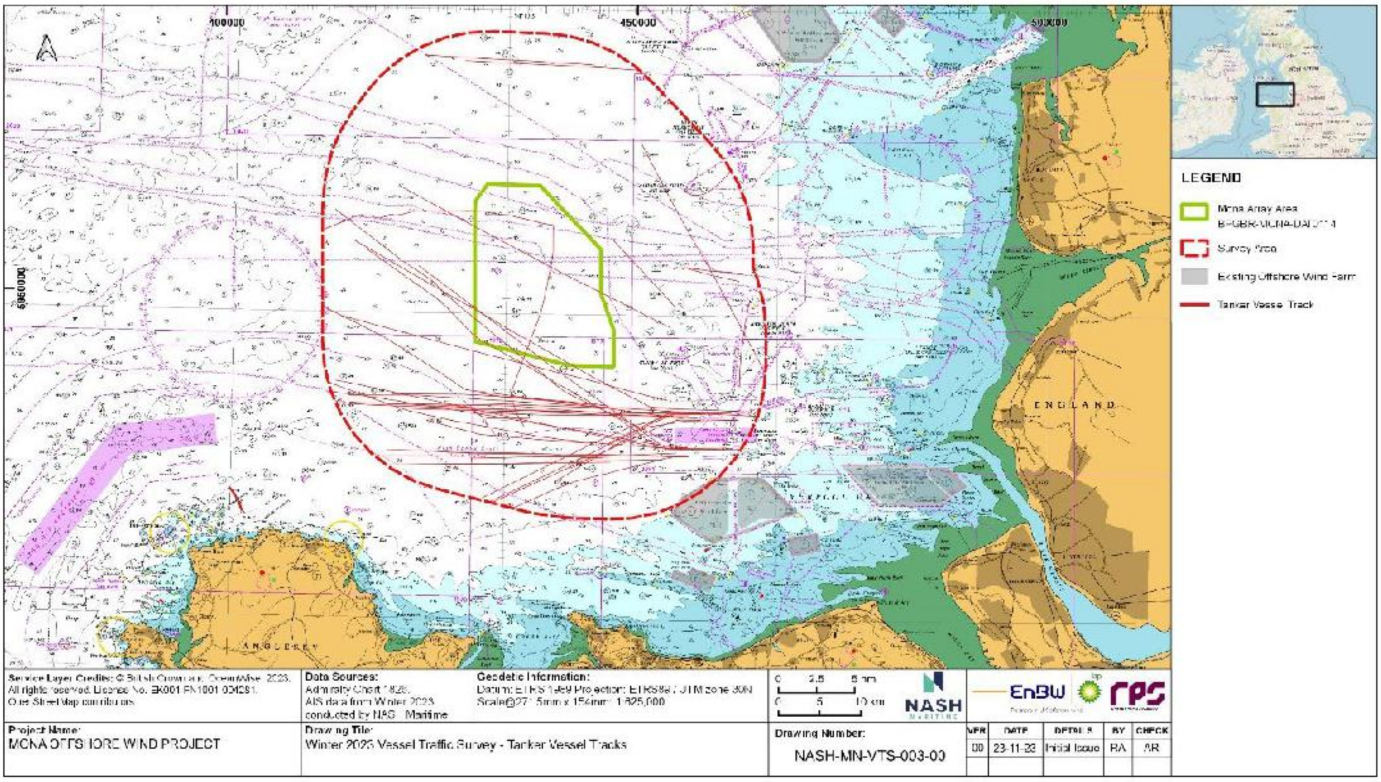

Figure 1.55: Tanker vessel tracks.

D.3.4 Passenger

D.3.4.1.1 There were 218 passenger vessel tracks identified during the survey, of which five tracks crossed the Mona Array Area (Figure 1.56). 57 of the tracks crossing the Mona Array Area were vessels operated by Stena Line on passage between Liverpool and Belfast. 47 tracks were Seatruck operated vessels transiting between Heysham and Belfast / Carlingford Lough, and Liverpool and Dublin. Six tracks were the Manannan operated by Isle of Man Steam Packet Company on passage between Liverpool and Douglas.

D.3.4.1.2 The largest passenger vessels identified during the survey period were the 215 m Stena Line vessels Stena Edda, Stena Estrid and Stena Embla. The Stena Embla and Stena Edda were also the largest passenger vessels identified during the summer 2022 survey.

D.3.4.1.3 Routes identified are the same ferry routes identified in the previous surveys.

D.3.4.1.4 Comparatively, this survey identified fewer passenger vessels than previously recorded, with 268 passenger vessels being identified in the winter 2021 survey and 349 identified in the summer 2022 survey.

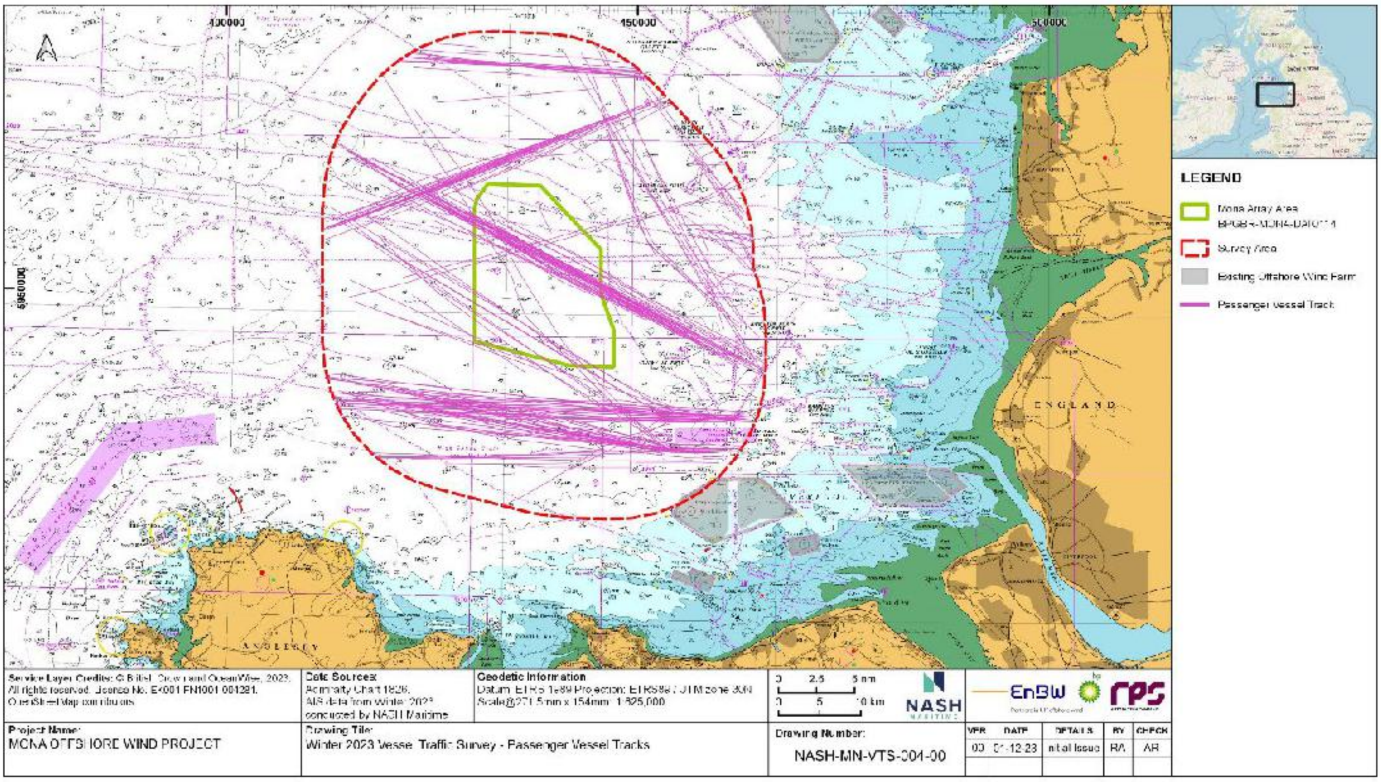

Figure 1.56: Passenger vessel tracks.

D.3.5 Fishing

D.3.5.1.1 There were 31 fishing vessel tracks identified during the winter survey period as shown in Figure 1.57. The tracks indicate fishing activity in locations corresponding to known areas used for scallop fishing activity. During the survey, vessel tracks recorded were associated to five unique fishing vessels.

D.3.5.1.2 This activity is consistent with what was expected based on the results of previous vessel traffic surveys.

D.3.6 Recreational

D.3.6.1.1 There was no recreational use of the area during the winter survey period.

D.3.6.1.2 The winter 2021 survey also found no recreational vessels. The summer 2022 survey identified 10 recreational vessels transiting the survey area.

D.3.7 Tug and Service

D.3.7.1.1 Figure 1.58 shows regular tug and service activity to the north and south of the Mona Array Area. There were 149 tug and service tracks identified during the survey period. A total of 24 tug and service vessel tracks were associated with operations by at the South Morecambe Gas Field to the north of the Mona Array Area. The majority of activity to the south of the Mona Array Area were offshore supply ships.

D.3.7.1.2 16 tug and service vessel tracks transited through the Mona Array Area. The majority of these movements were vessels on a northwest and southeast trajectory from the Irish Sea into the Liverpool Bay TSS.

D.3.7.1.3 The winter 2021 and summer 2022 surveys found similar transit numbers with 134 and 160 vessel transits being identified within the survey area. In the winter 2021 survey 30 of these transited the Mona Array Area and in the summer 2022 there were 33. In the previous surveys the west-east route using the Liverpool Bay TSS is present, as well as the vessels identified transiting northwest-southeast. There is also activity in the northeast of the survey area, around Calder Gas Field and South Morecambe Gas Field.

D.3.7.1.4 Some activity was present within the Mona Array Area associated with survey operations of the Mona Offshore Wind Project.

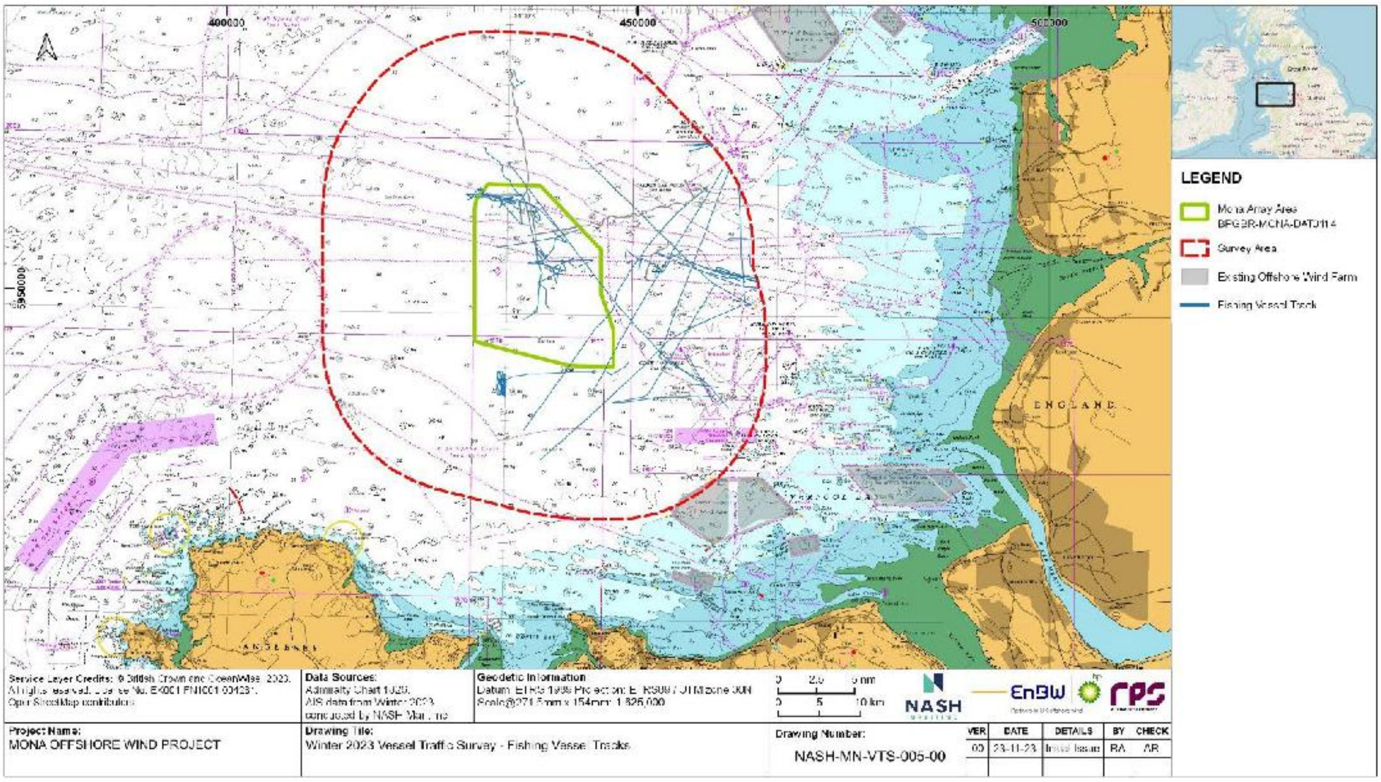

Figure 1.57: Fishing vessel tracks.

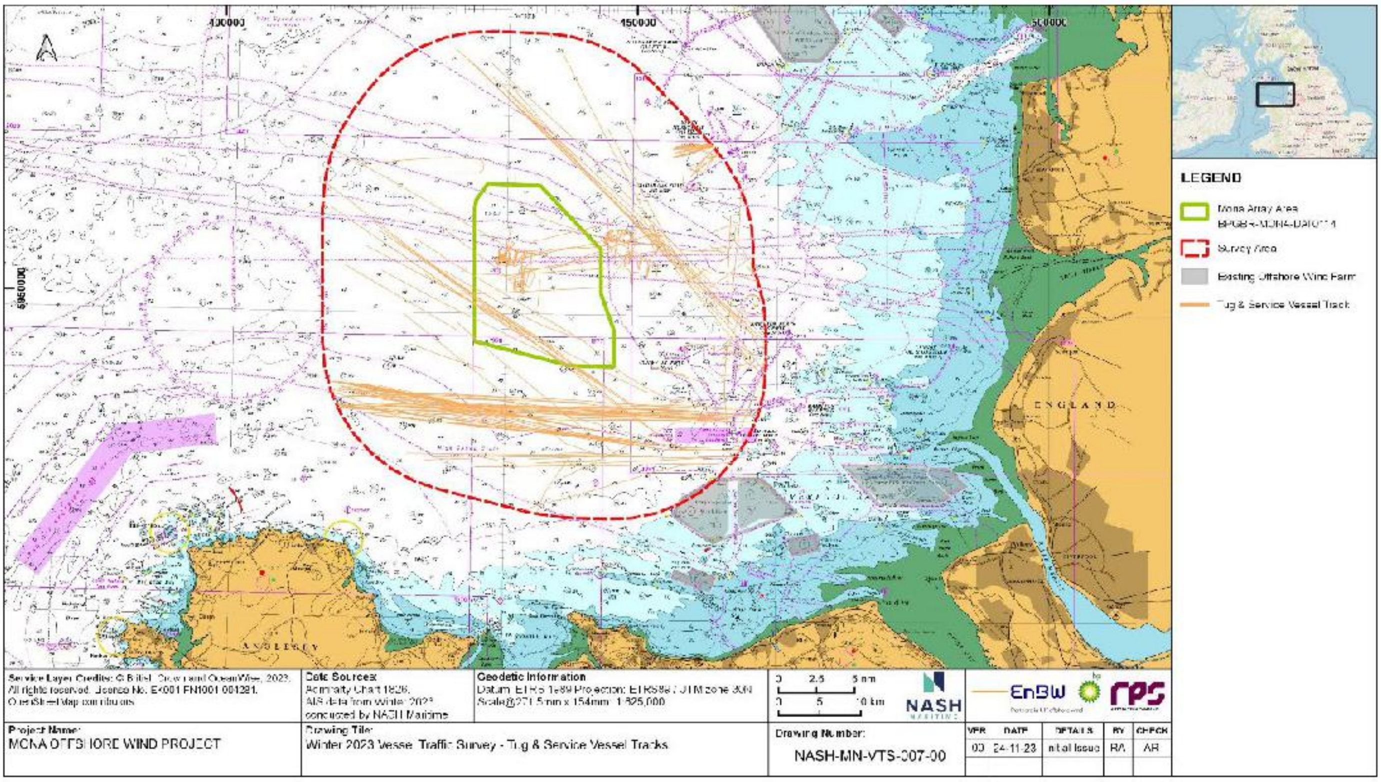

Figure 1.58: Tug and service vessel tracks.

D.3.8 Vessel Counts

D.3.8.1.1 Figure 1.59 shows the daily counts of vessel tracks either through the Mona Array Area or within the 10 nm buffer for the winter survey. There were 602 individual tracks identified during the winter survey period averaging 43 per day. 118 of these passed through the Mona Array Area. This is less than was recorded during the winter 2021 and summer 2022 surveys.

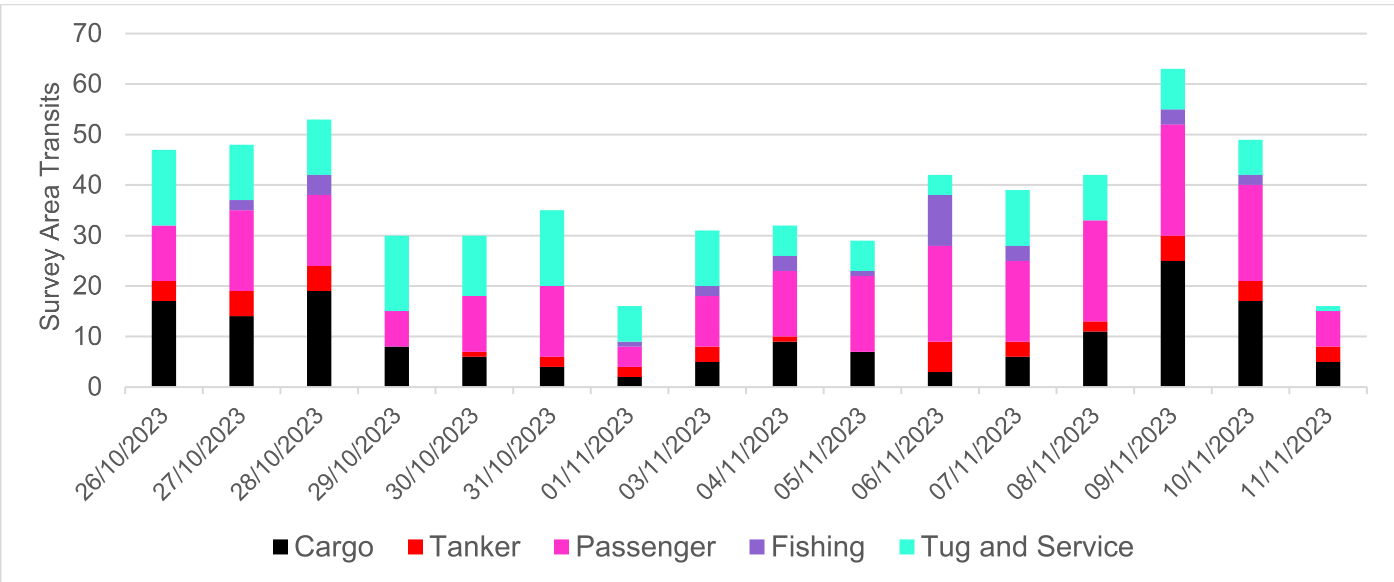

Figure 1.59: Vessel counts during the survey.

D.4. Summary

D.4.1.1.1 This appendix describes the findings of a 14 day top-up vessel traffic survey undertaken for the Mona Offshore Wind Project during October and November 2023.

D.4.1.1.2 The top up survey found 150 cargo vessel movements on three key routes. This was judged to be consistent with the previous surveys reported in the NRA and is considered to have no impact on the findings of that NRA.

D.4.1.1.3 The top up survey found 40 tanker vessel movements operating on the same three key routes as that of the identified cargo vessels. This is a substantial decline from the counts measured in the previous surveys. However, as this was a decline rather than an increase, it was judged that the findings of the NRA would not have been adversely affected.

D.4.1.1.4 The top up survey found 226 passenger movements on three routes. With the manoeuvres of the Stena Forwarder accounted for, the vessel counts and routes were judged to be consistent with the previous surveys reported in the NRA and is considered to have no impact on the findings of that NRA.

D.4.1.1.5 The top up survey found 31 fishing movements with no defined routes identified. This was judged to be consistent with the previous surveys reported in the NRA and is considered to have no impact on the findings of that NRA.

D.4.1.1.6 The top up survey found no recreational movements. This was judged to be consistent with the previous winter vessel traffic survey reported in the NRA and is considered to have no impact on the findings of that NRA.

D.4.1.1.7 The top up survey found 149 tug and service movements on three routes. This was judged to be consistent with the previous surveys reported in the NRA and is considered to have no impact on the findings of that NRA.

D.4.1.1.8 Therefore, it is concluded that the findings of the top-up survey are consistent with both the previous vessel traffic surveys conducted in 2021 and 2022, as well as the 2019 and 2022 AIS data. As such, no impact on the conclusions reached within the NRA have been identified.

D.4.1.1.9 Given this finding the datasets used within the Mona Offshore Wind Project NRA are concluded to be valid for a further 12 month period as per MGN654 4.6b (MCA, 2021).

Appendix E: Cumulative Regional Navigation Risk Assessment

NASH MARITIME

Irish Sea: CRNRA

Irish Sea Round 4 Offshore Wind Farms: Cumulative Regional Navigation Risk Assessment

bp, EnBW, Cobra and Flotation Energy

Document No: 22-NASH-0306 | 06-00
24 January 2024

PROJECT INFORMATION

PROJECT TITLE	Irish Sea: CRNRA
REPORT TITLE	Irish Sea Round 4 Offshore Wind Farms: Cumulative Regional Navigation Risk Assessment
CLIENT	bp, EnBW, Cobra and Flotation Energy

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R02-00	16 November 2022	Update following comments	ADR/RJM/ CLC/RLG	EJR/JJH	EJR/JJH
R03-00	09 March 2023	Final issue CRNRA at PEIR	ADR	EJR/JJH	EJR/JJH
R04-00	13 October 2023	Update CRNRA to inform Environmental Statement	ADR	EJR/JJH	EJR/JJH
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R06-00	24 January 2024	Final issue CRNRA at Environmental Statement	ADR	CJH	CJH

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0. EXECUTIVE SUMMARY

0.1 OVERVIEW

0.1.1.1.1 The developers of the Mona Offshore Wind Project, Morgan Offshore Wind Project Generation Assets, Morecambe Offshore Windfarm Generation Assets and Morgan and Morecambe Offshore Wind Farms Transmission Assets (the "Projects") within the east Irish Sea have collaborated to commission a Cumulative Regional Navigation Risk Assessment (CRNRA), which is reported within this document. This assessment has been undertaken in compliance with relevant legislation, policy and guidance applicable to shipping and navigation assessments. The purpose of this collaborative approach is to assess the relevant potential cumulative effects of the infrastructure of all four Projects on shipping and navigation (S&N) receptors. The objectives are to provide a focused assessment of the key cumulative effects associated with the four Projects, and in particular, the safety of navigation through the routes formed between and around them and other surface piercing structures (principally existing OWFs and oil and gas platforms) during the operational and maintenance phase of the Projects.

0.1.1.1.2 A previous CRNRA was undertaken in 2022 to accompany the Preliminary Environmental Information Reports (PEIR) of the Projects It identified that there was both insufficient sea room for safe navigation and appreciable impacts on the journey times of vessels including lifeline ferry services. Following this, the Projects committed to a number of mitigations, including boundary changes, to reduce these impacts. This CRNRA, which accompanies the Applications of each Project, reports on the updated findings accounting for the effectiveness of these measures.

0.1.1.1.3 The assessment identified a CRNRA study area which includes numerous shipping routes, ports, and existing activities, such as oil and gas extraction, offshore wind generation and aggregate extraction in the east Irish Sea. The majority of large commercial shipping is routed through existing Traffic Separation Schemes (TSS) into the Port of Liverpool. Four principal commercial ferry companies operate through the CRNRA study area, with services between Liverpool, Heysham, Douglas and Ireland. Fishing by static and mobile gear varies in intensity across the CRNRA study area but is shown to occur throughout the Irish Sea. Recreational cruising is concentrated mostly inshore, although some offshore cruising routes exist. Analysis of historical incident data determined relatively low frequencies of navigational incidents within or adjacent to the three Project Array Areas.

0.1.1.1.4 Due to the release of the scoping report for the Mooir Vannin Offshore Wind Farm in October 2023, after the completion of many of the activities undertaken to inform the CRNRA, an addendum was prepared to consider the additional cumulative impacts that might result (see Appendix D).

0.2 IMPACT ASSESSMENT

0.2.1.1.1 By comparing the four Project boundaries and proposals with the existing activities, and accounting for projected future traffic profiles, several key potential impacts were identified.

0.2.1.1.2 The potential impacts of the Projects on recognised sea lanes essential to international navigation determined that access to the TSSs in the CRNRA study area would be maintained.

0.2.1.1.3 The potential impacts of the Projects on ferry vessel routeing determined that there would be necessary deviation of Stena Line, Isle of Man Steam Packet Company (IoMSPC) and Seatruck routes around the Project Array Areas in both normal and adverse weather conditions.

0.2.1.1.4 The deviation in typical conditions would be less than five minutes for most ferry routes, with the exception of Stena Line services between Liverpool and Belfast, with increases of between 13 and 16 minutes. Existing passages are up to eight hours duration (dependent on route), with existing services having significant variation in turnaround times and transit times of greater than 25 minutes. The increase in passage distance and time duration associated with the Projects is unlikely to have significant schedule impacts but could increase pressures on operators. The presence of the Projects may also necessitate additional watchkeeping requirements to ensure safe navigation within the routes and effective collision avoidance.

0.2.1.1.5 During adverse weather, the assessment determined that existing adverse weather routes would not be viable and therefore a more circuitous route around the OWFs would be required. This would increase the schedule impacts by between 13 and 70 minutes (dependent on route). This could result in increased delays and cancellations of services.

0.2.1.1.6 Potential impacts of the Projects on cargo/tanker ship routeing determined that the principal shipping routes into Liverpool would necessitate a minor deviation to the southwest of the Mona Array Area, but this was not so significant to threaten the viability of Liverpool as a port. Less trafficked routes into Heysham and Douglas would necessitate greater deviations, between the Projects, but which are unlikely to make such services unviable.

0.2.1.1.7 Potential impacts of the Projects on small craft routeing determined that there is sufficient spacing between turbines across all three Project Array Areas to facilitate safe navigation for fishing and recreational craft within the Project Array Areas. Where small craft choose not to navigate within the Array Areas, there may be some effect of offsetting these vessels into adjacent routes. This could result in increased collision risk with passing commercial vessels.

0.2.1.1.8 The potential presence of Morgan Offshore Wind Project's offshore booster station at the most westerly portion of the search areas would have a minimal impact on navigation safety but might increase the deviation of Stena Lines Liverpool to Belfast route where they choose to go east of the Isle of Man.

0.2.1.1.9 The routes between the Projects were reviewed in context of guidance and UK precedents. The routes between the Morgan Array Area and Walney OWF, Mona and Morgan Array Areas and Mona and Morecambe Array Areas meet both MCA and PIANC guidance, even following sensitivity analysis with greater vessel numbers. Projects elsewhere in the UK have designs which are comparable in geometries to those between the four Projects and adjacent infrastructure.

0.2.1.1.10 The frequency at which vessels would encounter one another and the implications for collision avoidance was assessed. It was concluded that, with the exception of the region to the south of the Mona Array Area which is naturally busier, for much of the time there was a low likelihood of multiple commercial vessels navigating between the Projects at any one time (<25%). The likelihood of two or more commercial vessels was less than 3% for the route between Mona and Morgan Array Areas and less than 1% for the routes between Morgan Array Area and Walney OWF, and Mona and Morecambe Array Areas. Modelling of vessel encounters showed that the effect of the Projects would result in a 2% increase in total encounters, and a 15% increase in ferry encounters, which is approximately the equivalent of an additional (typical) ferry service in the study area.

0.2.1.1.11 The potential impacts on visual navigation were reviewed and showed that vessels could be easily distinguished within the OWFs both during the day and night and there would be sufficient time for large vessels navigating between or around the Projects to respond to vessels emerging from the OWF.

0.2.1.1.12 Modelling of collision and allision risk determined that the Projects would result in a minor to moderate relative increase in collision and allision risk, however, the return periods of such incidents were low at less than once in 88 and 72 years respectively. The individual incident likelihoods for both ferry and cargo/tanker collision and allisions were less than once in one hundred years in all cases.

0.2.1.1.13 The orientation and width of the routes between the OWFs could have an impact on the ability of vessels to respond to an emergency. However, it was concluded that suitable options remained open to the Master to respond to vessel motions, fires or medical incidents. The layouts of the Projects with regard to Search and Rescue (SAR) was considered. It was concluded that the layout commitments made by the Projects complied with all SAR guidance requirements and are in excess of those currently in place on existing projects in the Irish Sea.

0.2.1.1.14 The layout of the Projects, in relation to shipping routes, and accounting for oil and gas infrastructure decommissioning activities, would not appreciably increase the risk to oil and gas activities beyond the base case (current situation).The potential impacts of the Projects on ship's communications, radar and positioning systems determined that most impacts are negligible. Impacts to radar are inherent when navigating adjacent to offshore wind farms but there is sufficient sea room to mitigate these impacts.

0.3 NAVIGATION RISK ASSESSMENT

0.3.1.1.1 A risk assessment was undertaken, supported through a second hazard workshop undertaken to inform the Environmental Statements attended by representatives from ferry operators, regulators, commercial bodies, oil and gas operators, ports and the fishing community. 56 hazards were identified, split across different hazard types, vessel types and areas. The findings of the workshop were considered with the analysis and wider assessment undertaken by the Project teams to derive the overall risk assessment results.

0.3.1.1.2 A consensus was reached amongst stakeholders that all of these hazards were either Medium Risk – Tolerable if As Low as Reasonably Practicable (ALARP) or Low Risk – Broadly Acceptable. The highest hazards related to allisions involving Ferry/Passenger vessels between the Morgan Array Area and Walney OWF and between the Mona and Morgan Array Areas, as well as allisions involving fishing boats. The navigation simulations undertaken to inform the Environmental Statement had demonstrated that changes to the boundaries had significantly mitigated the collision risk for vessels transiting between the Projects. Whilst additional risk control measures were identified, some of these (such as ship routeing or emergency towing vessels) were not adopted as it was concluded they were disproportionate to the risk reduction and therefore all hazards could be determined to be ALARP without the need for additional mitigation.

0.4 SUMMARY

0.4.1.1.1 The CRNRA has brought together significant analysis, consultation, navigation simulations and the findings of the hazard workshops to determine the cumulative risks associated with the four Projects. The study has concluded that following the changes to the boundaries of the Array Areas post-PEIR, all hazards have been reduced to either Medium Risk – Tolerable if ALARP or Broadly Acceptable. Whilst it was recognised that the construction of four Projects in otherwise navigable waters would increase the risks of collision and allision for navigating vessels, a consensus was reached with stakeholders that these risks were not unacceptable. In particular, the increase in sea room between the OWFs provides sufficient space for vessels to safely manoeuvre in complex realistic traffic situations and adverse weather in full compliance with the COLREGs and the practice of good seamanship.

0.4.1.1.2 Appropriate risk controls were considered to be embedded in the Projects' design and whilst additional risk control options were discussed, it was agreed that these were disproportionate to the reduction in risk they might achieve. Therefore, the CRNRA has also concluded that all Medium Risks can be considered ALARP and that no further risk controls are warranted.

CONTENTS

FIGURES

TABLES

APPENDICES

ABBREVIATIONS

Abbreviation	Detail
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
AtoN	Aid to Navigation
BWEA	British Wind Energy Association
CBRA	Cable Burial Risk Assessment
CEA	Cumulative Effects Assessment
CGOC	Coastguard Operations Centre
CHA	Competent Harbour Authority
COLREGs	Convention on the International Regulations for Preventing Collisions at Sea
COVID-19	Coronavirus disease 2019
CPA	Closest Point of Approach
CRNRA	Cumulative Regional Navigation Risk Assessment
CTV(s)	Crew Transfer Vessel(s)
DCO	Development Consent Order
DfT	Department for Transport
DSC	Digital Selective Calling
DWT	Dead Weight Tonnes
EEXI	Energy Efficiency Existing Ship Index
EIA	Environmental Impact Assessment
EMODnet	European Marine Observation and Data Network
EMSA	European Maritime Safety Agency
EnBW	Energie Baden-Württemberg AG
ERCoP	Emergency Response and Cooperation Plan
ERRV	Emergency Rescue and Recovery Vessel
ETV	Emergency Towage Vessel
EU	European Union
FSA	Formal Safety Assessment
GNSS	Global Navigation Satellite System
GOMO	Guidance for Offshore Marine Operations
GPS	Global Positioning System
GT	Gross Tonnes
HAT	Highest Astronomical Tide
HAZID	Hazard Identification
HMCG	His Majesty's Coastguard
HSE	Health, Safety and Environment
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ICW	In Collision With
IHO	International Hydrographic Organisation
IMO	International Maritime Organization
IOER	Integrated Offshore Emergency Response
IoM	Isle of Man
IoMSPC	Isle of Man Steam Packet Company
IWRAP	IALA Waterway Risk Assessment Program
km	Kilometre
IPS	Intermediate Peripheral Structures
LAT	Lowest Astronomical Tide
Lo-Lo	Lift-on/Lift-off
LOA	Length Overall
LPS	Local Port Service
LYC	Liverpool Yacht Club
m/s	meter per second
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MDS	Maximum Design Scenario

Abbreviation	Detail
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MNEF	Marine Navigation Engagement Forum
MSC	Maritime Safety Committee
MW	Megawatt
NFFO	National Federation of Fishermen's Organisations
NLB	Northern Lighthouse Board
nm	Nautical Miles
NPS	National Policy Statement
NRA	Navigation Risk Assessment
NRW	Natural Resources Wales
NSIP	Nationally Significant Infrastructure Projects
NtM	Notice to Mariners
OSP	Offshore Substation Platform
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
OWF	Offshore Wind Farm
PDE	Project Design Envelope
PEIR	Preliminary Environmental Information Report
PEXA	Practice and Exercise Area
PIANC	The World Association for Waterborne Transport Infrastructure
PLB	Personal Locator Beacon
PPE	Personal Protective Equipment
QHSE	Quality, Health, Safety and Environment
REWS	Radar Early Warning System
RIDDOR	Reporting of Injuries, Disease and Dangerous Occurrences Regulations 2013
RNLI	Royal National Lifeboat Institution
Ro-Ro	Roll-on/Roll-off
RoPax	Roll-on/Roll-off Passenger
RYA	Royal Yachting Association
S&N	Shipping and Navigation
SAR	Search and Rescue
SBM	Single Buoy Mooring
SCV	Small Commercial Vessel
SFF	Scottish Fishermen's Federation
SHA	Statutory Harbour Authority
SIRA	Simplified IALA Risk Assessment
SOLAS	Safety of Life at Sea
SPS	Significant Peripheral Structure
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
TEU	Twenty-foot Equivalent Unit
TSS	Traffic Separation Scheme
UK	United Kingdom
UKHO	UK Hydrographic Office
UNCLOS	The United Nations Convention on the Law of the Sea (UN, 1982)
VHF	Very High Frequency
VMS	Vessel Monitoring System
VTS	Vessel Traffic Service
WTG	Wind Turbine Generator
yr	Year

1. INTRODUCTION

1.1 BACKGROUND AND INCEPTION

1.1.1.1.1 In 2021, the Crown Estate announced that it had selected six proposed new offshore wind projects in the waters around England and Wales, through a process known as Offshore Wind Leasing Round 4. This resulted in four projects in the east Irish Sea (The “Projects"):

- Mona Offshore Wind Project, developed by Energie Baden-Württemberg AG (EnBW) and bp Alternative Energy Investments Limited (bp).
- Morgan Offshore Wind Project Generation Assets (henceforth “Morgan Generation Assets”), developed by EnBW and bp.
- Morecambe Offshore Windfarm Generation Assets (henceforth “Morecambe Generation Assets”), developed by Cobra Instalaciones y Servicios, S.A. (Cobra) and Flotation Energy Ltd.
- Both the Morgan and Morecambe Offshore Wind Projects were scoped into the Pathways to 2030 workstream under the Offshore Transmission Network Review. The output of this process concluded that both Projects should work collaboratively in connecting the offshore wind farms (OWFs) to the National Grid at Penwortham in Lancashire. Therefore, a separate joint application (“the Transmission Assets”) is being made for the shared offshore export cable corridors to landfall and shared onshore export cable corridors to onshore substations.

1.1.1.1.2 The government classifies major energy projects over 100 MW in generating capacity as Nationally Significant Infrastructure Projects (NSIP) under the Planning Act 2008 and subject to Development Consent Orders (DCO). The Mona Offshore Wind Project, Morgan Offshore Wind Project Generation Assets and the Morecambe Offshore Windfarm Generation Assets are NSIP, as they exceed the threshold for an offshore generating station of 100 MW. Regarding the Morgan and Morecambe Transmission Assets, the Secretary of State issued a direction under section 35 of the Planning Act 2008 that the Transmission Assets should be treated as a development for which development consent is required. Scoping Reports and Preliminary Environmental Impact Reports (PEIRs) have been submitted for all four Applications (see **Table 1**).

1.1.1.1.3 OWFs have the potential to negatively impact upon navigational safety or commercial shipping routes. Therefore, a Navigation Risk Assessment (NRA) is required to demonstrate that these effects are Tolerable, or if not, identify mitigation measures to reduce them to As Low as Reasonably Practicable (ALARP). These effects may be more significant in a cumulative context rather than individually for each project. Policy, guidance and legislation which describes the requirements of an NRA are described in **Section 1.4** and **Section 2**.

Table 1: Summary of Projects.

Project	Description	Scoping Date	PEIR Date
Mona Offshore Wind Project	Up to 96 wind turbine generators (WTGs) and up to four offshore substation platforms (OSP) and an export cable route to Wales.	May 2022	April 2023
Morgan Generation Assets	Up to 96 WTGs and up to four OSPs.	June 2022	April 2023
Morecambe Generation Assets	Up to 35 WTGs and up to two OSPs.	June 2022	April 2023
Morgan and Morecambe Transmission Assets	Combined export cable route for Morgan and Morecambe Generation Assets plus an offshore booster station associated with the Morgan export cable corridor.	October 2022	October 2023

1.1.1.1.4 Given the concurrency at which these four Projects are progressing through the planning process, and that each Project is located within 10 nautical miles (nm) of one another, many stakeholders have raised the potential significance of cumulative effects. In a conventional approach to Environmental Impact Assessment (EIA), each Project would progress the cumulative assessment independently within each NRA. Given the proximity of each Project and the concurrent NRAs, it was agreed by the respective Applicants to undertake a combined cumulative assessment to address these concerns, and this was welcomed by stakeholders. A working group was established across the four Projects in 2022 and they have met fortnightly to discuss key activities and coordinate actions related to the potential impacts to shipping and navigation.

1.1.1.1.5 The objective of the Cumulative Regional NRA (CRNRA) is thus to enable The Planning Inspectorate and stakeholders to engage with, and understand, the potential cumulative effects of the Projects. Adopting a regional (collaborative) approach to assessment will also enable the individual Projects to quantify and manage the cumulative effects in a coordinated, consistent and efficient manner. This assessment dovetails with the individual NRAs of each Project, required as part of their DCO applications.

1.1.1.1.6 Separate individual NRAs are being prepared by all four Projects, each of which will reference the findings of this CRNRA for consideration of cumulative effects.

1.2 SUMMARY OF CRNRA UNDERTAKEN TO INFORM THE PEIR

1.2.1.1.1 A CRNRA was undertaken to inform the PEIRs during 2022 (see for example Mona Offshore Wind Project, 2023). This assessment involved undertaking an NRA in compliance with guidance, undertaking vessel traffic analysis and modelling, consultation with operators and regulators, full bridge navigational simulations and a hazard workshop in October 2022. During this first phase of the assessment, the following key conclusions were reached:

- The sea room available between the Mona and Morgan Array Areas was insufficient for safe navigation and posed an unacceptable risk of collision between large commercial vessels (including cargo, tanker and ferries) and small craft.
- The sea room available between the Morgan Array Area and Walney OWFs was insufficient for safe navigation and posed an unacceptable risk of collision between large commercial vessels (including ferries) and small craft.
- The proximity of the Mona Array Area to the approaches to Liverpool and the TSS, reduced the capability for westbound vessels out of the Liverpool TSS to comply with Collision Regulations (COLREGs) obligations when meeting crossing vessels heading southeast from the Isle of Man (IoM) and therefore posed an unacceptable risk of collision.
- The Projects collectively increased the risks of collision and allision for all vessels.
- The Projects resulted in significant deviations of ferry routes which posed an appreciable impact to operator schedules and timetables.
- During significant adverse weather, the assessment determined that several routes between Projects would no longer be safe to navigate, and a more circuitous route was required. This was likely to necessitate increased cancellations of services as existing timetables would not be viable with anticipated turnaround times.
- The orientation and width of the routes reduced the capability of vessels to respond to an emergency by altering their heading, such as during a fire or cargo shift incident.

1.2.1.1.2 As a result of these conclusions (Mona Offshore Wind Project, 2023) and following a review of the Section 42 responses (available in the respective Environmental Statement Chapters and associated consultation reports), the Projects committed to make the following changes (**Table 2**). **Figure 1** compares the Mona, Morgan and Morecambe Potential Array Areas (henceforth "PEIR Boundaries") and the Mona, Morgan and Morecambe Array Areas (henceforth "Environmental Statement Boundaries").

Table 2: Summary of changes post-PEIR.

Project	Description	Purpose
Morgan Generation Assets	Removal of "hump" and tapering approach angle along the northern boundary of the Morgan Array Area.	Maintain a linear navigational channel between Morgan Array Area and Walney OWF to reduce course change requirements.
Morgan Generation Assets	Increasing the distance with the Walney OWF from between 2.7/4.1 nm to between 4.3/5.3 nm by reducing the boundary of the Morgan Array Area.	Increase sea room available for collision avoidance and ensure adequate passing distances from structures/other vessels.
Mona Offshore Wind Project	Reduction in northern boundary of Mona Array Area to increase separation between Morgan and Mona Array Areas from 3.0 nm to 6.0 nm.	Increase sea room available for collision avoidance and ensure adequate passing distances from structures/other vessels.
Mona Offshore Wind Project	Increase separation between Mona Array Area and TSS from 1.5 nm and 2.0 nm, including tapering of	Reduce impact on routes inbound/outbound to Liverpool. Increase sea room available for collision avoidance and ensure

Project	Description	Purpose
	southwestern boundary of Mona Array Area.	adequate passing distances from structures/other vessels.
Mona Offshore Wind Project	Reduction in southeastern boundary of Mona Array Area to increase separation between Mona and Morecambe Array Areas.	Increase sea room available for collision avoidance and ensure adequate passing distances from structures/other vessels.
Morecambe Generation Assets	Reduction in extent of the western boundary of the Morecambe Array Area.	Reduce impact on vessel routes which pass to the west of the existing gas fields.

1.2.1.1.3 Furthermore, since completing the CRNRA undertaken to inform the PEIR, further details on the combined Transmission Assets for Morgan and Morecambe have been provided.

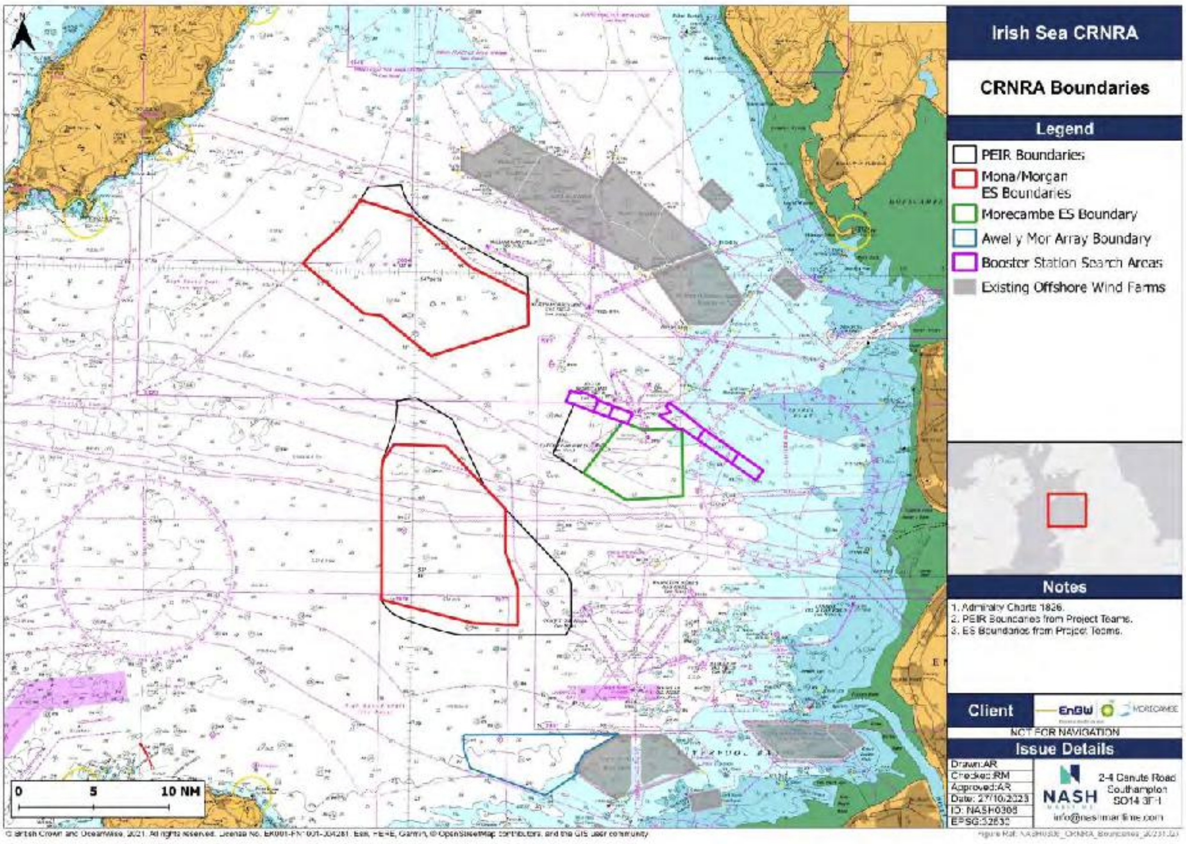


Figure 1: Changes to Project boundaries from PEIR to Environmental Statement.

1.3 OBJECTIVE OF CRNRA UNDERTAKEN TO INFORM THE ENVIRONMENTAL STATEMENT

1.3.1.1.1 Given the significance of the boundary commitments made following PEIR consultation, a full update of the CRNRA was undertaken to inform the Environmental Statement. This included updating the data analysis using 2022 datasets, repeating the navigation simulations with ferry companies and undertaking a second hazard workshop. The primary objective of this CRNRA undertaken to inform the Environmental Statement is therefore to re-assess the impacts to shipping and navigation of the aforementioned changes to the Project boundaries and determine whether all risks are either Broadly Acceptable or ALARP.

1.3.1.1.2 Furthermore, at the time of undertaking CRNRA to inform the PEIR, details of the Transmission Assets and possible offshore booster station search areas associated with the Morgan export cable corridor to the west of Morecambe Array Area were unknown and therefore this has now been included as part of CRNRA undertaken to inform the Environmental Statement and is shown in **Figure 1**. For the purposes of the CRNRA, it has been assumed that the most onerous positioning of the offshore booster station would be at the most westerly limit of the search area.

1.3.1.1.3 This updated CRNRA accompanies the Environmental Statements and Applications for each respective Project.

1.4 POLICY, GUIDANCE AND LEGISLATION

1.4.1.1.1 OWF developments are subject to numerous legislation, policy and guidance requirements with respect to shipping and navigation. The CRNRA is undertaken in compliance with these requirements, with further details contained within the respective Project's individual NRAs. In particular, the National Policy Statement (NPS) for Renewable Energy EN-3 (Department for Energy Security & Net Zero, 2023) states that "*2.8.180: The navigation risk assessment will for example necessitate… Cumulative and in-combination risks associated with the development and other developments (including other wind farms) in the same area of sea.*"

1.5 DOCUMENT STRUCTURE

1.5.1.1.1 This CRNRA consists of the following chapters and sections:

- **Section 1:** Introduction.
- **Section 2:** CRNRA Methodology.
- **Section 3:** Projects Description and Maximum Design Scenario.
- **Section 4:** Description of Marine Environment.
- **Section 5:** Description of Existing Maritime Activities.
- **Section 6:** Future Case Traffic Profile.
- **Section 7:** Cumulative Impact Assessment.
- **Section 8:** Cumulative Regional Navigation Risk Assessment.
- **Section 9:** Conclusions and Recommendations.
- **Appendix A**: Hazard Log.
- **Appendix B**: Hazard Workshop Summary.
- **Appendix C**: Passage Plans for Ferry Operators.
- **Appendix D:** Mooir Vannin OWF Addendum.
- **Appendix E:** Navigation Simulations.

1.6 CRNRA ASSUMPTIONS

1.6.1.1.1 Several key assumptions are made within the CRNRA:

1. A single operational phase assessment with the Projects in place is undertaken. Any cumulative effects due to concurrent construction of the Projects is not possible to assess given immature timetables.

2. A 2035 future case assessment is considered, accounting for any changes in vessel numbers or activity at that time (see **Section 6**).

3. It is assumed that Awel y Môr OWF is constructed following recent granting of development consent.

4. Immediately prior to finalisation of the CRNRA, a Scoping Report was issued for the Isle of Man (IoM) OWF, named as Mooir Vannin (Mooir Vannin Offshore Wind Farm, 2023). Therefore, there was insufficient information to include the development within the main assessment of the CRNRA which was undertaken prior to this date. However, ongoing liaison between the Projects and Mooir Vannin Offshore Wind Farm Limited provided some preliminary information which has been used to prepare an Addendum (**Appendix D**), considering the additional cumulative effects were the Mooir Vannin OWF to be developed in addition to the Projects considered within this CRNRA.

5. A Maximum Design Scenario (MDS) for each Project parameter (turbine spacing, numbers and size etc.) is presented in **Section 3**.

6. The CRNRA focusses on the impacts as a result of the presence of all four Projects, particularly the routes between them, and thus localised site-specific issues are expanded upon in each individual Project's respective NRA.

2. CRNRA METHODOLOGY

2.1 OVERVIEW

2.1.1.1.1 The CRNRA has been produced in accordance with the Maritime and Coastguard Agency's (MCA) Marine Guidance Note (MGN) 654 (MCA, 2021) and follows the International Maritime Organisations' (IMO) Formal Safety Assessment (FSA) (IMO, 2018). This assessment considers all identified impacts of the Projects on shipping and navigation receptors. The FSA defines a risk as "*the combination of frequency and the severity of the consequence*". Therefore, the likelihood and consequence of these impacts are assessed through the collection of significant datasets and consultation (**Figure 2**). Risk controls are then identified to determine whether the risks have been reduced to ALARP. Details of the risk criteria and matrix methodology are contained within **Section 8**. The CRNRA methodology is consistent with the methodologies employed on each of the respective Project's individual NRAs.

2.1.1.1.2 The International Association of Lighthouse Authorities (IALA) Simplified IALA Risk Assessment method (SIRA) follows the FSA process and allows Competent Authorities (and other organisations) to assess maritime and navigation risk in their waters so that they can meet their obligations for the management of navigation safety (e.g. obligations under international conventions such as Safety of Life At Sea (SOLAS), national domestic legislation, etc.).

2.1.1.1.3 Details of the overarching methodology are provided in the following IALA Guidance:

- Guideline 1018 - Risk Management.
- Guideline 1138 - The Use Of The Simplified IALA Risk Assessment Method.

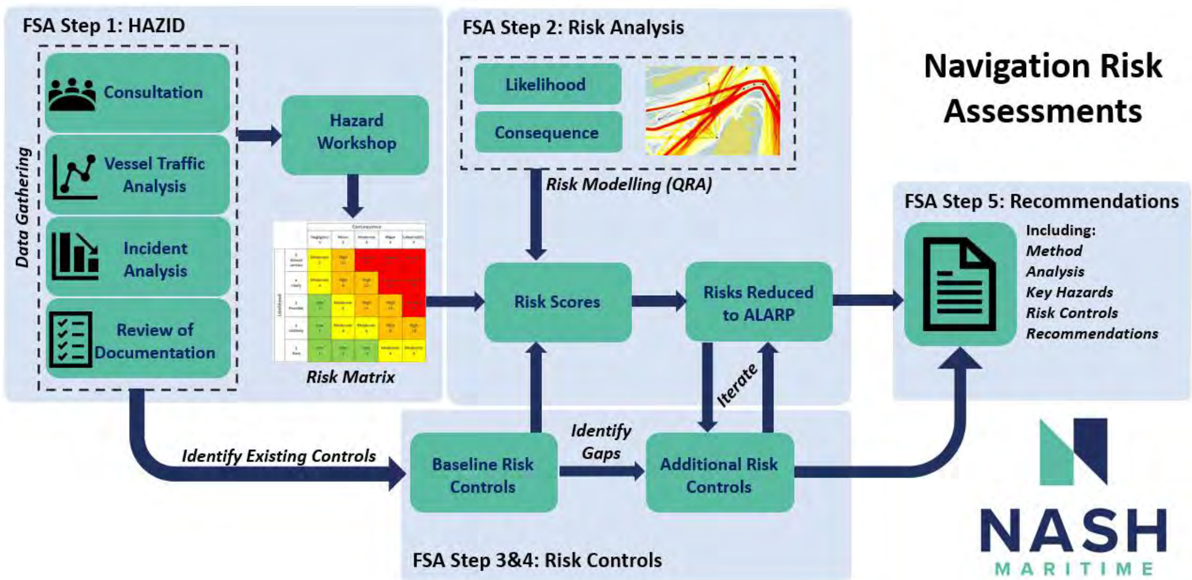


Figure 2: CRNRA methodology.

2.2 DEFINITION OF CRNRA STUDY AREA

2.2.1.1.1 The study area of the CRNRA is defined as the region of the east Irish Sea bounded by the IoM to the northwest, and the Welsh and English coasts to the south and east respectively and is approximately 17,800 km^2 (see **Figure 3**). The area encapsulates all waters directly affected by the Projects between Chicken Rock to the southwest of the IoM, the Traffic Separation Scheme (TSS) Off Skerries, Point of Ayre to the northeast of the IoM and all major ports on the English and Welsh coast.

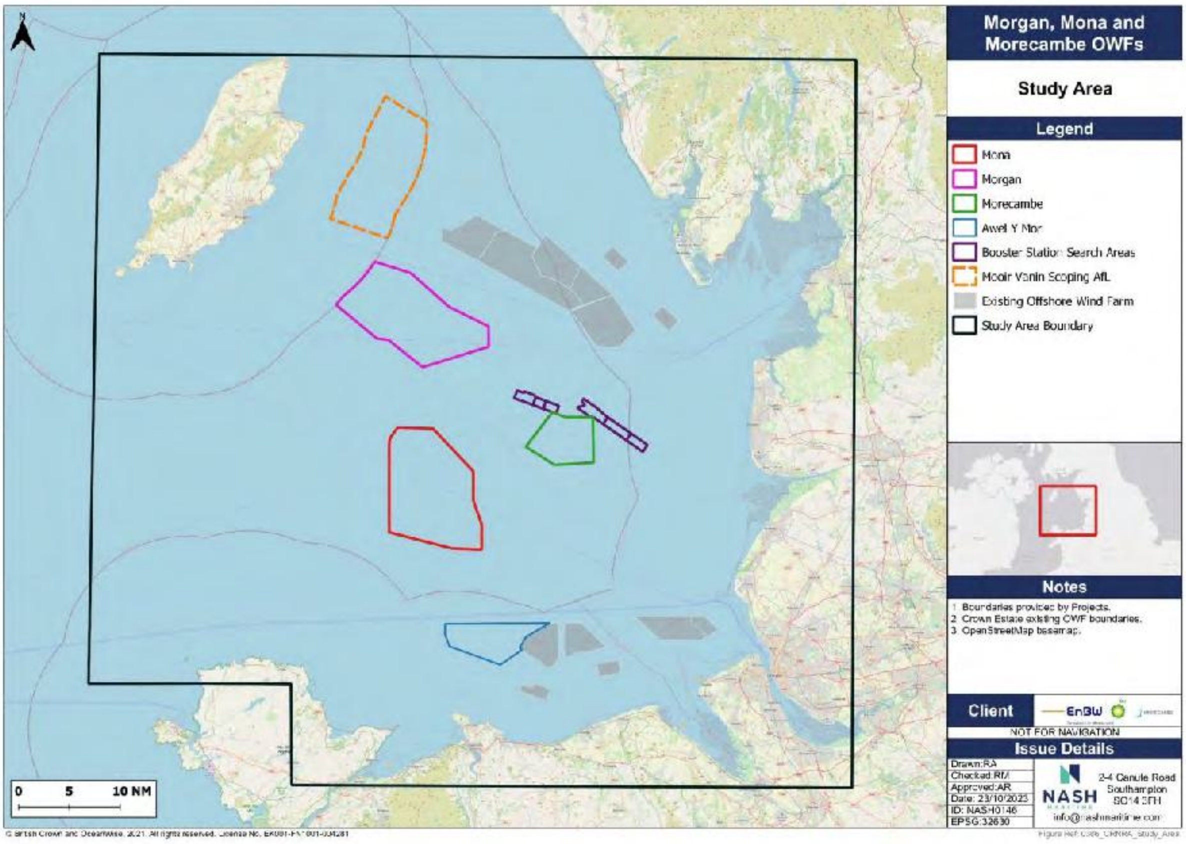


Figure 3: CRNRA study area.

2.3 SUMMARY OF DATA SOURCES AND INFORMATION GATHERING

2.3.1 Consultation and Engagement

2.3.1.1.1 Significant consultation activities have been undertaken to support this assessment, full details of which are contained within the respective Application documents for each Project. A wide group of stakeholders were identified and contacted to contribute to the CRNRA. **Table 3** provides a summary of key consultation activities and **Table 4** lists the key organisations who contributed to this work through providing consultation responses or attending workshops/simulations.

Table 3: Summary of consultation activities.

Consultation Activity	Purpose	Dates
Marine Navigation Engagement Forum (MNEF)	To disseminate information regarding the Projects within a wide stakeholder forum and to identify and discuss any key navigational concerns.	2021-2023
Individual stakeholder meetings	To discuss any specific concerns relating to individual stakeholders.	2021-2023
Scoping Opinions	To identify the scope of potential impacts which should be considered within the EIA.	May/Jun and Aug 2022
Full Bridge Simulation (to inform PEIR)	To undertake detailed, real-time, assessment of the potential impacts of the Projects on ferry routes and safety with realistic traffic conditions. These were undertaken with respective ferry master involvement.	2022
CRNRA Hazard Workshop 1 (to inform PEIR)	To collaboratively identify all relevant hazards, score the likelihood and consequence and discuss appropriate risk control measures.	Oct 2022
S42 Consultation (PEIR)	Statutory consultation on the information contained within the PEIR and to identify any further areas of assessment required.	Jun 2023
Full Bridge Simulation (to inform Environmental Statement)	To update the aforementioned simulation sessions to account for the changes in Project boundaries.	May-Sep 2023
CRNRA Hazard Workshop 2 (to inform Environmental Statement)	To update the aforementioned hazard workshop to account for the commitments made following the PEIR consultation including changes to the Project boundaries.	Sep 2023

Table 4: Consultees contributing to the CRNRA.

Type	Consultees
Regulatory/Governmental	MCA / HMCG Trinity House IoM Department of Infrastructure
Ferries	IoMSPC Stena Line Seatruck P&O
Commercial	UK Chamber of Shipping
Ports	Peel Ports
Aggregates	Boskalis
Other Offshore Developers	Mooir Vannin Offshore Wind Farm Limited
Fishing	Anglo-North Irish Fish Producers Organisations Independent Fisheries Experts Project Fisheries Liaison Officers Scottish Whitefish Producers Association
Oil and Gas	ENI Harbour Energy Spirit Energy
Recreational	Cruising Association RYA
Members of the Public	Members of the Public through S42 Responses

2.3.2 Vessel Traffic Datasets

2.3.2.1.1 Vessel traffic data from several sources was utilised to determine baseline conditions.

- High fidelity Automatic Identification System (AIS) data for 2019 and 2022 for whole Irish Sea.
- Marine Management Organisation (MMO) 2019 anonymised AIS data.
- European Marine Observation and Data Network (EMODNet) 2022 vessel density grids.
- RYA Coastal Atlas (2022).
- UK Vessel Monitoring System (VMS) 2020 Data.
- The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) European Union (EU) VMS 2017 data.
- Department for Transport (DfT) Shipping Statistics (2022).

2.3.2.1.2 Vessel traffic surveys in compliance with the requirements of MGN654 (MCA, 2021) have been conducted for each individual Project; which is analysed within the respective individual Project NRAs.

2.3.3 Incident Data

2.3.3.1.1 Five accident datasets were utilised to support this assessment:

- Marine Accident Investigation Branch (MAIB) accidents database (1992 to 2021).
- Royal National Lifeboat Institution (RNLI) incident data (2008 to 2019).
- DfT SAR helicopter taskings (2021).
- G+ Accident data (2021).
- Search of incidents occurring at other projects.

2.3.4 Other Data Sources

2.3.4.1.1 Other datasets were utilised to support this assessment:

- Marine aggregate dredging licences (Crown Estate 2023).
- Offshore Renewables (Crown Estate 2023).
- Industrial Infrastructure (Turbines, Oil and Gas, cables etc.) (Oceanwise, 2022).
- Oil and Gas Activity (Oil and Gas Authority, 2023).
- Admiralty Charts (2023).
- Admiralty Sailing Directions.
- Passage plans and vessel information provided by ferry operators (2022-2023).
- Admiralty Total Tide.
- MetOcean Data provided by the Projects.

2.3.5 Full Bridge Simulations

2.3.5.1.1 Full bridge simulations of ferry passages through the Irish Sea were commissioned by the Mona Offshore Wind Project and Morgan Generation Assets (and subsequently in collaboration with Morecambe Offshore Windfarm) to assess the

PEIR boundaries in 2022 and Environmental Statement boundaries in 2023 at HR Wallingford's UK Ship Simulation Centre (see **Table 5**). The aim of the simulations was to understand, in more detail, potential navigation impacts of the Projects on existing commercial ferries and to test the viability and safety of commercial ferry transits between and around the Projects in normal and adverse weather conditions. The simulations were undertaken following initial engagement in which the scope of the simulations, simulation scenarios and assessment criteria were agreed with participants (including ferry company staff) together with verification of the ship models being tested.

2.3.5.1.2 The 2022 PEIR simulations resulted in a number of failed runs, particularly during adverse weather and with complex traffic situations. As part of CRNRA undertaken to inform the Environmental Statement with the amended Project boundaries, the navigation simulations were repeated between May and September 2023 with a total of 35 additional runs carried out. The key findings of the updated navigation simulations are as follows:

- The new boundaries significantly improved navigation over the 2022 PEIR boundaries.
- The addition of Morgan Offshore Wind Project's offshore booster station search areas did not have any material impact on navigation during adverse weather or in collision avoidance situations.
- Collision risk whilst navigating between and around the Projects was manageable with existing operational procedures in complex, worst credible traffic situations. These were in full compliance with COLREGs and the practice of good seamanship.
- Several of the routes remain susceptible to adverse weather which necessitate longer deviations with Projects in place.
- Vessels operating near or within the OWFs were apparent by radar and visual means and any collision risk situation could be determined by the passing ferries.
- During emergency situations there remained some optionality for Masters to best position their vessel to respond.
- None of the simulated scenarios were appreciably more challenging at night than during the day.

2.3.5.1.3 The findings of the CRNRA simulations undertaken to inform the PEIR are reported in the respective PEIRs (see Mona Offshore Wind Project, 2023) and CRNRA simulations to inform the Environmental Statement in the appendices of the respective Application documents.

Table 5: Simulation session details.

Operator	Model Verification Session	PEIR Session	Environmental Statement Session
IoMSPC	21-22 July-2022	16-19 Aug-2022	12-14 Jun-2023 (Project team only) 13-15 Sep-2023
Stena Line	11-12 Aug-2022	23-25 Aug-2022	23-25 May 2023
Seatruck Ferries	Previously agreed with HRW	08-09 Sep-2022	22-23 Jun-2023
P&O (Project team only)	N/A	26-Aug-2022	N/A

3. PROJECT DESCRIPTION AND MAXIMUM DESIGN SCENARIO

3.1 INTRODUCTION

3.1.1.1.1 An NRA is assessed on the Project Design Envelope (PDE), to develop the MDS also known as the Rochdale Envelope (see the Planning Inspectorate's Advice Note Nine). The PDE sets out the design assumptions and parameters from which the realistic MDS is drawn for the NRA. Therefore, the project description is indicative and the 'envelope' has been designed to include flexibility to accommodate further project refinement during detailed design, post consent.

3.1.1.1.2 An MDS relevant to shipping and navigation receptors would typically consider:

- The largest extent of the development.
- The longest duration of activities.
- The most project vessel movements.
- The maximum number of structures.
- The minimum spacing between structures.
- The longest lengths of cables.
- The minimum cable burial.
- The maximum height of cable protection.

3.1.1.1.3 The CRNRA, however, considers the Projects at a regional scale and therefore is principally concerned with the physical footprint and arrangement of the surface piercing infrastructure in combination with one another which might present a hazard to navigation. The primary design features of each of the four Projects considered within the CRNRA are described in **Table 6.** Further detail on each Project's design will be contained within their respective Environmental Statements.

3.2 EMBEDDED RISK CONTROL MITIGATIONS

3.2.1.1.1 **Table 7** describes industry standard risk controls that would be present for all four Projects to individually manage their impacts on navigation. These are considered embedded in the risk assessment process rather than additional requirements. Where applicable, these risk controls will be secured within the respective individual Projects DCOs.

3.2.1.1.2 Furthermore, this CRNRA includes the boundary amendments described in **Table 2** as an embedded control measure.

Table 6: Assessment basis for CRNRA.

Key Project Feature	Morgan Generation Assets	Mona Offshore Wind Project	Morecambe Generation Assets
Project Boundaries	280 km^2	300 km^2	87 km^2
Construction Activities	Not included as part of CRNRA		
Operational Scenario	2035	2035	2035
Other Projects	Assume development of Awel y Môr OWF		
Maximum number of Structures	96 WTGs + 4 OSPs	96 WTGs + 4 OSPs	35 WTGs + 2 OSPs
Spacing between Structures	Vessels less than 24 m can and will navigate within the Array Area. Modelling to consider boundary and internal contact risk using quantitative and qualitative means.		
Lines of Orientation	Two lines of orientation.		
Operations and Maintenance Base and Activities	Assume: North Wales/Northwest England (from east). Up to 719 O&M vessel movements/year.	Assume: North Wales/Northwest England (from south). Up to 849 O&M vessel movements/year.	Assume Northwest England (from east). Up to 384 O&M vessel movements for a standard year and 832 during a heavy maintenance year.
Turbine Size and parameters	Lower blade height >34 m Lowest Astronomical Tide (LAT). Maximum rotor diameter of 320 m. Upper blade height above LAT of 364 m.	Lower blade height >34 m LAT. Maximum rotor diameter of 320 m. Upper blade height above LAT of 364 m.	Maximum Rotor Diameter: 280 m. Maximum blade tip height: 310 m above Highest Astronomical Tide (HAT). Minimum blade tip clearance: 25 m above HAT.
Transmission Infrastructure	Combined route with Morecambe Offshore Windfarm to Penwortham with up to 1 offshore booster station.	Route to south (North Wales), no offshore booster station.	Combined route with Morgan Offshore Wind Project to Penwortham.
Marking and Lighting	Compliance with IALA G1162 (2021): • Isolated structures should have white flashing Mo (U) ≤15s, nominal range of 10 nm. Mounted below lowest port of arc of any rotor blade but greater than 6 m above HAT. Availability >99% (IALA Category 2). • Each structure to display yellow identification panels with black lettering. • Fixed structures to be painted yellow all around from the level of HAT to at least 15 m. • A Significant Peripheral Structure (SPS), on the corners of the OWF, may be fitted with a special yellow flashing mark, with a nominal range of 5 nm. • Any Intermediate Peripheral Structures (IPS), between SPS, may also be marked with flashing yellow lights, with a nominal range of 2 nm. • Hazard Warning Signals, Racons or AIS may be fitted. • All lighting and marking arrangements will be promulgated through Notice to Mariners (NtM) and to UK Hydrographic Office (UKHO).		

Table 7: Applied risk controls.

ID	Title	Description	Risks mitigated
Promulgation and Awareness			
1	Notice to Mariners	To ensure that the appropriate authorities are informed of works being carried out in waters adjacent to the Projects. To include: -UKHO -MCA -Kingfisher -Trinity House -Northern Lighthouse Board (NLB) -RYA -Local Ports and Harbours -Oil and Gas operators -MMO -Natural Resources Wales.	All direct impacts of Projects.
2	Site Marking and Charting	Offshore infrastructure is marked on nautical charts including an appropriate chart note.	All direct impacts of Projects.
3	Safety Zone	Application and use of safety zones. These will consist of a radius of 500 m from OSP/WTG undergoing active construction or major maintenance. 50 m safety zones will be applied for around each item of infrastructure during the construction phase, where no construction works are taking place on that infrastructure (for example, where a WTG is incomplete or is in the process of being tested before commissioning).	Risk of allision with structures and collision with Project vessels.
4	Fisheries Liaison and Co-existence Plan	Provision of detailed Project information to fishermen, to aid coexistence, such as Array Area and export cable route location for upload into fish plotters.	Fishing hazards, including snagging of cables.
Emergency Response			
5	Emergency Response and Cooperation Plan (ERCoP)	ERCoP with agreement of MCA.	Reduction of consequences of incidents.
6	Marine Pollution Contingency Plan	Measures will be adopted to ensure that the potential for release of pollutants from construction, operations/maintenance and decommissioning activities is minimised, which will include accidental spills, planning, response and notification requirements.	Reduction of consequences of incidents.
7	Periodic Exercises	Periodic emergency management and response exercises will be run by Applicants, ran in conjunction with SAR, as detailed in the ERCoP.	Reduction of consequences of incidents.

ID	Title	Description	Risks mitigated
8	Incident Investigation and Reporting	There are statutory incident reporting requirements and expectations: -MAIB (Merchant Shipping Act) -Health, Safety and Environment (HSE), Reporting of Injuries, Diseases and Dangerous Occurrences. Regulations 2013 (RIDDOR) -Harbour Authority under Port Marine Safety Code. Risk assessments to be reviewed following incidents, and additional risk controls identified if appropriate.	Reduction of likelihood of incident reoccurrence.
Site Design			
9	Aids to Navigation (AtoNs)	Suitable AtoNs lighting and marking of the offshore structures shall be undertaken complying with IALA Recommendations G1162 (IALA, 2021), to be finalised and approved in consultation with MCA and Trinity House through an Aids to Navigation Management Plan. Fog horns to alert vessels to the position of structures when visibility is poor. Informal naming/associated markings shall not interfere with formal AtoNs. AIS transponders to be placed on periphery corner of WTGs/OSPs.	Risk of allision with structures.
10	Buoyed Construction Area	Buoys deployed around construction work in Project Array Areas in line with Trinity House requirements and may include a combination of cardinal and/or safe water marks. To be finalised and approved in consultation with MCA and Trinity House through an Aids to Navigation Management Plan.	Risk of allision with structures or collision with construction vessels.
11	Hydrographic Surveys	MGN654 requires that hydrographic surveys should fulfil the requirements of the International Hydrographic Organisation (IHO) Order 1a standard, with the final data supplied as a digital full density data set, and survey report to the MCA Hydrography Manager and the UKHO.	Risk of grounding or snagging of cables.
12	Cable Specification and Installation Plan and details of cable monitoring	Cable Specification and Installation Plan will be informed by a Cable Burial Risk Assessment (CBRA) to be undertaken pre-construction, including consideration of under keel clearance. All subsea cables will be either fully buried to at least 0.5 m (where ground conditions permit and burial tool performance allows), partially buried (buried but not to target depth) with rock protection, or surface laid with the over-placement of cable protection. Selected methods will be based on the risk assessment and the protection will be periodically monitored and maintained as practicable. The Projects will ensure compliance with MGN654 where appropriate.	Risk of grounding or snagging of cables.
13	Air Draught Clearance	WTG blades will have at least 22 m clearance above MHWS	Risk of allision/contact with structures.

ID	Title	Description	Risks mitigated
14	Layout Plan and Lines of Orientation	WTG and OSPs layout plan to be agreed with MCA and Trinity House prior to construction and must maintain at least one line of orientation unless justified and agreed with the MCA.	Risk of allision/contact with structures and ensuring access for SAR.
15	Electromagnetic interference minimisation	A Cable Specification and Installation Plan will be prepared. This will include the technical specification of offshore electrical circuits, and a desk-based assessment of attenuation of electro-magnetic field strengths, shielding and cable burial depth in accordance with industry good practice.	Impact on navigation and communications equipment.
16	Offshore Construction Method Statement and Construction Programme	Offshore Construction Method Statement and Construction Programme and plan to be submitted to MCA and Trinity House for consultation. Where possible, construction to follow linear progression avoiding disparate construction sites across development area.	Risk of allision with structures or collision with construction vessels.
Operational Management			
17	Vessel Traffic Management Plan	Coordination of Project vessels during construction and during operations and maintenance to ensure project vessels do not present unacceptable risks to each other or third parties. Project marine traffic coordination plans to be made available to all maritime users. Information and warnings will be distributed via NtMs and other appropriate media (e.g. Admiralty Charts and fishermen's awareness charts) to enable vessels and operators to effectively and safely navigate around the offshore structures and any associated works.	Risk of allision with structures or collision with vessels.
18	Vessel Standards	All work vessels operating on behalf of Projects will have: -MCA Vessel Coding (e.g. small commercial vessel (SCV) and workboat code) -Appropriate Insurance -Crewed by suitably trained/qualified personnel -AIS (Class A/B) -Very High Frequency (VHF) (Ch16) -Appropriate mooring arrangements.	Risk of allision with structures or collision with vessels.
19	Personal Protective Equipment (PPE)	All personnel to wear the correct Personal Protective Equipment (PPE) suitable for the location and role at all times, as defined by the relevant Quality, Health, Safety and Environment (QHSE) documentation. This will include the use of Personal Locator Beacons (PLBs).	Minimising risk of loss of life.
20	Guard Vessels	Use of guard vessels as required.	Risk of allision with structures or collision with construction vessels.

ID	Title	Description	Risks mitigated
21	Inspection and Maintenance Programme	Regular maintenance regime by Applicants to check the Project infrastructure, its fittings and any signs of wear and tear. This should identify any failings which might result in a failure.	Minimising risk of Project asset failure.
22	Training	Applicants are responsible for ensuring that all staff engaged on operations are competent to carry out the allocated work.	Minimising risk of loss of life.
23	Compliance with International, UK and Flag State Regulations inc. IMO conventions	Compliance from all vessels associated with the Projects with international maritime regulations as adopted by the relevant flag state (e.g. International Convention for the Prevention of Collision at Sea (COLREGS) (IMO, 1972) and International Convention for the Safety of Life at Sea (SOLAS (IMO, 1974)).	Risk of allision with structures or collision with vessels.
24	Vessel health and safety requirements	As industry standard mitigation, the Applicant will ensure that all Project related vessels meet both IMO conventions for safe operation as well as HSE requirements, where applicable. This shall include the following good practice: • Wind farm associated vessels will comply with International Maritime Regulations; • All vessels, regardless of size, will be required to carry AIS equipment on board; • All vessels engaged in activities will comply with relevant regulations for their size and class of operation and will be assessed on whether they are "fit for purpose" for activities they are required to carry out • All marine operations will be governed by operational limits, tidal conditions, weather conditions and vessel traffic information. • Walk to work solutions will be utilised where possible.	Minimising risk of loss of life.
Site Monitoring			
25	Continuous Watch	Continuous watch by multi-channel VHF, including Digital Selective Calling (DSC).	Responding to incidents swiftly.
26	Vessel Traffic Monitoring	Continuous monitoring during construction and immediate period post construction to MCA approval.	Identification of unanticipated Project impacts.

4. DESCRIPTION OF MARINE ENVIRONMENT

4.1 PRINCIPAL NAVIGATIONAL FEATURES

4.1.1.1.1 Key features relevant to the CRNRA study area and features relating to the management of vessels and safety of navigation are described in this section. Principle navigational features within the CRNRA study area have been identified using the appropriate UKHO Admiralty charts and UKHO Admiralty Sailing Directions appropriate to the area. Principle navigational features in proximity to the Projects are shown in **Figure 4**.

4.1.2 Responsible Authorities – MCA

4.1.2.1.1 The Projects are in a region of general navigation in UK waters with the MCA as the responsible authority for safe navigation. Additional authorities are responsible for navigation in port approaches and within IoM territorial waters.

4.1.3 IMO Routeing Schemes, Reporting Measures and Recommended Channels

4.1.3.1.1 There are two IMO adopted routeing measures located in proximity to the Array Areas. The Liverpool Bay TSS is located approximately 4.5 nm southeast of the southeast boundary of the Mona Array Area, as shown in **Figure 4**. This TSS deconflicts vessel traffic on passage to/from the Mersey ports and maintains a safe distance between vessels, the oil and gas infrastructure to the north and the Gwynt Y Môr Offshore Windfarm to the south. The Off Skerries TSS is located 17.6 nm southwest of the Mona Array Area to separate traffic transiting around the northwest coast of Anglesey.

4.1.3.1.2 The area surrounding the Douglas oil field infrastructure is charted as an Area to be Avoided with the accompanying note: '*The IMO-adopted Area to be Avoided should only be entered by authorised vessels to access the Douglas oil field*'.

4.1.3.1.3 There are no reporting measures within the CRNRA study area.

4.1.4 Aids to Navigation

4.1.4.1.1 AtoNs located in proximity to the Projects are shown in **Figure 4**. A range of AtoNs are situated to the northeast of the Morgan Array Area marking the Walney and Walney Extension OWFs. These AtoNs include cardinal marks indicating where the safe water is and markings of the WTGs on the periphery of the windfarms to indicate the extent of the area. The West of Duddon Sands Windfarm located adjacent to the southeastern boundary of the Walney OWF also has cardinal marks to identify the safe water.

4.1.4.1.2 The Morecambe westerly cardinal mark is located approximately 5 nm northeast of the Morecambe Array Area. This buoy marks the western extent of Shell Flat on the south approaches to Lune Deep.

4.1.4.1.3 The oil and gas infrastructure in the area (see **Section 4.2.3** for further detail) has lights to identify surface infrastructure and buoyage to identify sub-surface infrastructure which may pose a hazard to navigation.

4.1.5 Pilot Boarding Stations

4.1.5.1.1 Pilot boarding stations for the ports in the CRNRA study area with Competent Harbour Authority (CHA) status are shown on **Figure 4**. The pilot stations and their distances from the windfarms are provided in **Table 8**, all of which are more than 10 nm from the Project Array Areas.

Table 8: Key pilot boarding stations.

Boarding Station	Location Relative to Project		
	Mona Array Area	Morgan Array Area	Morecambe Array Area
Liverpool	17 nm southeast	29 nm southeast	14 nm southeast
Point Lynas (Liverpool heavy weather)	14 nm southwest	30 nm southwest	29 nm southwest
Mostyn	23 nm southeast	39 nm southeast	24 nm southeast
Mostyn Outer (vessels over 95 m Length Overall (LOA))	16 nm southeast	35 nm southeast	23 nm south
Heysham/Fleetwood	31 nm northeast	26 nm east	18 nm northeast
Barrow	26 nm northeast	20 nm east	14 nm northeast
Douglas	25 nm northwest	12 nm northwest	35 nm northwest

4.1.6 Vessel Traffic Services

4.1.6.1.1 None of the Projects are located in a Vessel Traffic Service (VTS) area or Local Port Service (LPS) area. The Port of Liverpool operates the only VTS in the east Irish Sea. The VTS covers the Liverpool Statutory Harbour Authority (SHA) area monitoring vessel traffic through AIS and Radar.

4.1.7 Practice and Exercise Area (PEXA) Schemes

4.1.7.1.1 There is a firing practice area (D406) located approximately 5 nm to the north of the Morgan Array Area. No restrictions are placed on the right to transit the firing practice areas at any time. The firing practice area is operated using a clear range procedure, meaning that firing only takes place when the area is confirmed clear of all shipping.

4.1.8 Anchorages and waiting areas

4.1.8.1.1 Two chartered anchorages are located within the Port of Liverpool SHA Area, as shown on **Figure 4**. One of these lies to the south of the approaches to Liverpool between the Burbo Bank Extension and Gwynt y Môr windfarms. The other anchorage is to the north of the approaches to the Mersey.

4.1.8.1.2 Douglas Bay is used as an anchorage for vessels waiting to enter the Port of Douglas and for cruise vessels when undertaking tendering operations.

4.1.8.1.3 There is an anchorage called Rhyl North used by vessels waiting for pilotage to the Port of Mostyn located directly north of the Mostyn Pilot Boarding Station.

4.1.8.1.4 Heysham Port has a designated anchorage located in Lune Deep adjacent to the Pilot Boarding Station.

4.1.9 Disposal Areas

4.1.9.1.1 There are nine licenced disposal areas in the CRNRA study area. Each active disposal area and the distance to each of the Project Array Areas is presented in **Table 9**.

Table 9: Active disposal areas.

Disposal Area	Location Relative to Project		
	Mona Array Area	Morgan Array Area	Morecambe Array Area
Douglas	23 nm northwest	10 nm northwest	34 nm northwest
Douglas Harbour	24 nm northwest	12 nm northwest	34 nm northwest
Barrow D	25 nm east	19 nm east	12 nm northeast
Morecambe Bay: Lune Deep	29 nm east	24 nm east	16 nm northeast
Site Y	12 nm southeast	24 nm southeast	9 nm southeast
Site Z	18 nm southeast	28 nm southeast	13 nm southeast
Burbo Bank Extension OWF	16 nm southeast	31 nm southeast	16 nm southeast
Mersey	26 nm southeast	30 nm southeast	25 nm southeast
Mostyn Deep	23 nm southeast	26 nm southeast	25 nm southeast

4.1.10 Wrecks

4.1.10.1.1 There are over 1,300 charted wrecks in the CRNRA study area. These are identified on navigational charts.

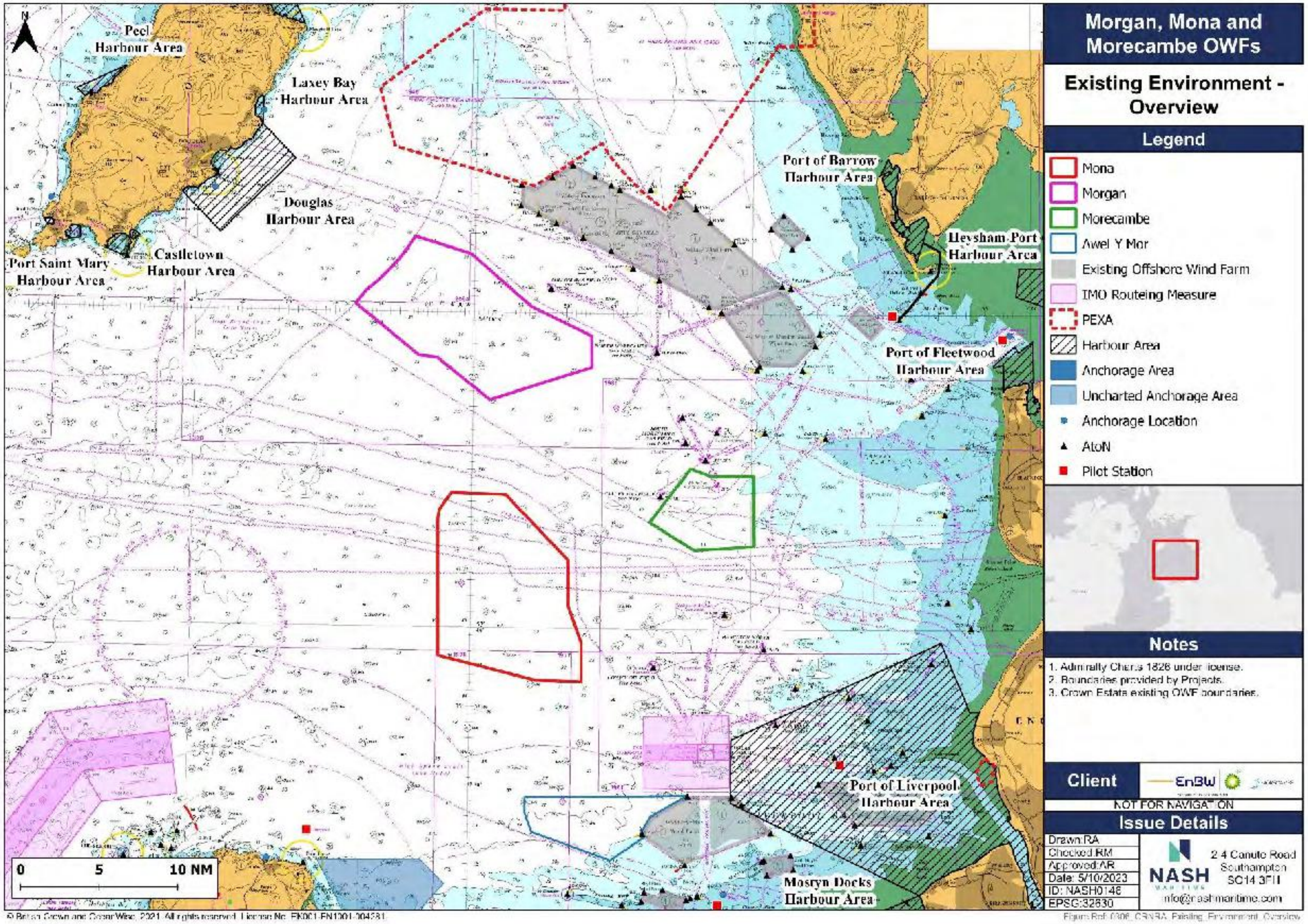


Figure 4: Existing offshore activities and infrastructure.

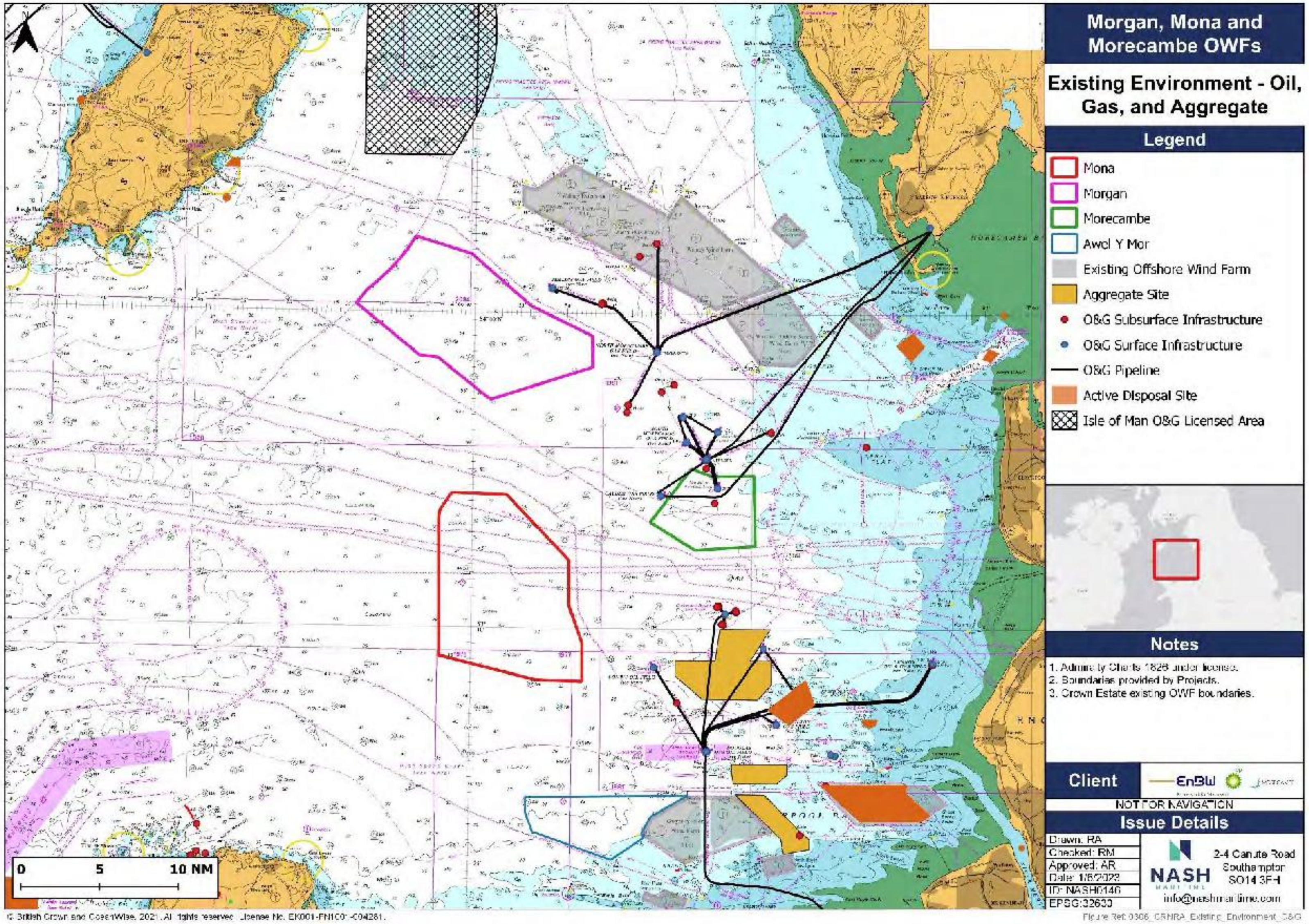


Figure 5: Existing offshore activities and infrastructure – oil and gas and aggregate.

4.2 EXISTING INFRASTRUCTURE

4.2.1 Ports and Harbours

4.2.1.1.1 Nearby ports and harbours are shown in **Figure 4** and **Table 10**. The nearest ports are Liverpool and Douglas on the IoM. All Projects lie outside of the limits of any ports or harbours.

Table 10: Key ports and harbours in the CRNRA study area.

Name	Type	Location Relative to Project		
		Mona Array Area	Morgan Array Area	Morecambe Array Area
UK Mainland Ports				
Port of Liverpool	Major regional port.	10 nm southeast	25 nm southeast	11 nm southeast
Heysham Port	Commercial shipping port.	33 nm northeast	27 nm east	20 nm northeast
Port of Fleetwood	Recreational/ fishing port	30 nm east	26 nm east	17 nm northeast
Port of Barrow	Commercial shipping port	26 nm northeast	20 nm east	14 nm northeast
Port of Mostyn	Commercial shipping port	26 nm southeast	41 nm southeast	27 nm southeast
Conwy Harbour	Recreational/ fishing port	18 nm south	37 nm south	28 nm south
Holyhead	Commercial shipping port	26 nm southwest	41 nm southwest	41 nm southwest
IoM Ports				
Douglas Port	Commercial shipping port.	22 nm northwest	9 nm northwest	32 nm northwest
Laxey Bay	Recreational/ fishing port	26 nm northwest	12 nm northwest	35 nm northwest
Castletown Harbour	Recreational/ fishing port	25 nm northwest	15 nm west	37 nm northwest
Port St Mary	Recreational/ fishing port	29 nm northwest	18 nm west	40 nm northwest
Port Erin	Recreational/ fishing port	31 nm northwest	20 nm west	42 nm northwest
Peel	Recreational/ fishing port	34 nm northwest	21 nm northwest	44 nm northwest
Ramsey	Recreational/ fishing port	31 nm northwest	15 nm northwest	37 nm northwest

4.2.2 Other Offshore Wind Projects

4.2.2.1.1 Existing offshore wind infrastructure within the CRNRA study area is listed in **Table 11** and shown in **Figure 4**.

Table 11: Other offshore wind projects in Irish Sea.

Name	Type	Location Relative to Project			Status
		Mona Array Area	Morgan Array Area	Morecambe Array Area	
Gwynt y Môr OWF	Operational wind farm (576 MW capacity)	9.6 nm southeast	27.7 nm southeast	15.6 nm south	Operational since 2015
North Hoyle OWF	Operational wind farm (60 MW capacity)	16.0 nm southeast	33 nm southeast	19.6 nm south	Operational since 2004
Rhyl Flats OWF	Operational wind farm (90 MW capacity)	13.8 nm south	32.7 nm southeast	21.6 nm south	Operational since 2009
Burbo Bank OWF (including extensions)	Operational wind farm (90 MW plus 258 MW extension)	16.0 nm southeast	30.2 nm southeast	18.0 nm southeast	Operational since 2007, extension operational since 2017
West of Duddon Sands OWF	Operational wind farm (389 MW capacity)	17.2 nm northeast	8.3 nm east	7.0 nm north	Operational since 2014
Barrow OWF	Operational wind farm (90 MW capacity)	23.4 nm northeast	16.2 nm east	11.3 nm northeast	Operational since 2006
Walney OWF (including extensions)	Group of operational wind farms (total capacity of 1026 MW)	18.4 nm northeast	4.4 nm northeast	10.2 nm north	Operational since 2011, with extensions operational in 2012 and 2018
Ormonde OWF	Operational wind farm (150 MW capacity)	23.8 nm northeast	13.2 nm	14.6 nm north	Operational since 2012

4.2.3 Oil and Gas

4.2.3.1.1 Oil and gas infrastructure within proximity of the Projects is listed in **Table 12** and shown in **Figure 5**. Several of the Projects are in close proximity to, or overlap, with both surface or subsurface infrastructure associated with the oil and gas industry.

Table 12: Oil and gas infrastructure.

Name	Type	Location Relative to Project			Status
		Mona Array Area	Morgan Array Area	Morecambe Array Area	
South Morecambe gas field	Manned	10 nm northeast	7 nm southeast	1 nm north	Producing. Decommissioning of two drilling platforms commenced in 2021. DP3 decommissioned as of 2023
Calder gas field	Normally unmanned	7 nm northeast	9 nm southeast	<0.5 nm northwest	Producing
North Morecambe gas field	Manned	13 nm northeast	4 nm east	7 nm north	Producing
Millom gas field	Normally unmanned	13 nm north	1 nm north	14 nm northwest	Producing
Conwy oil field	Manned	4 nm east	19 nm southeast	8 nm south	Producing
Douglas oil field	Manned	9 nm southeast	26 nm southeast	12 nm south	Producing
Hamilton North gas field	Normally unmanned	7 nm east	21 nm southeast	6 nm south	Producing
Hamilton gas field	Normally unmanned	12 nm southwest	26 nm southeast	11 nm south	Producing
Lennox oil and gas field	Normally unmanned	22 nm east	28 nm southeast	13 nm southeast	Producing

4.2.4 Submarine Cables

4.2.4.1.1 The Irish Sea has a significant number of cables, primarily telecommunication connections between the UK and the IoM and Ireland along with numerous export cables from existing offshore windfarms. The nautical charts show a total of 10 submarine cables pass through the CRNRA study area and seven pass through the Project Array Areas, as shown in **Figure 4** and **Figure 5**.

4.2.5 Aggregate Extraction

4.2.5.1.1 There are three aggregate extraction areas to the southeast of the Projects, these are shown in **Figure 5** and listed in **Table 13**.

Table 13: Aggregate extraction areas.

Name	Type	Location Relative to Project		
		Mona Array Area	Morgan Array Area	Morecambe Array Area
Area 457: Liverpool Bay	Extraction Area	6 nm east	19 nm southeast	5 nm south
Area 392/393: Hilbre Swash	Extraction Area	12 nm southeast	29 nm southeast	16 nm south
Area 1808:	The Crown Estate 2018/19 Marine Aggregates Tender	11 nm southeast	27 nm southeast	14 nm south

4.3 METOCEAN CONDITIONS

4.3.1 Introduction

4.3.1.1.1 In this section, MetOcean conditions are described for the CRNRA study area for the wind and wave climate, tide and currents, and visibility. Additional work was undertaken by HR Wallingford, to underpin the bridge navigation simulations and summarised here together with information provided within Admiralty Sailing Directions West Coasts of England and Wales Pilot, NP37, 21st Edition, 2022.

4.3.2 Wind and Wave

4.3.2.1.1 **Figure 6** shows the modelled wind speeds and directions within the centre of the CRNRA study area for the years 1988 to 2018. The predominant wind direction is from the southwest, and account for the greatest proportion of strong wind events. The Admiralty Sailing Directions state that gales are reported between 12 days/year (Walney) and 30 days/year for Ronaldsway).

4.3.2.1.2 The Met Office North West Shelf Reanalysis Hindcast covers the period 1980 to 2021 and is based on coupled NEMO and WaveWatchIII hydrodynamics and wave models, with the wave model forced with ECMWF ERA5 model winds. The wave models horizontal resolution is between 3 km to 1.5 km in coastal waters. Model wave data was downloaded for the southeast Irish Sea and a subset of model points were extracted and analysed by HR Wallingford.

4.3.2.1.3 Annual average wave conditions at a point (53.8°N, -4.0°E) within the area of interest is shown in **Figure 7**. These demonstrate that wave conditions are predominantly southwesterly and account for the majority of wave conditions greater than 2.5 m Hs. **Table 14** demonstrates the extreme wave conditions within the CRNRA study area, with 4.2 m Hs and 50 knot winds from the southwest the typical annual extreme.

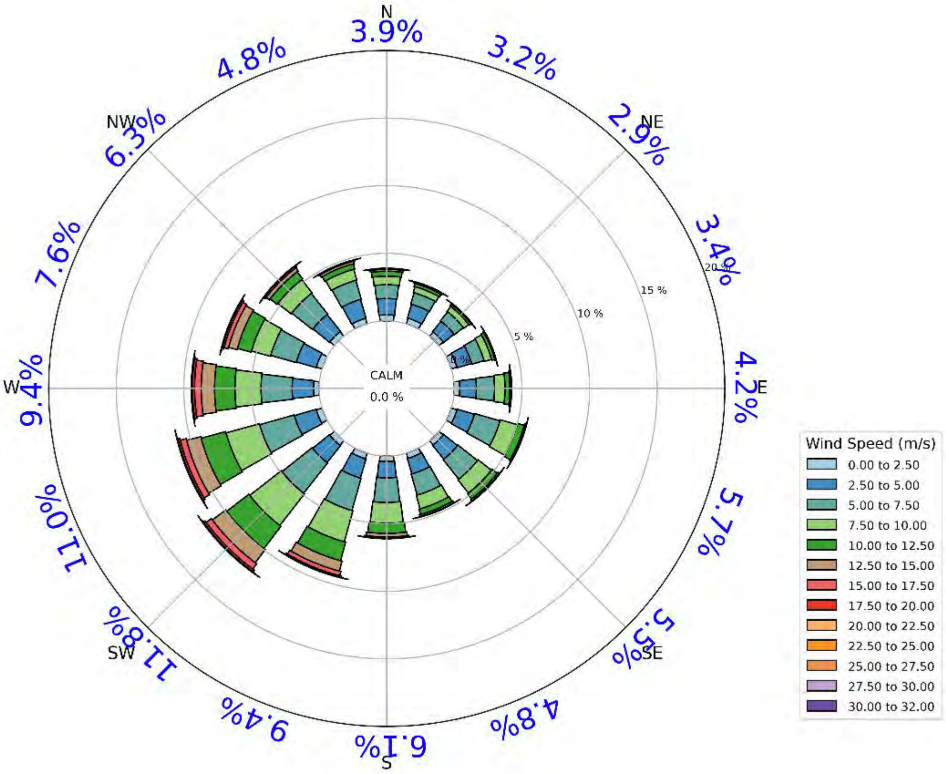


Figure 6: Annual average wind rose (1988 to 2018) – HR Wallingford.

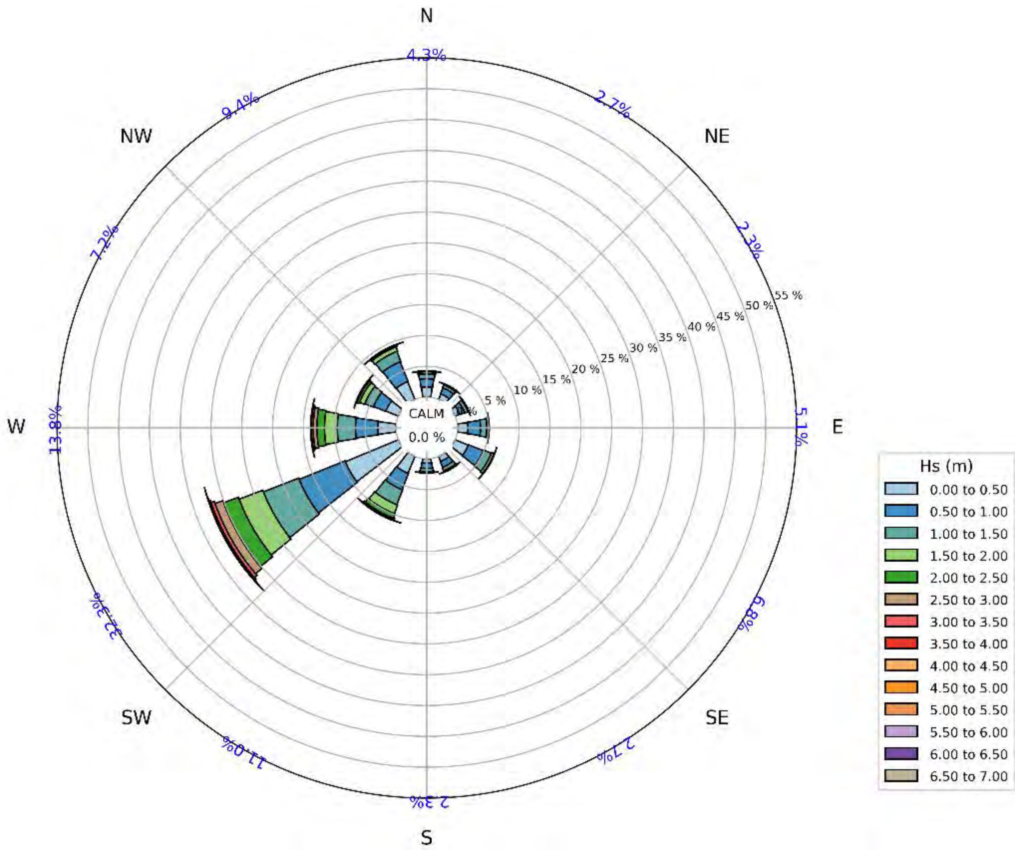


Figure 7: Annual average wave rose (53.8N, -4.0E) 1980 to 2021 – HR Wallingford.

Table 14: Summary of wave extremes. Source: Met Office NWS model (1980 to 2021). Analysed by HR Wallingford.

Return Period	Significant wave height Hs (m)	Wave Direction	Corresponding Approximate Wind Speed (knots)
Weekly (1 in 50)	1.5	232	15
Monthly (1 in 10)	2.9	264	30
Yearly (1 in 1)	4.2	227	50
1 in 5 years	4.6	236	-
1 in 10 years	5.4	240	-

4.3.3 Tidal

4.3.3.1.1 Flow modelling for a spring tide by HR Wallingford for the Irish Sea is shown in **Figure 8**. The maximum flow speeds within the CRNRA study area are less than 1.5 metres per second (m/s).

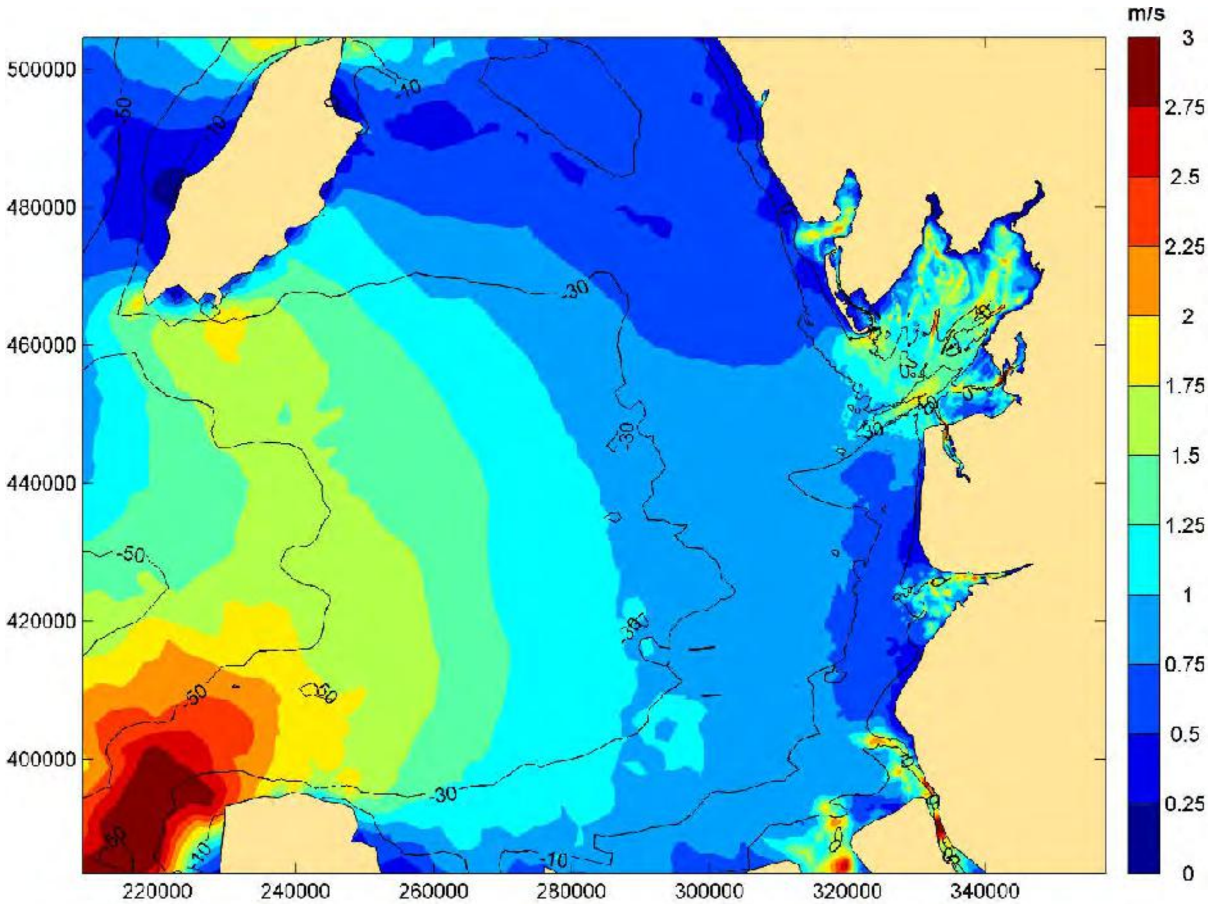


Figure 8: Maximum current flow speeds (m/s) for spring tide. Source: HR Wallingford.

4.3.4 Visibility

4.3.4.1.1 The Admiralty Sailing Directions report fog between 12 days/year (Crosby), 24 days/year (Ronaldsway) and 43 days/year (Blackpool).

4.4 SEARCH AND RESCUE

4.4.1 HMCG

4.4.1.1.1 His Majesty's Coastguard (HMCG) is responsible for requesting and coordinating SAR activities within the UK's SAR region. The local coastguard base for the region is Holyhead Coastguard Operations Centre (CGOC). The nearest HMCG helicopter base is located at Caernarfon Airport, Gwynedd. The Caernarfon facility provides a 24-hour search and rescue service, with two Sikorsky S-92 helicopters.

4.4.2 RNLI

4.4.2.1.1 There are 19 RNLI lifeboat stations within the CRNRA study area, as detailed in **Table 15** and shown in **Figure 9**.

Table 15 RNLI stations.

Name	Type	Distance from Array Area		
		Mona Array Area	Morgan Array Area	Morecambe Array Area
England & Wales				
Blackpool	Lifeboat station with three inshore lifeboats, including an Atlantic 85 and two D class lifeboats.	28 nm east	27 nm southeast	16 nm east
Lytham St Annes	Shannon class all-weather lifeboat and a D class inshore boat. Lifeboats are housed in Lytham and St Annes.	28 nm east	29 nm southeast	16 nm east
New Brighton	Operates a B class Atlantic 85 lifeboat.	29 nm southeast	40 nm southeast	25 nm southeast
Hoylake	Shannon class lifeboat.	26 nm southeast	39 nm southeast	24 nm southeast
West Kirby	D class lifeboat.	27 nm southeast	41 nm southeast	26 nm southeast
Flint	D class lifeboat.	32 nm southeast	48 nm southeast	33 nm southeast
Rhyl	Shannon class all-weather lifeboat and a D class inshore boat.	20 nm southeast	39 nm southeast	26 nm south
Llandudno	Shannon class all-weather lifeboat and a D class inshore boat.	17 nm south	36 nm south	27 nm south
Conwy	D class lifeboat.	20 nm south	38 nm south	29 nm south
Beaumaris	B class lifeboat.	22 nm south	39 nm south	34 nm southwest
Moelfre	Tamar class and D class lifeboats.	18 nm south	35 nm south	32 nm southwest
Holyhead	Severn class and D class lifeboats.	28 nm southwest	43 nm southwest	44 nm southwest
Trearddur	B class and D class lifeboats.	29 nm southwest	44 nm southwest	45 nm southwest
Barrow	Tamar class and D class lifeboats.	31 nm northeast	23 nm east	19 nm northeast
Morecambe	D class and Hover class lifeboats.	40 nm northeast	33 nm east	27 nm northeast
Fleetwood	Shannon and D class lifeboats.	31 nm northeast	28 nm east	18 nm northeast

Name	Type	Distance from Array Area		
		Mona Array Area	Morgan Array Area	Morecambe Array Area
IoM				
Port Erin	B class lifeboat.	31 nm northwest	20 nm west	43 nm northwest
Port St Mary	Trent class and D class lifeboats.	29 nm northwest	19 nm west	41 nm northwest
Douglas	Mersey class lifeboat.	25 nm northwest	12 nm northwest	36 nm northwest
Ramsey	Shannon class lifeboat.	33 nm northwest	17 nm northwest	40 nm northwest

4.4.3 Other assets

4.4.3.1.1 All vessels have an obligation under the SOLAS convention to render assistance to persons or vessels in distress. For incidents adjacent to OWFs, it is common for Project craft such as Crew Transfer Vessels (CTVs) to be the first responders.

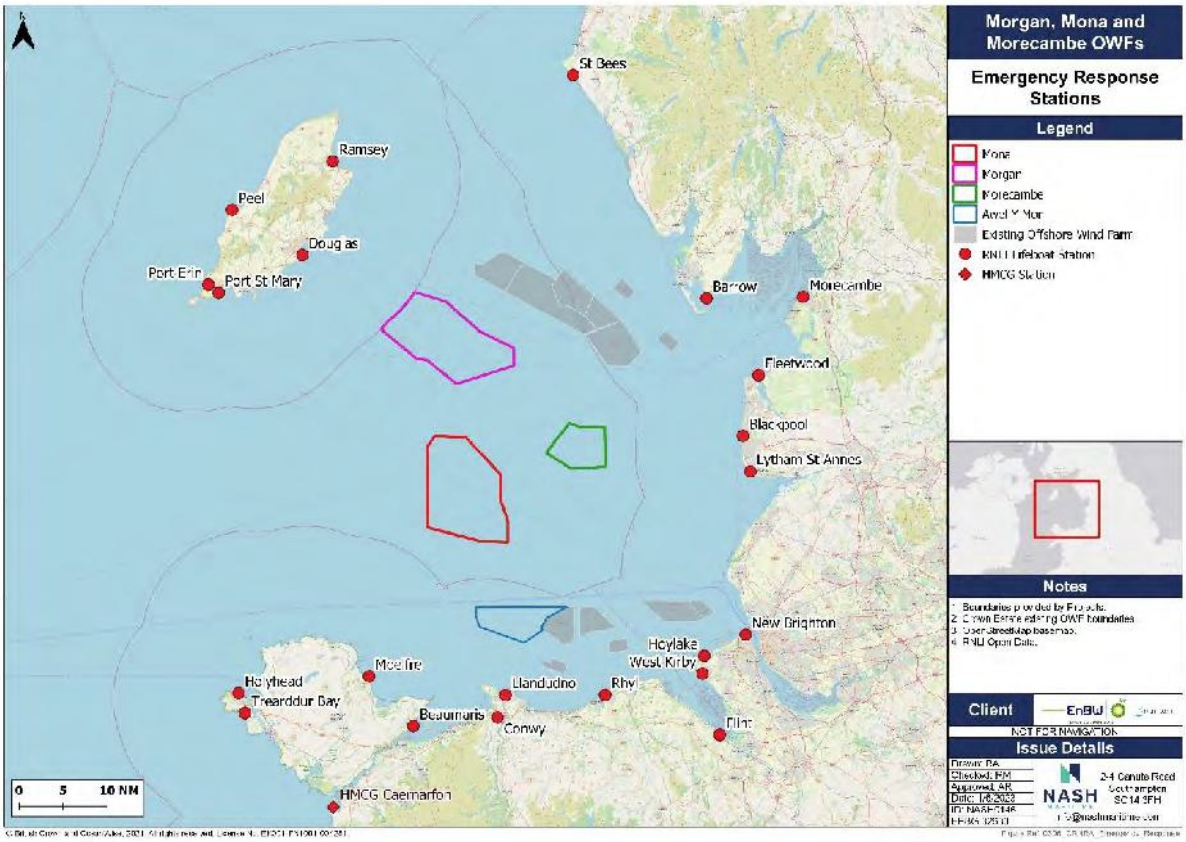


Figure 9: Emergency response stations.

5. DESCRIPTION OF EXISTING MARITIME ACTIVITIES

5.1 INTRODUCTION

5.1.1.1.1 A description of existing marine activities in the CRNRA study area is presented based on the data collected as listed in **Section 2.3**. The following section includes:

- Description of Coronavirus disease 2019 (COVID-19) effects.
- Details of the vessel traffic surveys.
- Analysis of vessel traffic by:
- Traffic types.
- Determination of vessel routes.
- During adverse weather.
- Non-Transit Activity.
- Analysis of historical maritime incidents.

5.1.2 Effects of COVID-19

5.1.2.1.1 Since early 2020, the COVID-19 pandemic has substantially impacted recreational and commercial vessel movements both globally and locally. It is therefore possible that data collected between 2020 and 2021 may be influenced by the pandemic although vessel traffic is expected to largely return to pre-pandemic levels. As such, where appropriate, datasets have been used that precede the pandemic (including AIS data for 2019 for the whole Irish Sea) to benchmark those collected more recently and in order to provide a representative description of the baseline vessel traffic activity. Following the PEIR, a 2022 dataset has been obtained to provide greater recency for the analysis.

5.1.3 Vessel Traffic Surveys

5.1.3.1.1 In compliance with MGN654, the Projects have undertaken at least two 14-day vessel traffic surveys of the individual Array Areas. The principal dataset used in **Section 5.2** is a full years AIS data for the whole east Irish Sea for the year 2022. Each individual Project NRA contains the analysis and interpretation of their respective MGN654 traffic surveys.

5.2 VESSEL TRAFFIC ANALYSIS

5.2.1 Overview

5.2.1.1.1 Annualised vessel traffic density is displayed in **Figure 10**, which presents the number of vessel transits through each grid cell. The figure shows that:

- Several key vessel high density routes in the CRNRA study area are determined by the convergence/divergence of traffic using the Liverpool Bay TSS located approximately 4.5 nm southeast of the most southeastern boundary of the Mona Array Area.
- Several vessel traffic routes run from Douglas and Heysham through the Morgan and Mona Array Areas.

- Many of the most defined routes are associated with ferry services which cross the entire CRNRA study area, principally between Heysham, Liverpool, Douglas and the island of Ireland.
- Service vessel activity is prevalent including to the north of Morecambe Array Area for oil and gas activity and associated with existing OWFs.

5.2.1.1.2 **Figure 11** shows all vessel tracks by vessel draught. Deeper draught vessels over 10 m largely navigate to the south of the CRNRA study area between the Liverpool Bay TSS, across the north coast of Wales and the Off Skerries TSS. A number of these deeper draught vessels are also shown using the bay on the east side of Anglesey to anchor. Vessel traffic within the Morgan and Morecambe Array Areas largely comprises of vessels with a draught under 8 m. Some vessels with a draught over 8 m navigate across the southwestern portion of the Mona Array Area, from Liverpool northwest towards Ireland.

5.2.1.1.3 **Figure 12** shows all vessel tracks by vessel length. As with vessels of deeper draught, vessels over 250 m are largely navigate through the south of the CRNRA study area between the Liverpool Bay TSS, across the north coast of Wales and the Off Skerries TSS. There is also a proportion of the vessels over 250 m length overall (LOA) shown transiting through the southwest portion of the Mona Array Area towards the south end of the IoM and Belfast. There are distinct vessel traffic routes of vessels between 100 and 200 m LOA, due to the major ferry routes from Liverpool to Belfast. Vessels transiting through the Morgan and Morecambe Array Area are largely under 200 m LOA.

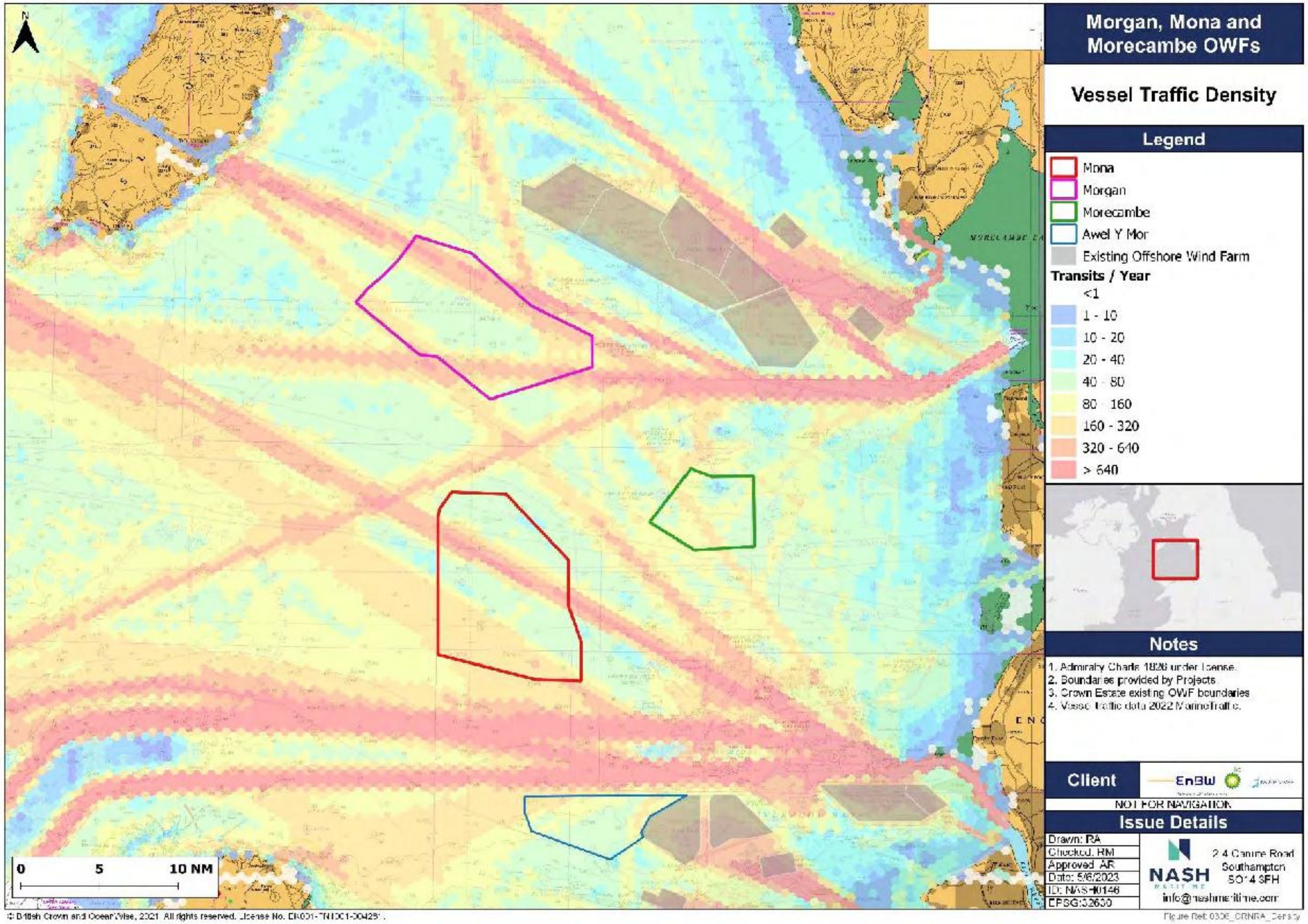


Figure 10: Annualised vessel traffic density in the CRNRA study area (2022).

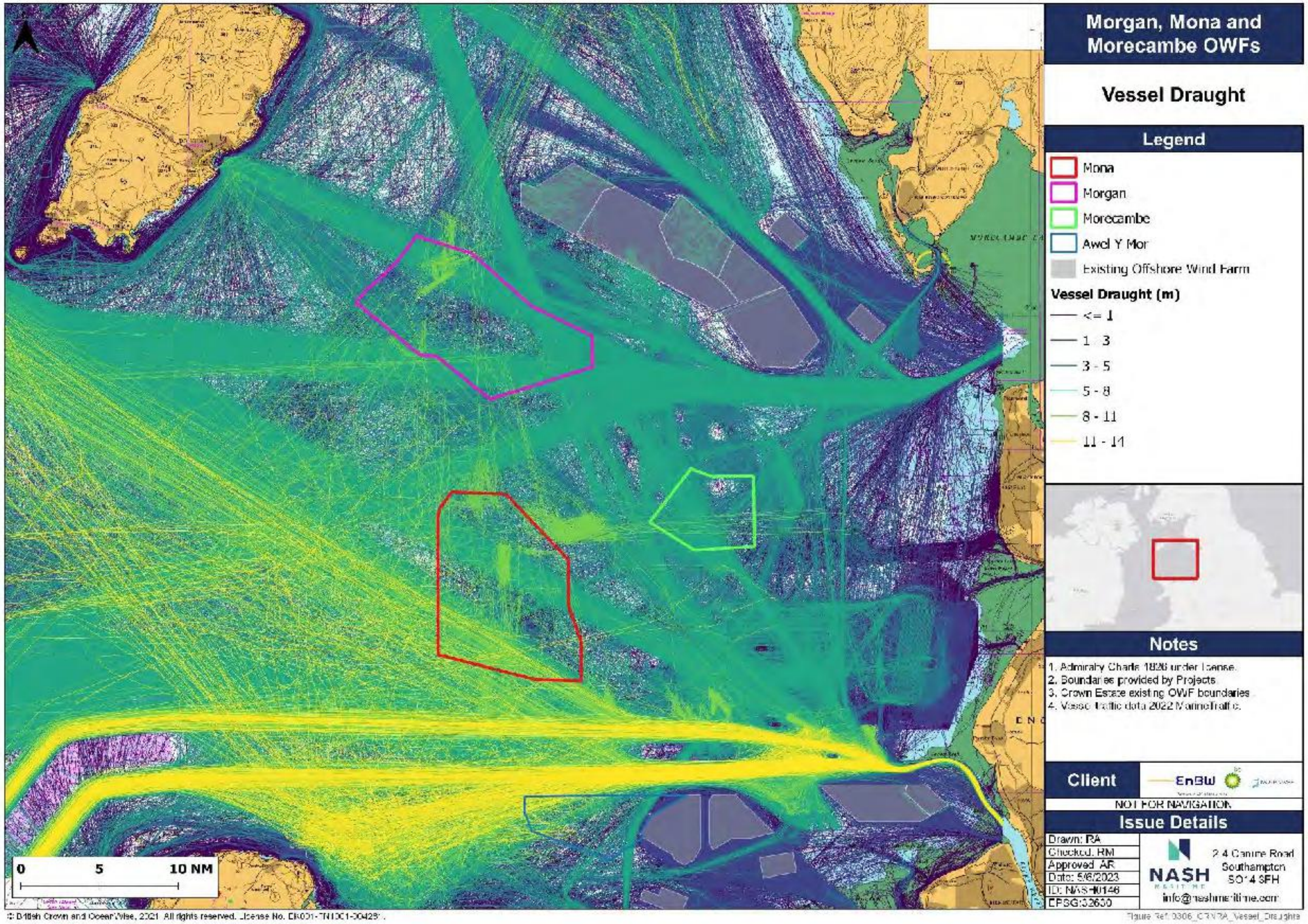


Figure 11: Vessel tracks by draught in the CRNRA study area (2022).

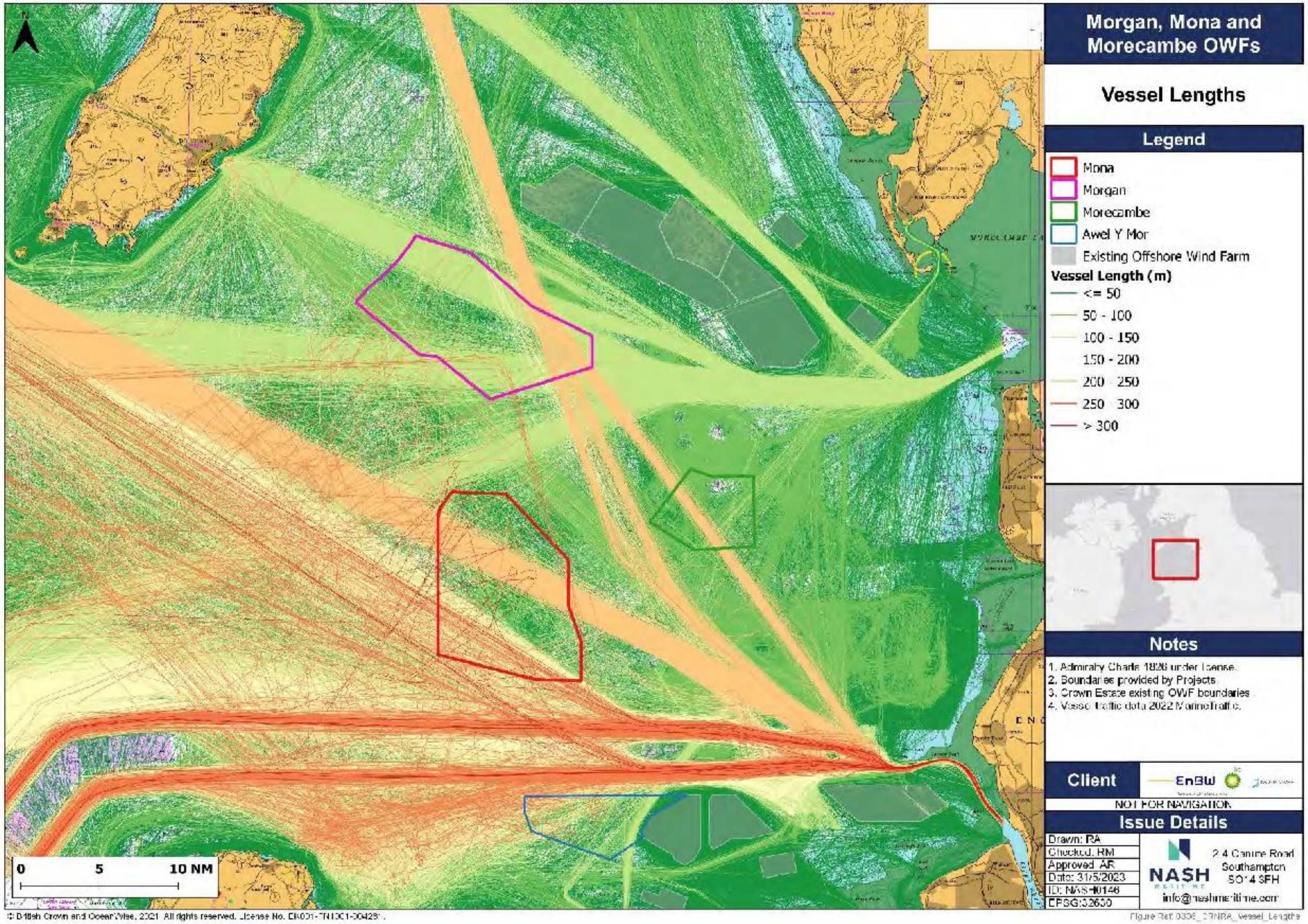


Figure 12: Vessel Tracks by LOA in the CRNRA study area (2022).

5.2.2 Vessel Tracks by Type

5.2.2.1.1 The following sections consider the vessel traffic by types for AIS data obtained for the period 1 January 2022 to 31 December 2022. The collection of radar and visual data during the vessel traffic surveys undertaken for each individual Project have been used to supplement the understanding of vessel traffic movements in the CRNRA study area.

5.2.2.2 Cargo and Tanker

5.2.2.2.1 The tracks of cargo vessels and tanker vessels are shown in **Figure 13** and **Figure 14**, respectively.

5.2.2.2.2 There are multiple cargo vessel routes shown in **Figure 13,** with the inward and outward-bound routes for the Port of Liverpool to the south of the Mona Array Area showing a wide distribution of tracks. This is mainly due to vessels converging on approach to Liverpool from a range of other ports or vessels diverging once departing Liverpool and exiting the Liverpool Bay TSS. Most of the cargo vessel tracks transiting between Liverpool and the northern Irish Sea passing west of the IoM are shown to pass through the Mona Array Area.

5.2.2.2.3 Cargo vessel tracks between the ports of Barrow or Heysham and the Off Skerries TSS are shown passing through the centre of the Morecambe and Mona Array Areas. Most of the cargo vessel tracks passing through the Morgan Array Area are between the east side of the IoM and either the Port of Liverpool or the Off Skerries TSS.

5.2.2.2.4 Tanker vessel tracks in **Figure 14** mostly pass through the Liverpool Bay TSS, although a limited number also pass northwest through the Mona Array Area, northwest towards the IoM. A variety of tanker vessel types are recorded including crude oil, Liquified Natural/Petroleum Gas, chemical and asphalt/bitumen. Some of the tankers which do not use the Liverpool Bay TSS are observed to pass to the east of the Mona Array Area, through the Morgan and Morecambe Array Areas and towards the northern Irish Sea. The 77 m Keewhit accounts for the majority of tanker vessel movements in the east portion of the CRNRA study area.

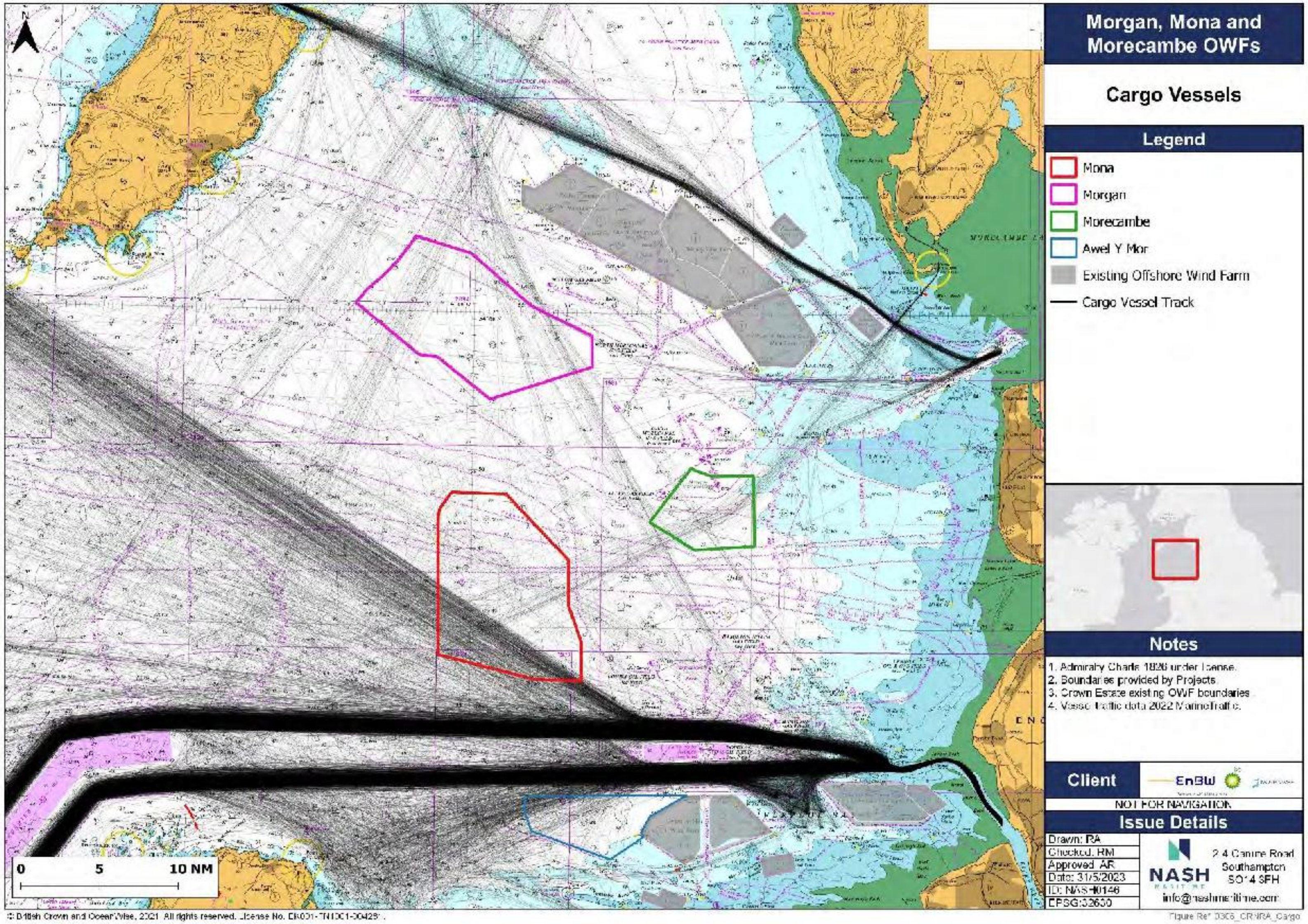


Figure 13: Cargo vessel tracks in CRNRA study area (2022).

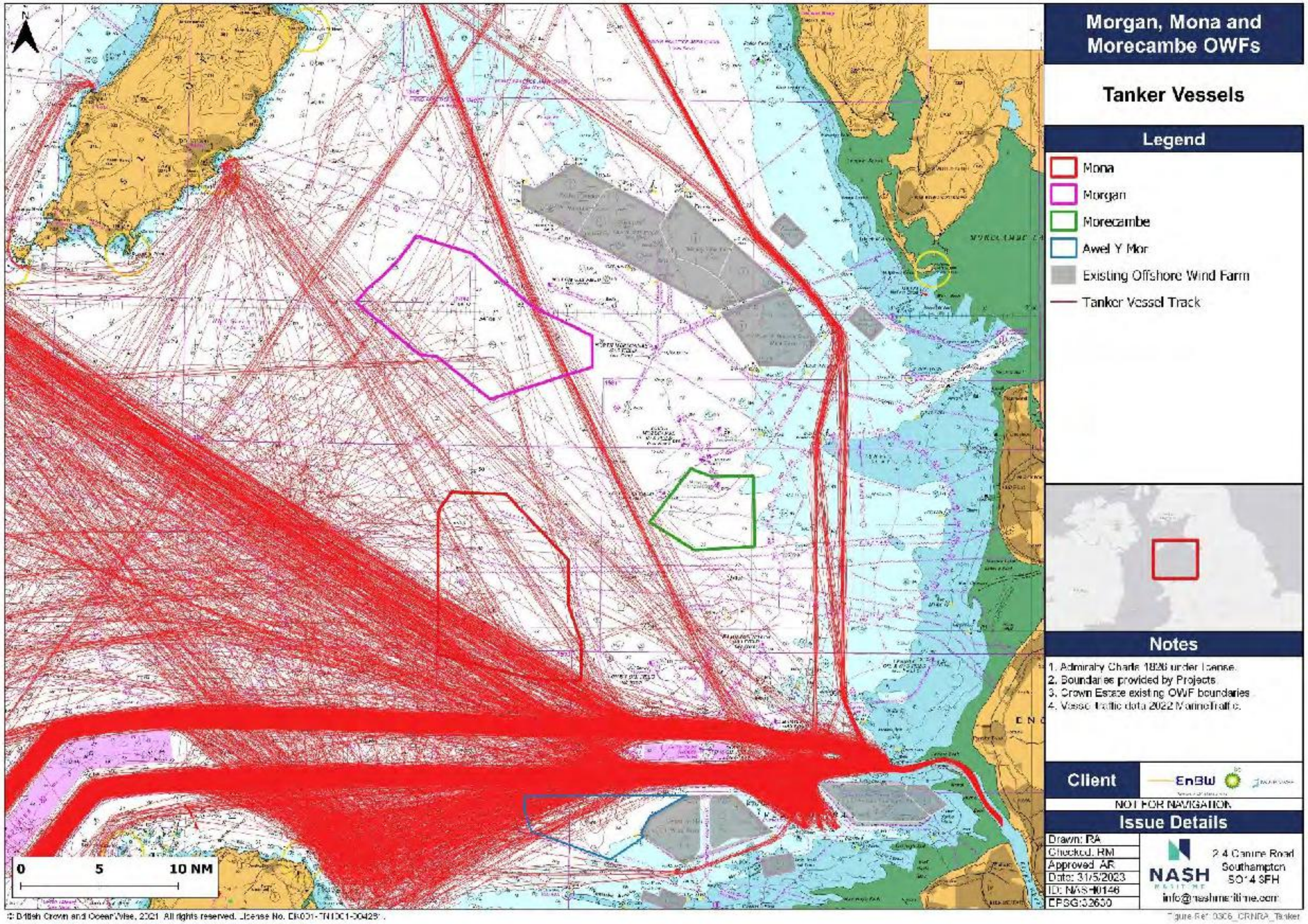


Figure 14: Tanker vessel tracks in the CRNRA study area (2022).

5.2.2.3 Ferries

5.2.2.3.1 There are multiple ferry routes in operation within the region, primarily between Heysham or Liverpool and Ireland or the IoM with tracks crossing each of the Project Array Areas. The tracks of ferries are shown in **Figure 15**, including passenger and freight services. Four principal operators are identified in the east Irish Sea. IoMSPC operate between Douglas, Liverpool and Heysham. Seatruck operate between Heysham, Liverpool, Warrenpoint and Dublin. Stena Line operate between Liverpool, Heysham and Belfast. Finally, P&O currently operate between Liverpool and Dublin.

5.2.2.3.2 Ferry tracks for the main operators in the area are displayed in **Figure 16**. The ferry tracks show adverse weather routeing where alternative courses are used to reduce the effects of the prevailing wind and wave conditions. See **Section 5.2.4.3** for information on each of the routes.

5.2.2.4 Cruise ships

5.2.2.4.1 Tracks of cruise ships are shown in **Figure 15.** Cruise vessel activity in the area is centred around the Port of Liverpool and Douglas. Liverpool has a cruise terminal which has a regular cruise itinerary and provides turnaround services. Cruise vessels at Douglas regularly anchor in Douglas Bay using tenders to take passengers ashore. Cruise ships up to 345 m in length (Queen Mary 2) have called at Liverpool and proceeded to navigate through the CRNRA study area. However, most cruise ships recorded during 2022 were between 200 m and 300 m in length.

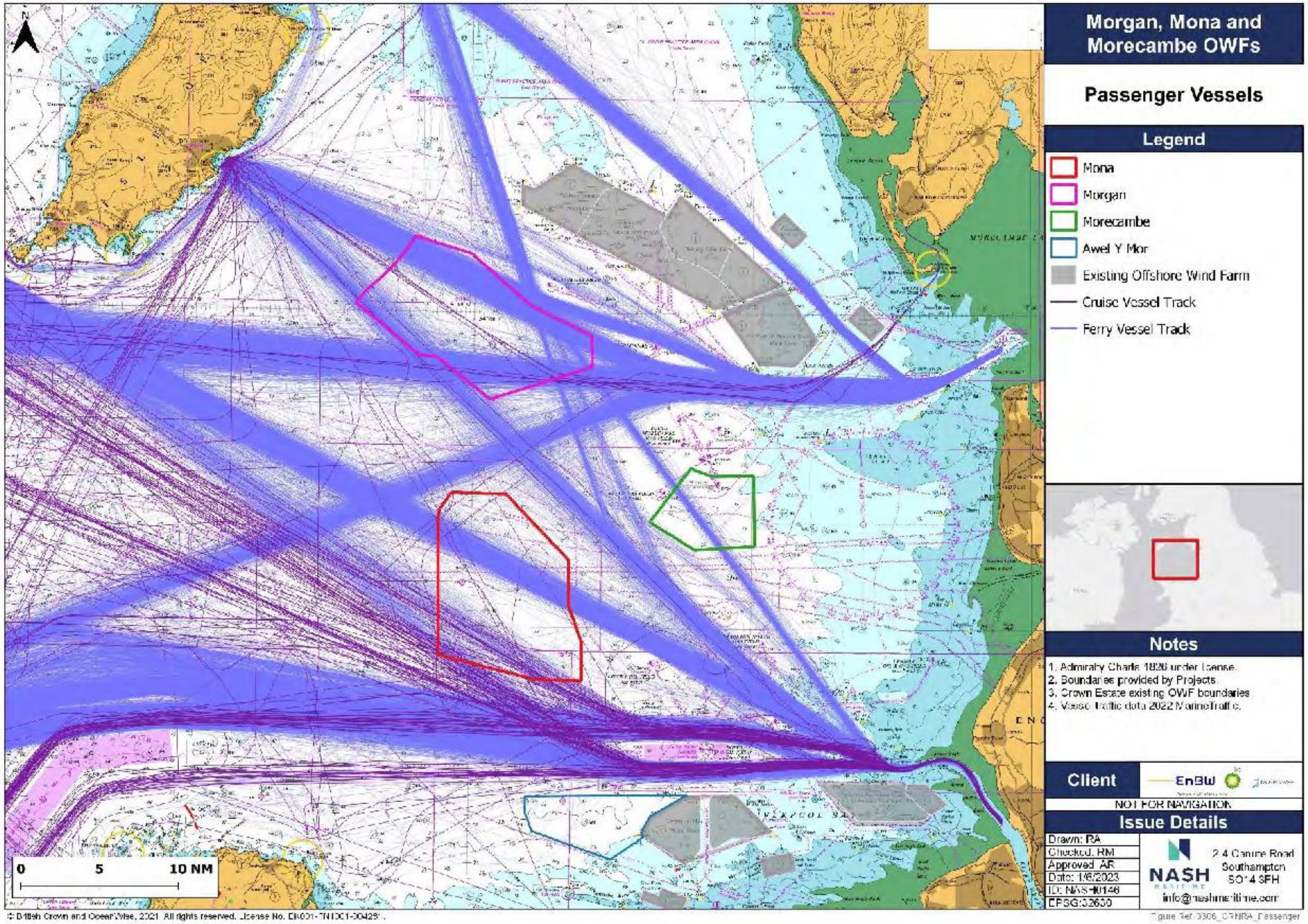


Figure 15: Cruise ship and ferry vessel tracks in the CRNRA study area (2022).

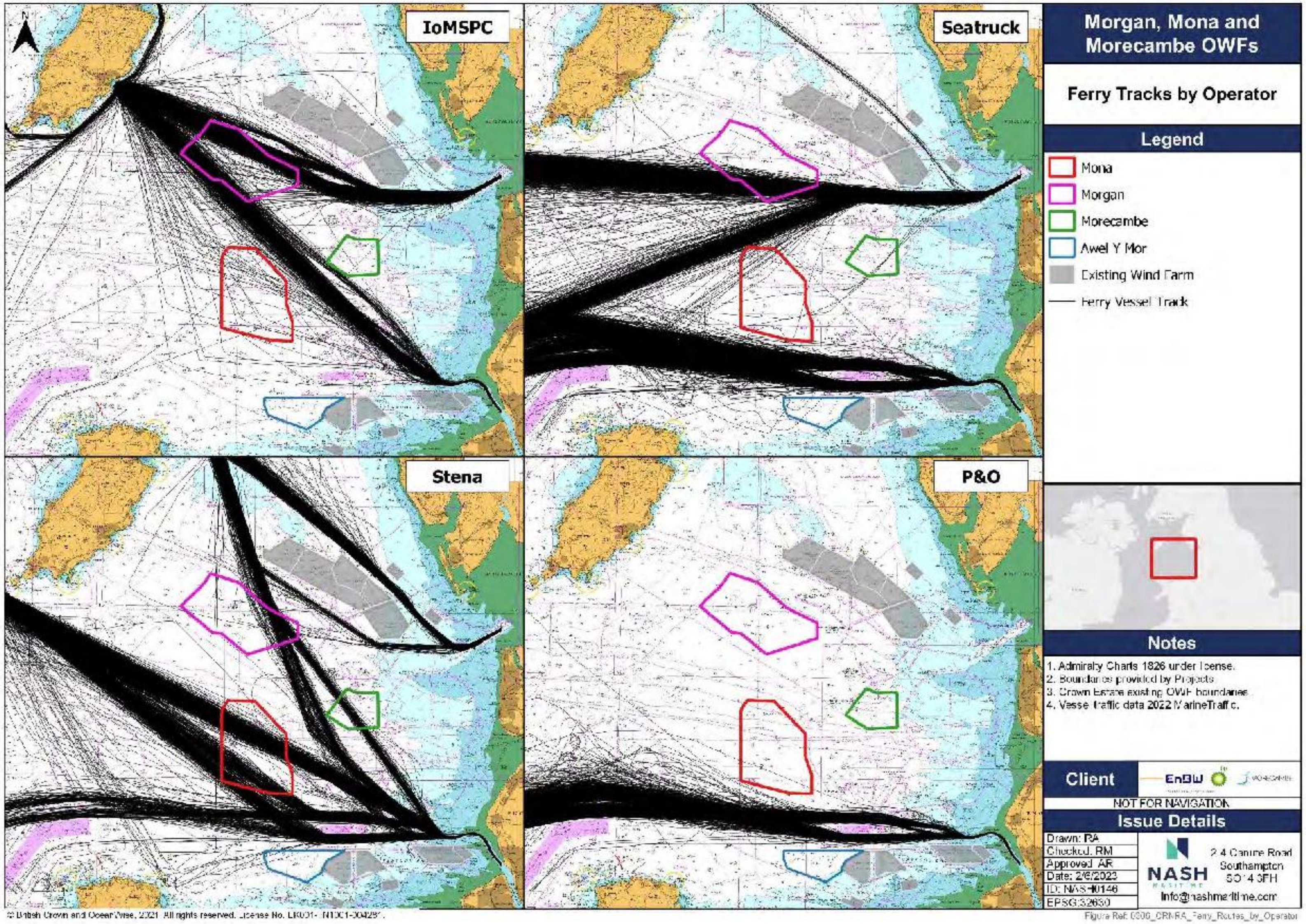


Figure 16: Ferry routes by operator in the CRNRA study area (2022).

5.2.2.5 Recreational

5.2.2.5.1 Recreational vessel activity is shown in **Figure 16**. Historical AIS data and the RYA Coastal Atlas have been combined to determine which areas have greater recreational intensity. There is little recreational activity in the Project Array Areas, with most recreational activity occurring along the coast, particularly between Liverpool, Holyhead, Douglas, and Rhyl. During the vessel traffic surveys between the four Projects, it was noted that very few recreational craft were recorded by AIS or radar. Approximately one vessel per day was recorded navigating through or adjacent to each Project Array Area respectively during the summer traffic surveys, but no recreational craft were identified during the winter surveys. This suggests significant seasonality in recreational movements through the CRNRA study area.

5.2.2.5.2 AIS data showed that recreational vessels were occasionally transiting through the Mona, Morgan, and Morecambe Array Areas, with some vessels sailing offshore passages to transit between clubs or marinas. **Figure 17** shows the recreational vessel tracks through the CRNRA study area derived from 2022 AIS data. Overall, 108 recreational tracks were detected crossing the Project Array Areas in 2022, with 24 tracks crossing Morecambe Array Area, 36 tracks crossing Mona Array Area, and 48 tracks crossing Morgan Array Area. Five cruising routes were also identified in the Study Area from these tracks (see **Figure 18**): (1) Conwy to Douglas, (2) Conwy to Morecambe, (3) Liverpool to Douglas, (4) Morecambe to Douglas, and (5) Whitechapel to Anglesey. The sparsely navigated (in terms of recreational vessels) Study Area appears to be enclosed by a “triangle” formed by routes between Morecambe Bay, Douglas, and Liverpool, with few intersections between recreational vessel tracks and Project Array Areas.

5.2.2.5.3 The cruising route Liverpool to Douglas passes through the centre of the CRNRA Study Area. This route is also taken by vessels participating in the IoM Midnight Race, organised by the Liverpool Yacht Club (LYC), which is the only relevant yacht race that cross the Project Array Areas. Nevertheless, 75% of recreational vessels detected along this route did not sail through the Project Array Areas. Similarly, 72% of vessels sailing the Morecambe Bay to Douglas route, which crosses the northern section of the Morgan Array Area, also naturally avoided the Project Areas. However, most of the vessels sailing between Whitechapel and Anglesey cross the northwestern boundary of the Morgan Array Area, though this route is less frequently navigated by recreational crafts.

5.2.2.5.4 Existing offshore windfarms can also serve as a reference for understanding response patterns of recreational crafts when their routes are intersected by offshore windfarms. For example, the route between Morecambe Bay and Douglas is intersected by two offshore windfarms (Walney and West of Duddon Sands). About 79% of cruising vessels sailing along this route decided to sail a longer passage to avoid crossing the existing windfarms. The majority of crafts opted for a southerly route around the wind farms, extending the shortest possible passage of 46 nm by an additional 4 nm, which can add more than an hour of passage time depending on the vessel type and weather conditions.

5.2.2.5.5 One of the challenges in analysing recreational vessel patterns using AIS data is that not all vessels, particularly the smaller crafts, transmit AIS signals. According to a RYA survey done in 2014, 37% of vessels transmit AIS signals around the UK. Previous RYA studies have concluded that between 10% to 30% of recreational crafts are transmitting AIS signals in the UK, although this largely depends on the specific location. For comparison, 63% of vessels participating in the LYC IoM Midnight Race in 2022 were transmitting AIS signals (81% in 2019).

5.2.2.6 Fishing

5.2.2.6.1 Commercial fishing in the east Irish Sea region has a wide spatial distribution and targets a number of valuable fisheries for demersal, pelagic and shellfish species. Key shellfish species include; king scallop, and queen scallop which are targeted by dredges; and whelk, lobster and crab, which are targeted by pots. The most important demersal target species include bass, sole, thornback ray and plaice, which are typically caught by beam and otter trawlers. Pelagic fish landings from this area are mainly of herring and mackerel, which are predominantly caught by pelagic trawls. Fishing ports in the CRNRA Study Area with the highest fishing efforts are Amlwch, Conwy, Holyhead and Fleetwood. Fishing vessels are also active from Annan, Douglas, Kilkeel, Kirkcudbright, Maryport and Peel. In addition, Belgian trawlers are known to operate throughout the CRNRA study area.

5.2.2.6.2 The tracks of fishing vessels are shown in **Figure 19**. There is considerable fishing activity within and near the Morgan, Mona and Morecambe Array Areas. Static gear (such as creel) and mobile gear (such as trawling) are utilised within the Irish Sea. It is noted that some of the fishing vessels shown are engaged in guard vessel duties or survey works and account for some of the concentrations around oil and gas installations. Between the winter and summer traffic surveys it was noted that between zero and two fishing vessels fish in the Project Array Areas and might be expected to be present between the OWFs. The IoM Queen Scallop season accounts for a concentration to the northwest of the Morgan Array Area. Up to a dozen concurrent fishing boats might be encountered within this area.

5.2.2.6.3 Analysis of fishing vessel intensity using AIS data identified that for more than 60% of the time there would be no fishing vessels present in the waters between the Projects. For more than 90% of the time would there be one or fewer. Whilst on occasions there may be multiple fishing vessels on transit or engaged in fishing, the presence of three or more vessels would be less than 2% of the year. Input from fisheries experts suggested that the majority of fishing boats active within the Project Array Areas would carry AIS and therefore have been included in this analysis.

5.2.2.6.4 Analysis of fishing in the Study Area showed that fishing activity routinely takes place within the existing east Irish Sea OWFs, namely Walney Extension and Gwynt y Môr OWFs, both of which have significantly smaller spacings between WTGs compared to the Projects.

5.2.2.6.5 **Figure 20** shows the intensity of fishing activity as recorded by the MMO using the VMS, required on fishing vessels over 15 m LOA. For those vessels recorded in the VMS, there is a small area of high-density fishing activity within the Mona and Morgan Array Areas. Additional data and analysis on fishing activity is contained within each individual Project’s Commercial Fisheries chapter.

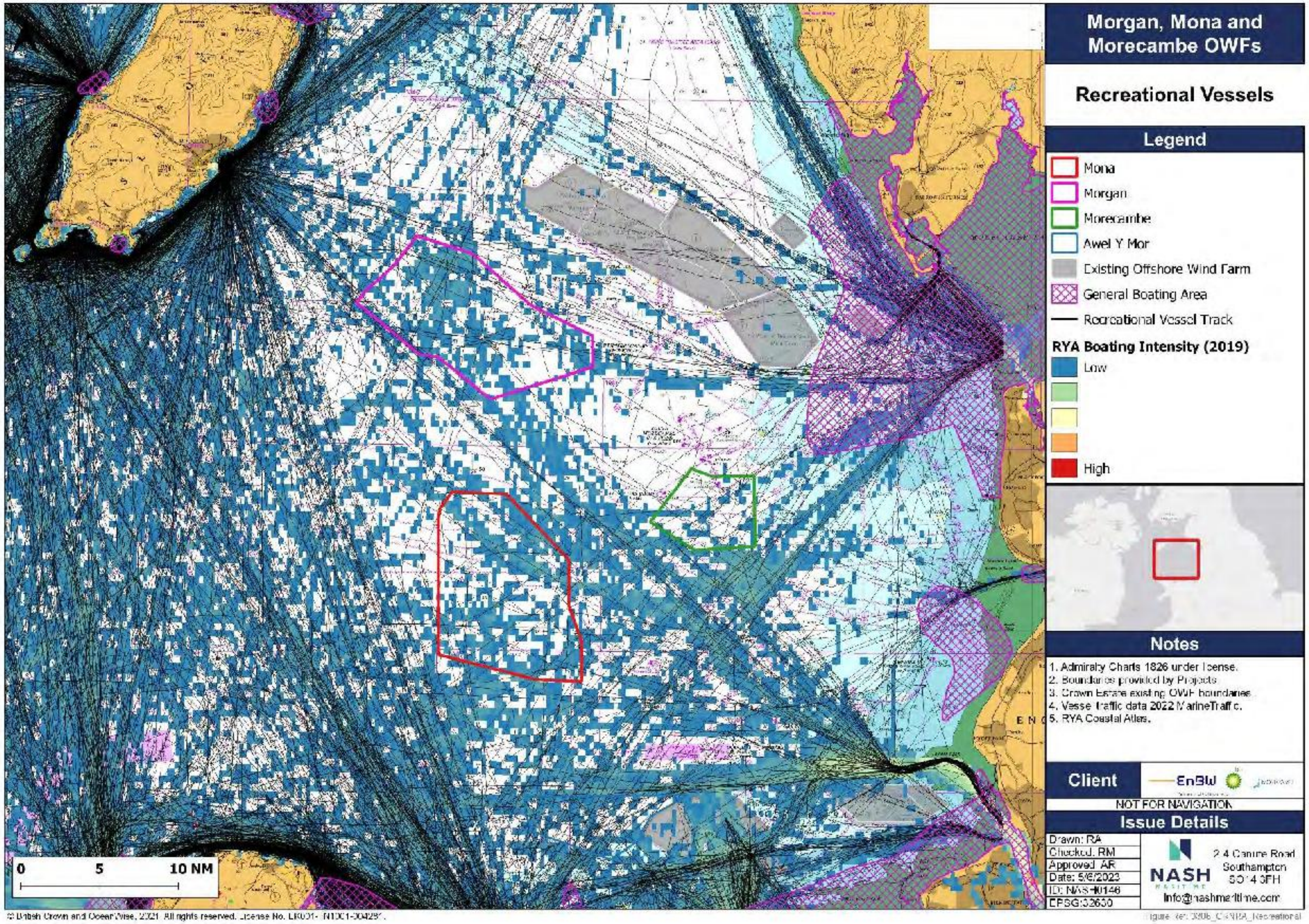


Figure 17: Recreational vessel activity in the CRNRA study area (2022).

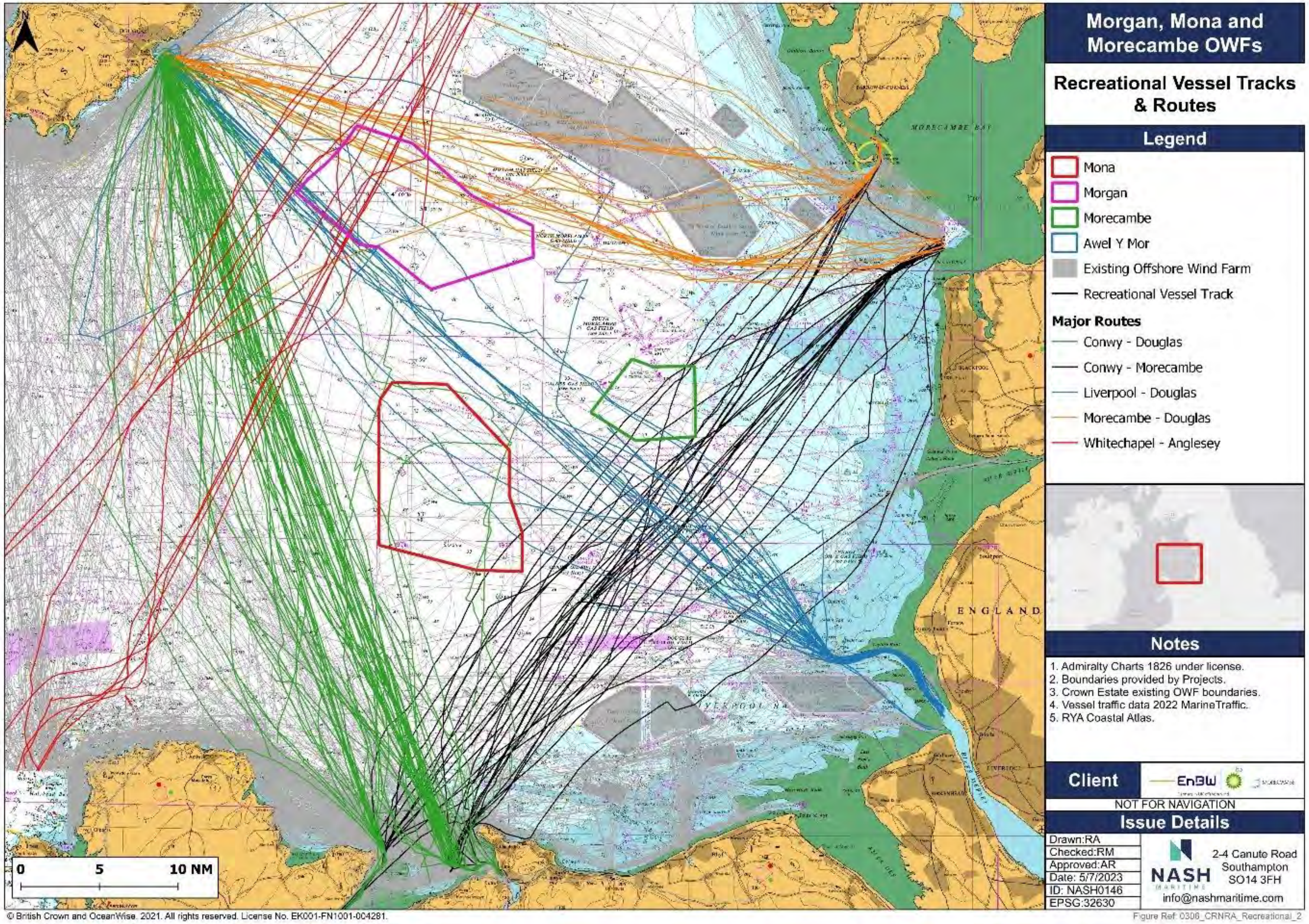


Figure 18: Recreational vessel routes (2022).

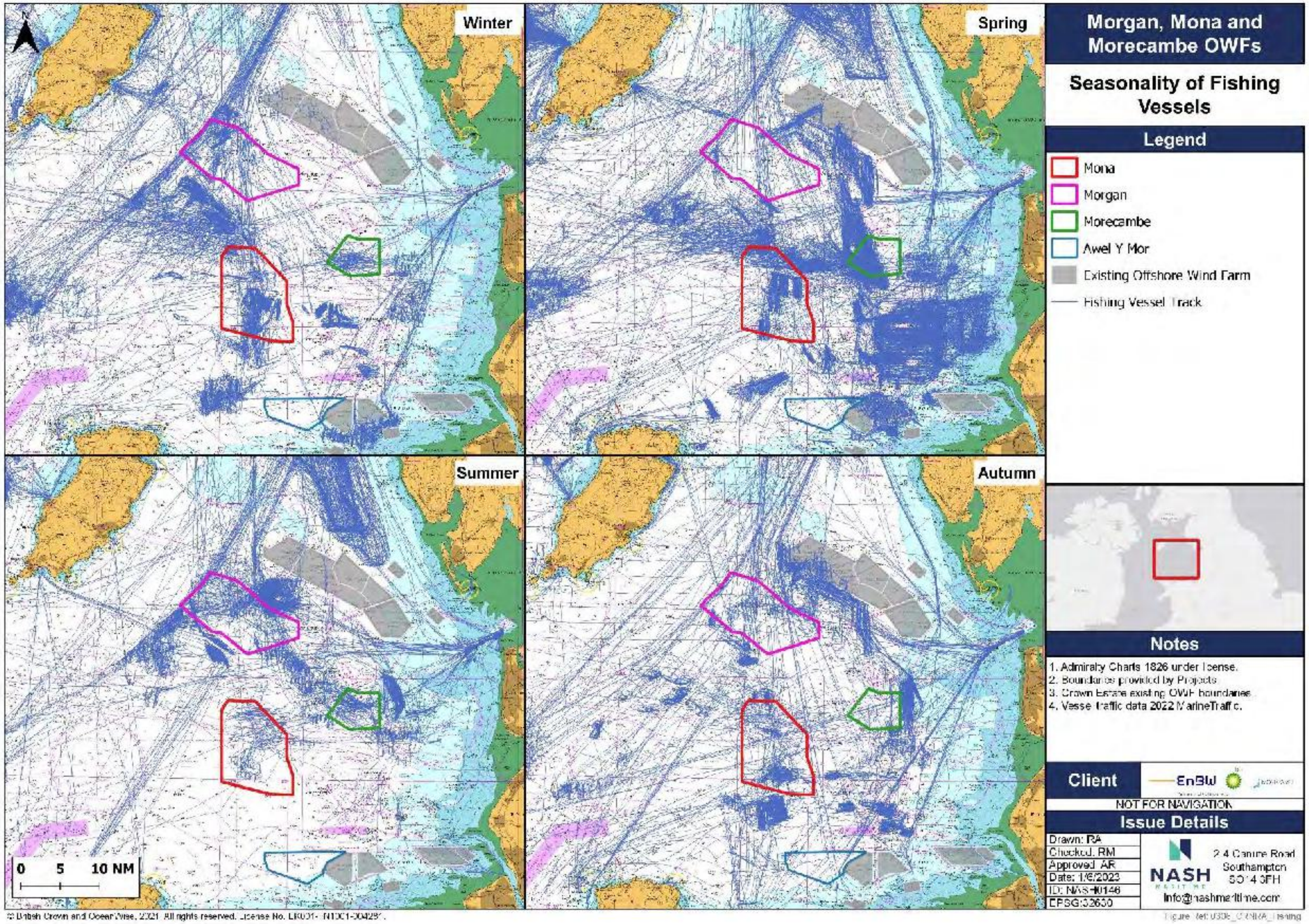


Figure 19: Fishing vessel activity in the CRNRA study area (2022).

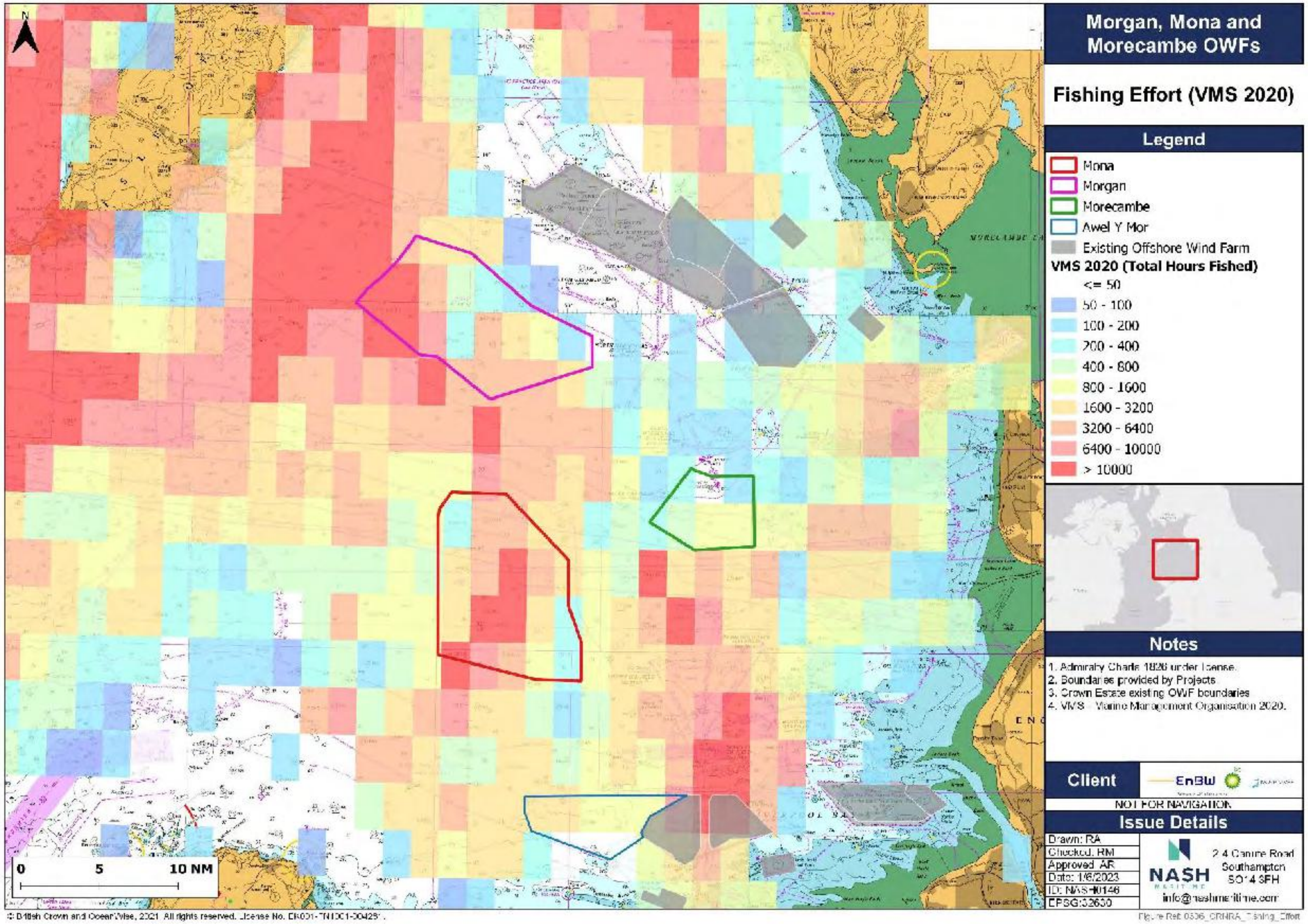


Figure 20: Fishing vessel activity (VMS) in CRNRA study area.

5.2.2.7 Tug and Service

5.2.2.7.1 Tug and service vessel activity is shown in **Figure 21** with vessels associated with oil and gas infrastructure, aggregate sites and existing wind farms. There is substantial tug and service vessel activity within the area, particularly surrounding existing wind farms to the northeast and southeast of the cumulative schemes.

5.2.2.7.2 CTVs operate between operations and maintenance bases (primarily out of Liverpool, Barrow, Mostyn, and Douglas) and the existing OWFs to the north (Walney and West of Duddon Sands) and south (Burbo Bank and Gwynt y Môr) of the CRNRA study area. CTV transit through the Projects within the CRNRA study area, although the frequency of transits is low (<1 vessel/day). The primary route through the Morgan Array Area is to the north, transiting southeast-northwest between Douglas and Barrow. Transits through Morecambe Array Area use two routes; a northwest-southeast route between Liverpool and Walney OWF, and a northeast-southwest route between Barrow aligned with Off Skerries TSS which intersects the Mona Array Area. Transits through the east region of the CRNRA study area pass north/south between Liverpool and the OWFs to the north, totalling 99 transits/year. 21 of these tracks passed within 1 nm of the northeastern corner of the Morecambe Array Area.

5.2.2.7.3 Oil and gas associated supply ships and standby safety vessels have a high intensity within the Morecambe Array Area and east of Mona and Morgan Array Areas where platforms are located. Oil and gas service vessels mostly operate out of Heysham or Liverpool. In 2022, approximately one vessel per day passed through the Morecambe Array Area. A low-use route (<1 vessel/month) through the gap between Mona and Morgan Array Areas is used by supply ships from Aberdeen undertaking operations associated with platforms at South Morecambe gas field.

5.2.2.7.4 The activities of dredgers are concentrated to the east and southeast of the CRNRA study area within aggregate extraction sites. A low-use route is used by dredgers between Heysham and Off Skerries TSS (<1 vessel/month). SAR vessels are dispersed throughout the CRNRA study area and concentrated along the coastline. Pilot vessels operations are undertaken out of Anglesey, Mostyn, Liverpool, Heysham and Barrow. Two pilot vessels intersected the Project Array Areas in 2022.

5.2.2.7.5 Other vessel types are distributed across the CRNRA study area. A high concentration of vessels are associated with survey activities east of Walney OWF and North of Burbo Bank OWF. <1 vessel/day transited within any of the Project Array Areas in 2022.

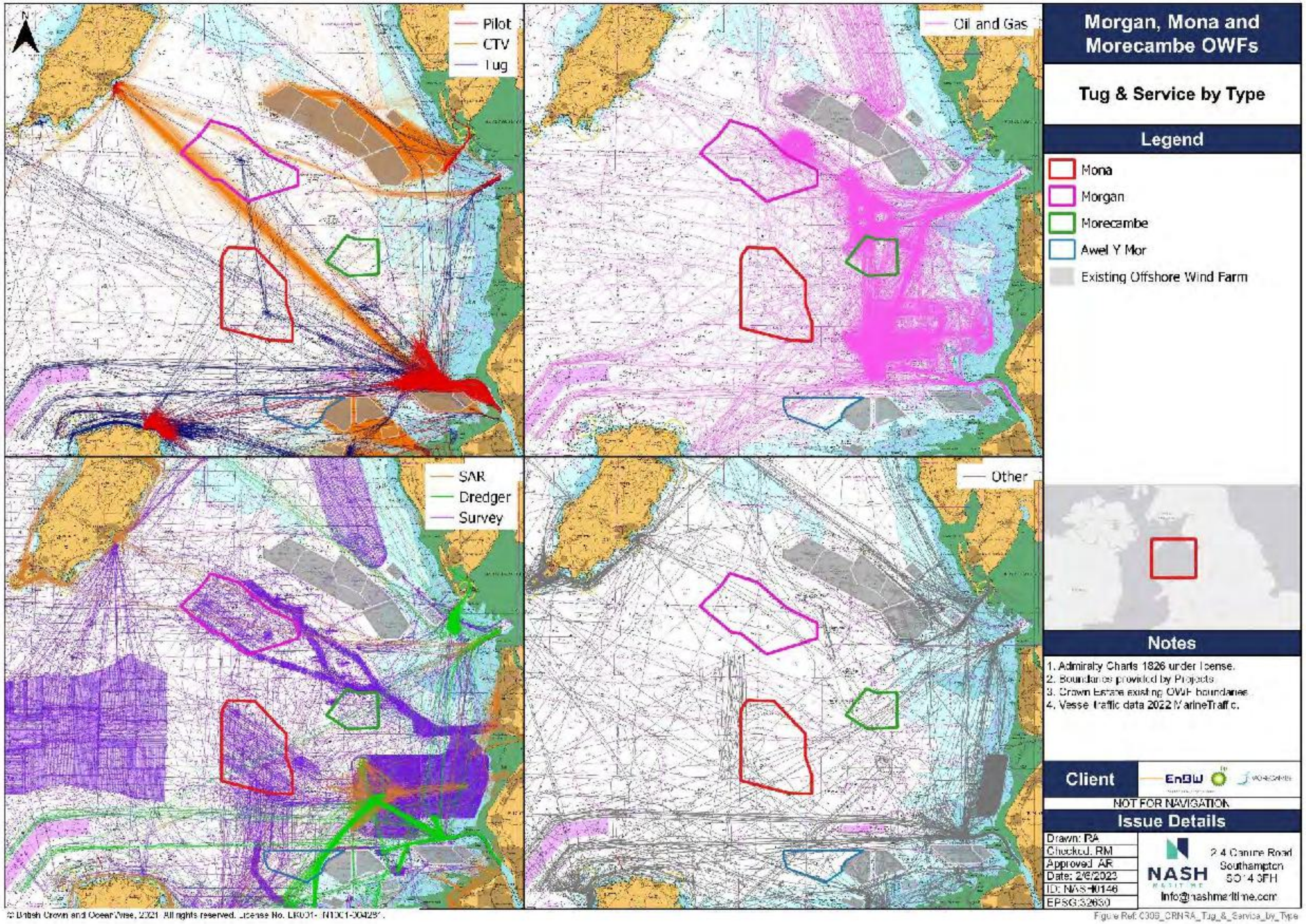


Figure 21: Tug and service vessel tracks in CRNRA study area (2022).

5.2.3 Vessel Traffic Counts and Seasonality

5.2.3.1 Count by vessel Type

5.2.3.1.1 **Figure 22** shows that the Morgan Array Area has the most vessel traffic with 4,239 vessels passing through the Array Area per year, whilst the Mona Array Area has 3,166. Passenger vessels are responsible for the majority of this activity, representing and 78% of vessel traffic in the Morgan Array Area and 50% in the Mona Array Area. This is mainly the regular ferry routes present in the area. Morecambe Array Area has considerably less traffic passing through the Array Area each year at 938 per year which is mostly comprised of tug and service vessels representing 51% of the transiting vessel traffic.

5.2.3.1.2 The Mona Array Area has a higher number of cargo/tanker vessels passing through than the other OWF Array Areas, with 622 cargo vessels and 318 tankers per years. Morgan and Morecambe Array Areas combined, only represent 24% of the total cargo/tanker traffic through all three Project Array Areas. In contrast to Morgan and Mona Array Areas, the Morecambe Array Area has a high level of tug and service vessel activity, accounting for 51% of tug and service vessel traffic in the Array Area.

5.2.3.1.3 The 5 nm buffer around the Mona Array Area has the highest vessel count at approximately 11,005 vessels per year. As within the Array Areas, passenger vessels contribute to the highest proportion of traffic (56%). As also shown in the Mona Array Area count, the Mona Array Area 5 nm buffer experiences the highest cargo/tanker traffic out of all the OWFs with approximately 3,400 cargo and tanker vessels per year. In contrast, the Morecambe and Morgan Array Area 5 nm buffers combined have less than 200 cargo/tanker transits per year. Instead, the Morecambe and Morgan Array Area 5 nm buffers have high activity of tug and service vessels with experiencing 2,178 and 1,528 vessels per day respectively.

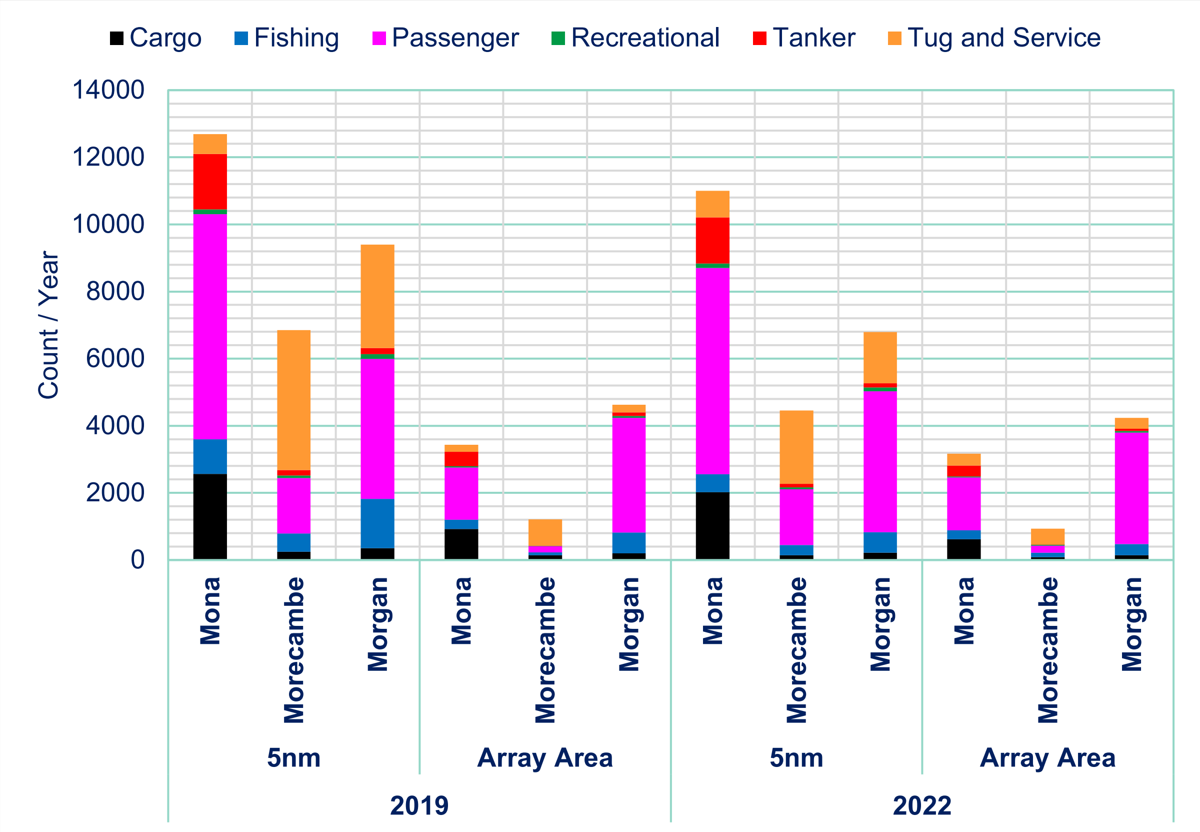


Figure 22: Vessel count per year by vessel type for Mona, Morecambe and Morgan Array Areas and 5 nm buffers (2019 and 2022).

5.2.3.2 Count by Vessel Size

5.2.3.2.1 **Figure 23** shows that Morgan and Mona Array Areas have a similar 0-100 m vessel count of less than three vessels per day, with Morecambe Array Area exhibiting marginally fewer with less than two vessel per day. However, counts of other vessel length have greater variability between the different Project Array Areas.

5.2.3.2.2 Over half of the vessels passing through Morgan Array Area are 100 m to 150 m in length. The Array Area had four vessels per day smaller than 100 m, but only one vessel larger than 150 m per day. The Mona Array Area has the largest number of vessels over 150 m in length out of the three Project Array Areas, with a count of approximately five >150 m vessels per day. Morecambe Array Areas has a noticeably low count of 100 m to 150 m vessels and instead has a larger proportion of 50 m to 100 m vessels passing per year, contributing to 51% of vessel traffic through the Array Area.

5.2.3.2.3 **Figure 24** provides the vessel count per year for the Project Array Areas and a 5 nm buffer. Comparing **Figure 23** and **Figure 24** shows that the proportion of vessels with length <150 m is significantly higher in the 5 nm buffers than in the Project Array Areas. Only 21% of total vessel traffic through the 5 nm buffers is over 150 m in length, compared to 28% in the Project Array Areas. The Morgan Array Area 5 nm buffer (**Figure 24**) experiences the highest number of smaller vessels <50 m, whilst the Mona Array Area 5 nm buffer (as also seen in the Array Areas) has the highest number of large vessels >150 m. Vessels between 50 m to

150 m in length contributes to 75% of Morgan and Morecambe's Array Area 5 nm buffer activity, and 56% of Mona Array Area 5 nm buffer activity.

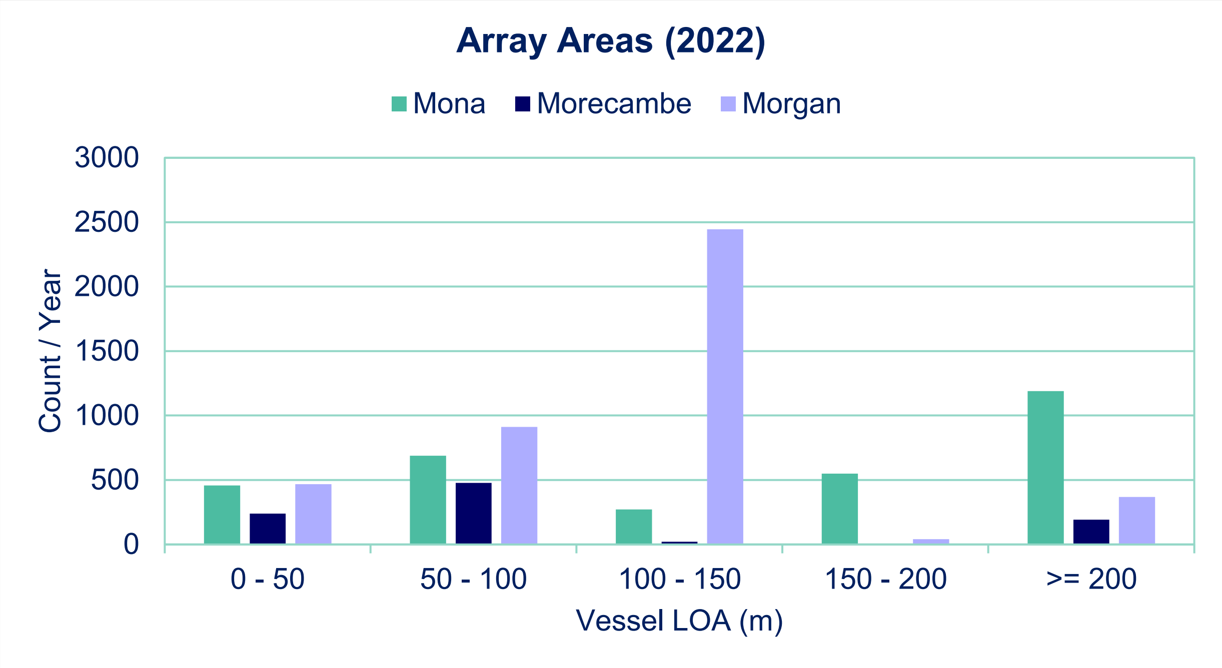


Figure 23: Vessel count per year by vessel LOA (m) for Mona, Morecambe and Morgan Array Areas (2022).

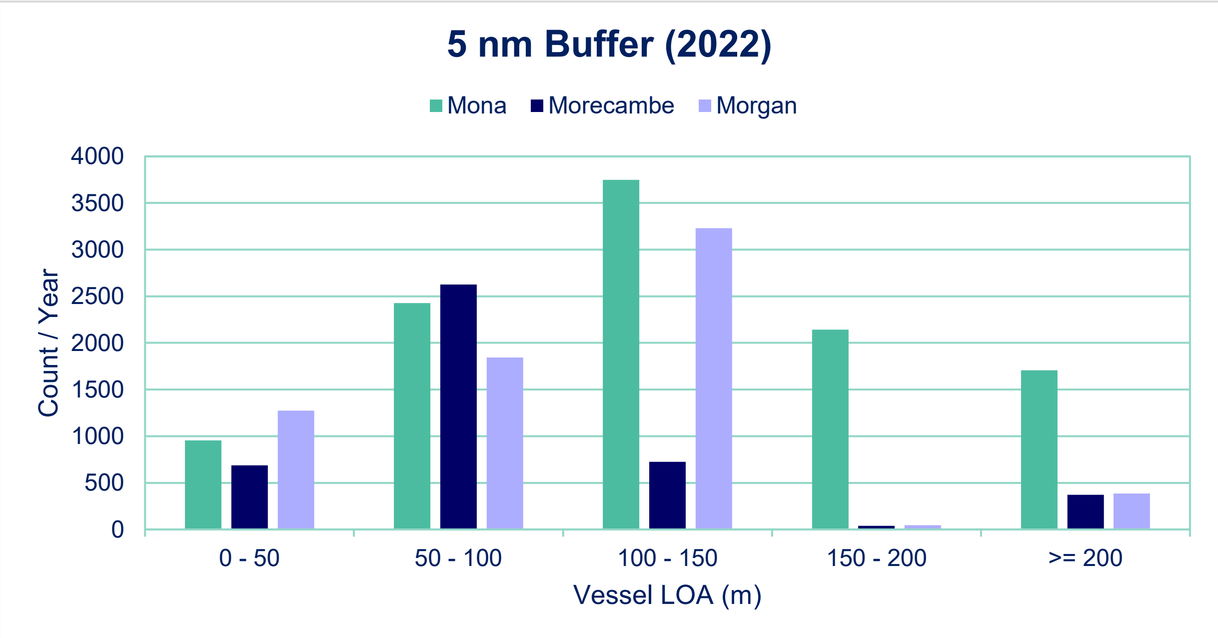


Figure 24: Vessel count per year by vessel LOA (m) for Mona, Morecambe and Morgan Array Area 5 nm buffers (2022).

5.2.3.3 Monthly Count

5.2.3.3.1 In **Figure 25**, all three Project Array Areas show a seasonal trend that peaks over the summer months (May to August) and decreases in the winter months (November to February). Morgan and Morecambe Array Areas see a similar seasonal proportional count increase of 54% and 53%, respectively. Mona Array Area follows a similar seasonal pattern but the variation is less prominent with an increase of 34% from winter to summer. These changes are primarily due to an increase in ferry service operations, recreational and fishing activity. As shown in **Figure 26,** all three Project Array Area 5 nm buffers show a seasonal trend. Mona, Morgan and Morecambe Array Areas 5 nm buffers see a seasonal count increase of 29%, 81% and 85%, respectively.

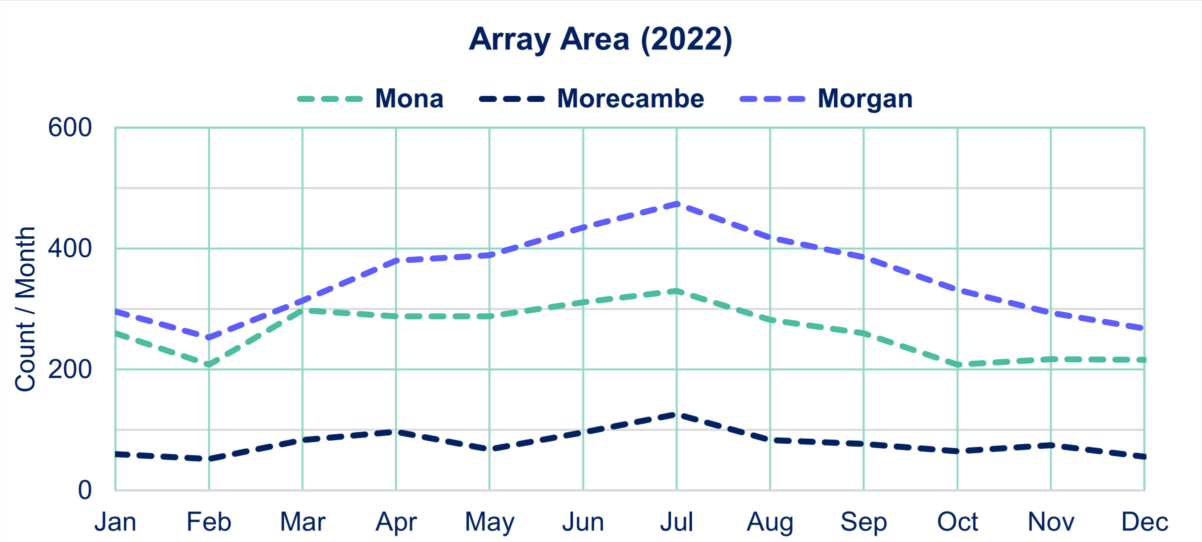


Figure 25: Vessel count per month for Project Array Areas (2022).

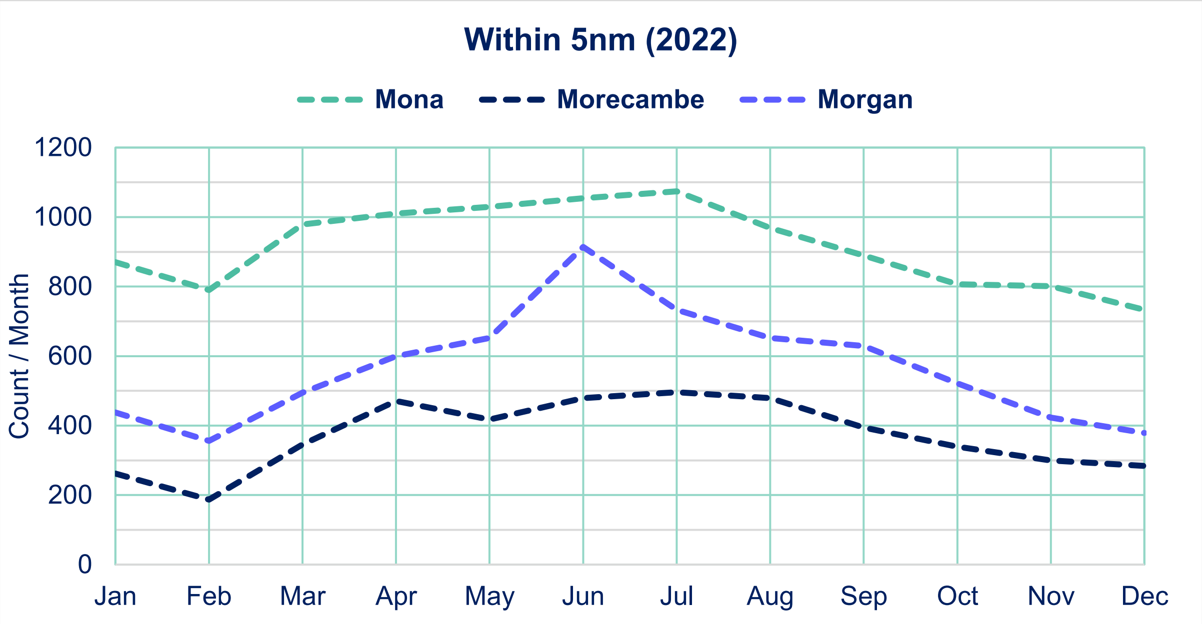


Figure 26: Vessel count per month for 5 nm buffers (2022).

5.2.4 Identification of Vessel Routes

5.2.4.1.1 MGN654 (MCA, 2021) provides guidance regarding the definition of shipping routes in order to inform OWF assessments. To account for variation of tracks taken by vessels, the guidance note establishes the 90th percentile corridor principles, the central portion of traffic on a route containing the majority of vessel traffic. The 90th percentile concept considers that as vessels navigate between specific locations, they may take a variety of routes due to avoiding other traffic or as a result of leeway from wind or waves. To minimise any anomalous tracks and therefore mark the usual width of a specified route, the MCA advise using the centre 90th percentile of the determined Total Route Width (see **Figure 27**) around the assumed Median or Centre Line, for all vessels engaged on passage between the same two points.

5.2.4.1.2 To identify the 90th percentile routes, the following data processing steps were undertaken:

- **Step 1:** Vessel tracks filtered to commercial only (cargo, tanker and passenger).
- **Step 2:** Tracks along a defined route selected.
- **Step 3:** Gate transects constructed along the length of the route (ensuring transects at course changes are included).
- **Step 4:** Calculate number of tracks through cross track transect subsections.
- **Step 5:** Calculate location of 90th percentile through transect.
- **Step 6:** Draw polygon capturing all 90th percentile locations on each transect.

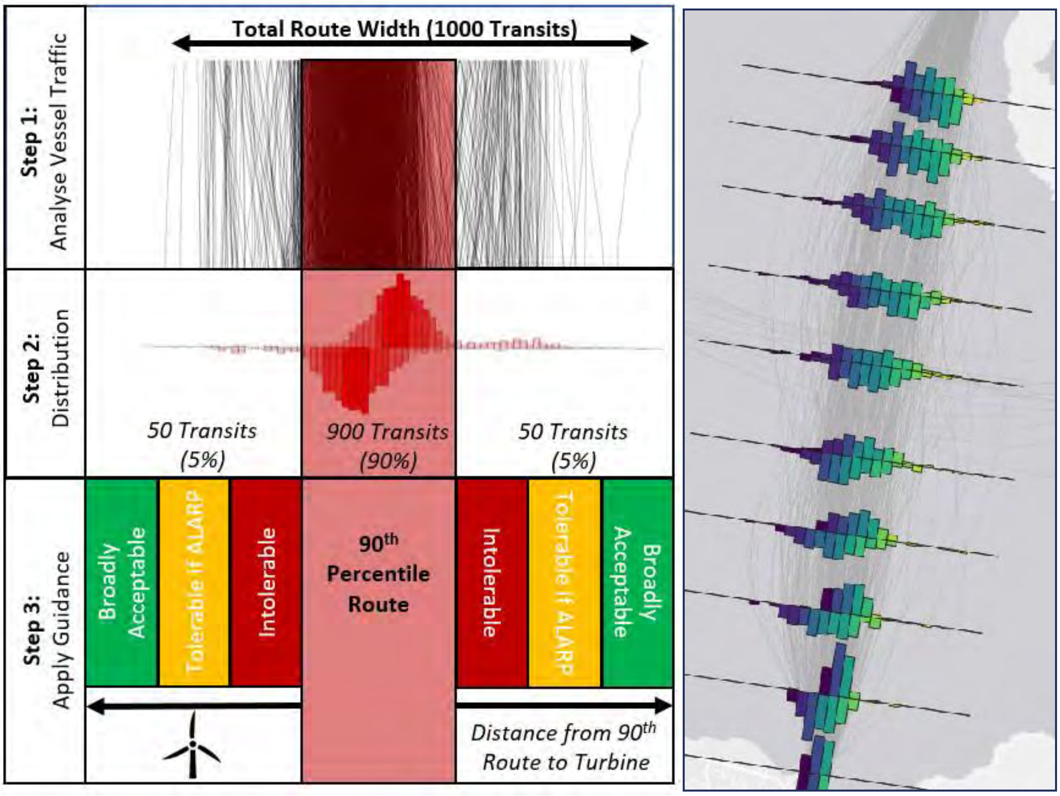


Figure 27: Identification of 90th percentile routes.

5.2.4.2 Cargo/Tanker Routes

5.2.4.2.1 Cargo/tanker vessel routes have been identified in **Figure 28** which also shows the number of vessel transits per day. These routes and their interaction with each Project Array Area are described in **Table 16**. Where appropriate, connecting to specific east or west bound TSS lanes, the routes have been differentiated, otherwise they include all transits in both directions. The routes with more than one vessel transit per day are all to/from the Port of Liverpool. The route between the Liverpool Bay TSS and the Off Skerries TSS has the most vessel traffic with approximately four vessel transits per day in either direction, and is clear of the Projects.

5.2.4.2.2 The Mona Array Area has two vessel routes passing through the Array Area with more than one vessel move per day. Both of these routes are vessels transiting between the northern Irish Sea to the west of the IoM and the Liverpool Bay TSS. There are multiple routes through the Morgan Array Area with zero to one vessel transits per day used by vessels related to the ports in the area.

5.2.4.2.3 There are six cargo/tanker vessel routes which intersect with the Morgan Array Area. All of these routes had less than one vessel transits per day in 2022. These routes are either used by vessels associated with Douglas or to the north of the IoM. Five cargo/tanker vessel routes with less than one vessel transits per day intersect with the Morecambe Array Area.

Table 16: Statistics of cargo/tanker vessel routes in CRNRA study area.

ID	Route	Approximate Annual Crossings	Intersects Array Area		
			Mona	Morgan	Morecambe
Greater than one transit per day					
3	Skerries TSS to Liverpool TSS (W)	1610	X	X	X
1	Liverpool TSS to Skerries TSS (E)	1563	X	X	X
13	Liverpool TSS to W IoM (W)	533	✓	X	X
4	Liverpool TSS to Skerries TSS and Anglesey (E)	525	X	X	X
2	W IoM to Liverpool TSS (E)	428	✓	X	X
Less than one transit per day					
14	E IoM to Heysham	184	X	X	X
18	Liverpool to W IoM	153	✓	X	X
12	Liverpool TSS to Irish Sea via Skerries TSS (W)	137	X	X	X
23	Liverpool to E West of Duddon Sands	66	X	X	X
20	Southern Irish Sea to Solway Firth	60	X	X	X
26	Liverpool TSS to Irish Sea (W)	55	✓	X	X
15a	Liverpool to E IoM – Central	54	X	✓	✓
11	Liverpool TSS to Central Irish Sea (W)	45	X	X	X
21	Off Skerries TSS to Solway Firth	42	X	✓	X
9	Irish Sea to Liverpool TSS (E)	36	X	X	X
6	Off Skerries TSS to Heysham (E)	23	✓	X	✓
22	Douglas to Liverpool TSS	21	✓	✓	X

ID	Route	Approximate Annual Crossings	Intersects Array Area		
			Mona	Morgan	Morecambe
5	Inshore Anglesey to Liverpool TSS (E)	17	X	X	X
15c	Liverpool to E IoM – E route	14	X	✓	✓
10	Liverpool TSS to Inshore Anglesey (W)	13	X	X	X
25	Colwyn Bay to W IoM	13	X	X	X
15b	Liverpool to E IoM – W	10	✓	✓	X
19	Douglas to Liverpool TSS (E)	9	✓	X	X
24	Off Skerries TSS to Barrow (E)	9	X	X	X
8	Heysham to Off Skerries TSS (W)	7	✓	X	✓
16	Douglas to Heysham	6	X	✓	X
7	Off Skerries TSS to Barrow (W)	4	✓	X	✓

5.2.4.3 Ferry Routes

5.2.4.3.1 The ferry routes in the CRNRA study area are presented in **Table 17** along with a count of the crossings during 2019 and 2022. There are 11 ferry routes through the CRNRA study area, split between four operators, with the 90th percentile routes shown in **Figure 29**. **Figure 30** shows all routes divided between the four operators and includes passage plan information provided by IoMSPC, Stena Line and Seatruck during consultation combined with vessel traffic analysis.

5.2.4.3.2 The IoMSPC ferries operate between Douglas on the IoM, and either Heysham or Liverpool. The Heysham/Douglas route is the most frequently run route with 1,275 transits/year (three to four per day) and passes east/west between South Morecambe gas field and West of Duddon Sands and Walney OWFs through the northern region of the Morgan Array Area. The Liverpool/Douglas route had 593 transits/year (two per day), passing northwest/southeast through the CRNRA study area. The passage plan for the route traverses between Morecambe and Mona Array Areas and intersects the southwest extent of Morgan Array Area. The fast ferry Manannan runs a seasonal service on this route, with four transits per day in summer. The route runs primarily west of the single buoy mooring to the south of Morecambe Array Area but a small proportion of transits are to the east of the Single Buoy Mooring (SBM) within the Hamilton North gas field. During consultation it was confirmed vessels transit east of the SBM on northbound transits to avoid congestion in Liverpool Bay TSS (thereby exiting the TSS earlier) and are dependent on current and forecast weather conditions to ensure safe and comfortable passage for passengers.

5.2.4.3.3 Stena Line operates routes between Belfast and either Liverpool or Heysham. Vessels between Heysham and Belfast operate on a route between Barrow/Ormonde and West of Duddon Sands/Walney OWFs (1,094 transits per year, three per day). Vessels using the route between Belfast and Liverpool can pass east or west of the IoM dependent on prevailing metocean conditions. Primarily, vessels use the westerly route that passes northwest-southeast through the central portion of the Mona Array Area with 1,480 transits/year (three to four vessels per day), with a minority taking the Liverpool TSS. Ferries passing east of the IoM transit northwest/southeast on two planned routes. One route passes southwest of Morecambe Array Area to the west of the Calder platform, and through the east of the Morgan Array Area (194 transits per year). 80% of traffic used on this route is southbound traffic. The second route passes directly through the Morecambe Array Area to the east of Calder and through the east extent of the Morgan Array Area and is utilised by northbound traffic exiting Liverpool Bay TSS (196 transits per year, less than one vessel per day).

5.2.4.3.4 Seatruck operates two east-west routes through the CRNRA study area. Heysham to Warrenpoint passes through the south extent of the Morgan Array Area with 1,099 transits/year (3/day). The Heysham to Dublin route passes between Morecambe and Morgan Array Areas, passing to the north of the Mona Array Area. 606 transits were recorded on this route in 2019. Seatruck also operates a route between Liverpool to Dublin south of the CRNRA study area between Awel y Môr and Mona Array Area (2,091 transits per year, five per day).

5.2.4.3.5 P&O ferries currently operate a route between Liverpool and Dublin which passes south of the CRNRA study area between Awel y Môr and the Mona Array Area with 1,162 transits/year (five per day).

Table 17: Summary of ferry routes.

Operators	Routes	Example Vessels	Approximate Annual Crossings (2019)	Approximate Annual Crossings (2022)
IoMSPC	HEY – DOUG	ARROW	86	107
		BEN-MY-CHREE	1,286	1,275
		MANANNAN	0	69
	LIV – DOUG	MANANNAN	628	590
		BEN-MY-CHREE	46	3
Stena	LIV – BEL W of IOM & No TSS	STENA EDDA / STENA EMBLA / STENA ESTRID (2022 Only) / STENA HORIZON (2019 Only) / STENA LAGAN (2019 Only) / STENA MERSEY (2019 Only) / STENA FORECASTER / STENA FORERUNNER (2019 Only) / STENA FORETELLER (2022 Only)	1,442	1,098
	LIV – BEL W of IOM & East TSS		0	226
	LIV – BEL W of IOM & West TSS		0	166
	LIV – BEL E of IOM (E of Calder)		153	196
	LIV – BEL E of IOM (W of Calder)		200	194
	HEY – BEL	STENA HIBERNIA STENA SCOTIA	1,150	1,094
Seatruck	HEY – WAR	SEATRUCK PERFORMANCE SEATRUCK PRECISION	967	1,099*
	HEY – DUB	SEATRUCK PACE SEATRUCK PANORAMA (2019 Only)	523	606**
	LIV – DUB	CLIPPER PENNANT / SEATRUCK PACE / SEATRUCK POWER / CLIPPER PROGRESS (SEATRUCK PROGRESS in 2022) / SEATRUCK PANORAMA (2019 Only)	1,800	2,091
P&O	LIV – DUB	MISTRAL / NORBANK	1,600	1,162
		NORBAY		
		STENA FORECASTER (2022 Only)		

*14 transits of HEY- WAR in 2022 were undertaken by the vessels CLIPPER PENNANT (2), CLIPPER POINT (1), SEATRUCK PACE (10), and SEATRUCK PROGRESS (1).
** 48 transits of HEY – DUB in 2022 were undertaken by the vessels CLIPPER POINT (25), SEATRUCK PERFORMANCE (14), and SEATRUCK PRECISION (9)

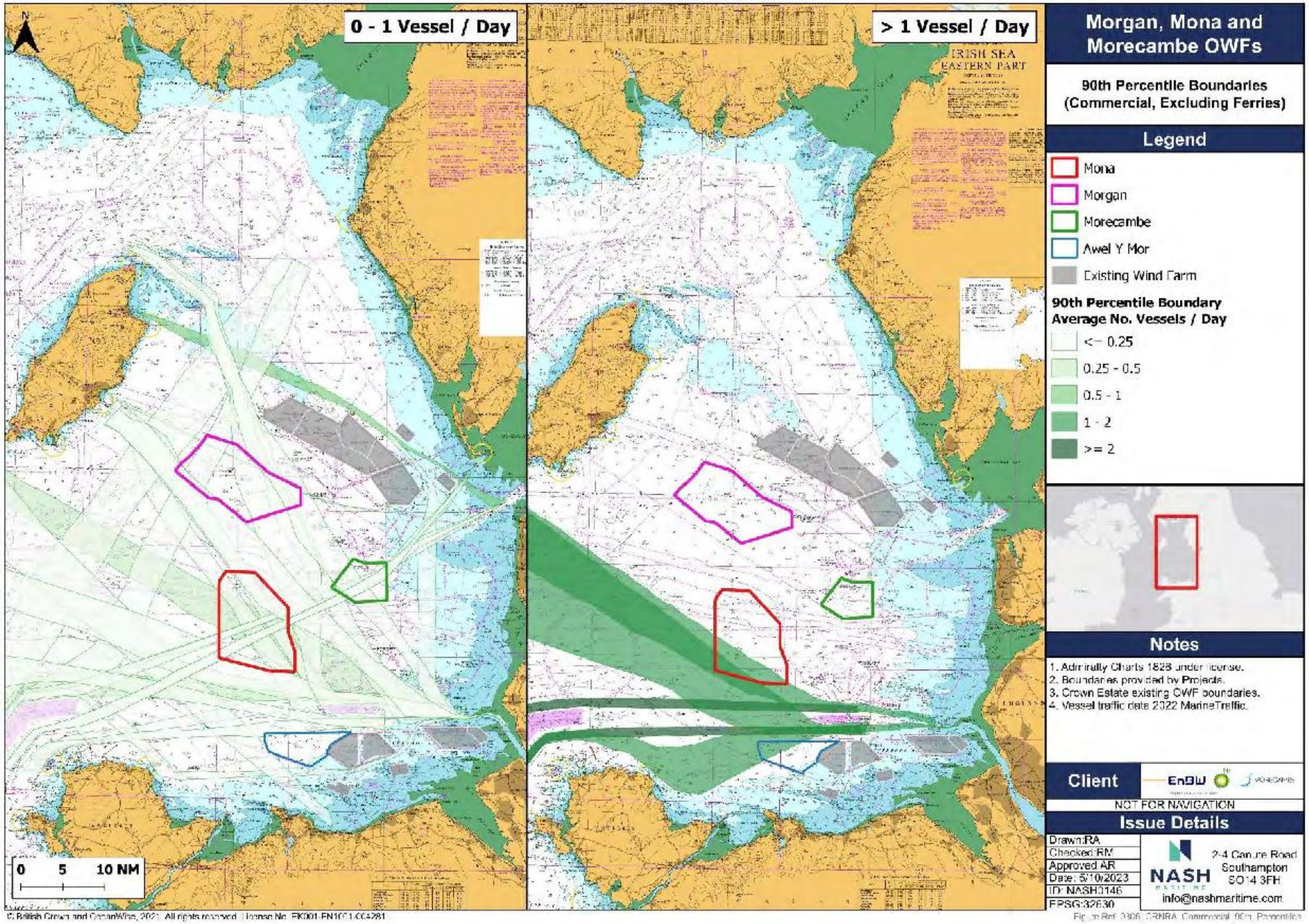


Figure 28: Cargo/tanker vessel routes in the CRNRA study area.

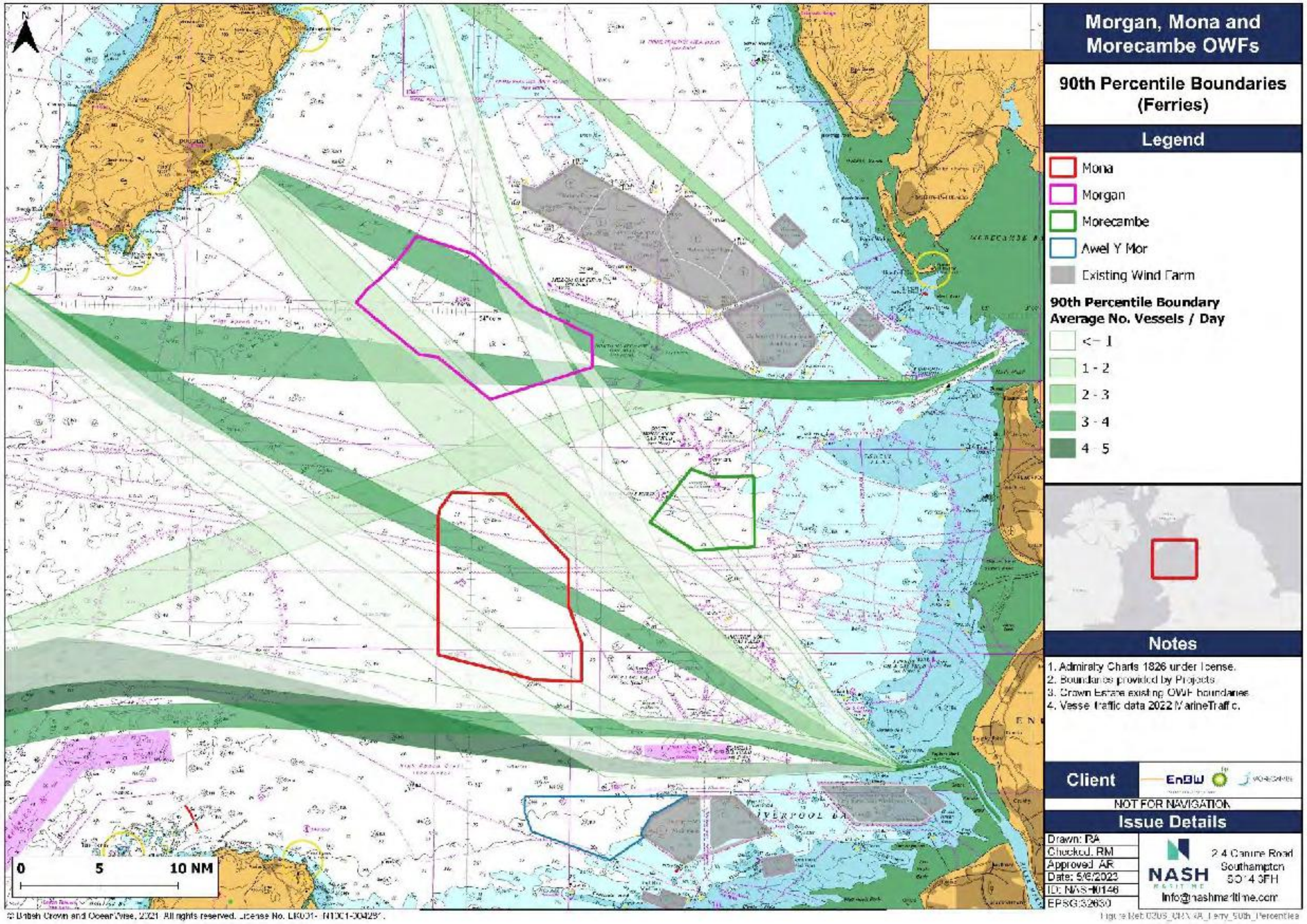


Figure 29: 90th percentile routes of principal ferry routes in the CRNRA study area.

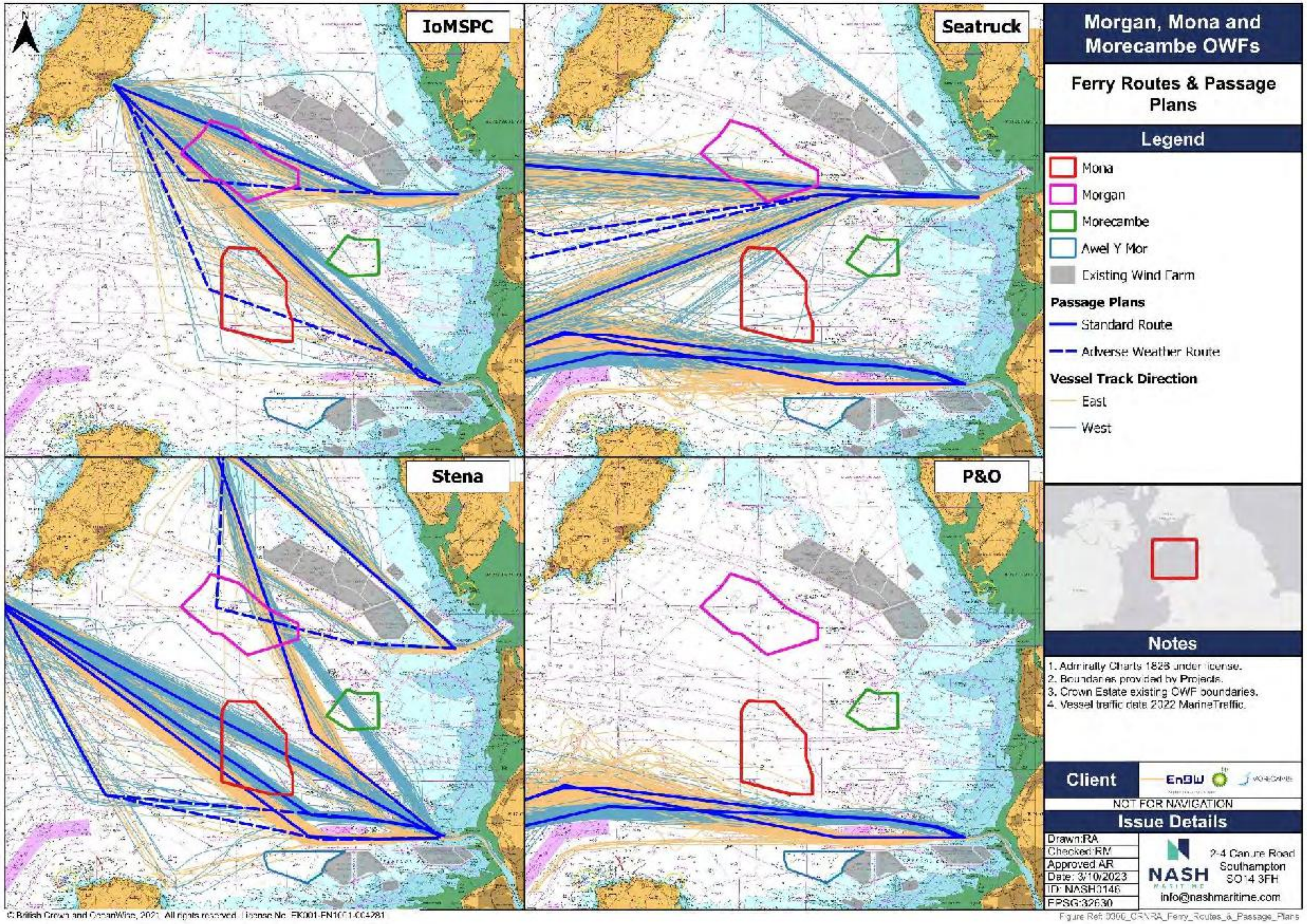


Figure 30: Ferry route passage plans.

5.2.5 Adverse Weather Routeing

5.2.5.1 Cargo/tanker Routeing

5.2.5.1.1 Analysis of vessel tracks during MetOffice named storms in 2022 are shown in **Figure 31** which shows that alternative routeing isn't used in every period where there is adverse weather and repeatable adverse weather routeing behaviours taken by cargo/tanker shipping were not clearly identified. The decision to use an alternative route will largely depend on the direction of the swell, waves and wind. In addition, there is greater demand for the anchorage to the east of Anglesey by cargo/tanker vessels.

5.2.5.2 Ferries Routeing

5.2.5.2.1 Many ferry services continue to operate in gale force winds, at the Master's discretion. **Figure 32** indicates the non-typical routes taken by ferries, including during adverse weather routes. This has been undertaken by comparing 2022 vessel tracks with the 90th percentile routes. In general, prevailing south westerly adverse weather typically results in ferries taking a more southwesterly transit in order to both control the course relative to the conditions and take advantage of the lee from the Welsh coast. This minimises dangerous motions aboard the vessel and improves passenger comfort.

5.2.5.2.2 Both the IoMSPC routes show significant deviation to the southwest of their current routes as vessels both take advantage of the shelter from the Welsh coast and manage the motion of the vessel by maintaining advantageous orientation to the waves (first panel of **Figure 32**). The Stena Line Liverpool to Belfast route, shows similar deviation to the southwest when passing to the west of the IoM, but little deviation from the 90th percentile routes when passing to the east. The Heysham to Belfast route demonstrates that in adverse weather, masters may choose to pass to the west of the existing Irish Sea OWFs, rather than pass between West of Duddon Sands and Barrow. Deviation from the 90th percentile routes for Seatruck tends to occur further west, with tracks diverging in the region of the proposed OWFs.

5.2.5.2.3 P&O routes from Liverpool to Dublin are largely unaffected by weather and show limited variations from the 90th percentile routes.

5.2.5.2.4 **Section 7.3.3** contains detailed analysis for the impact of adverse weather on ferry routeing.

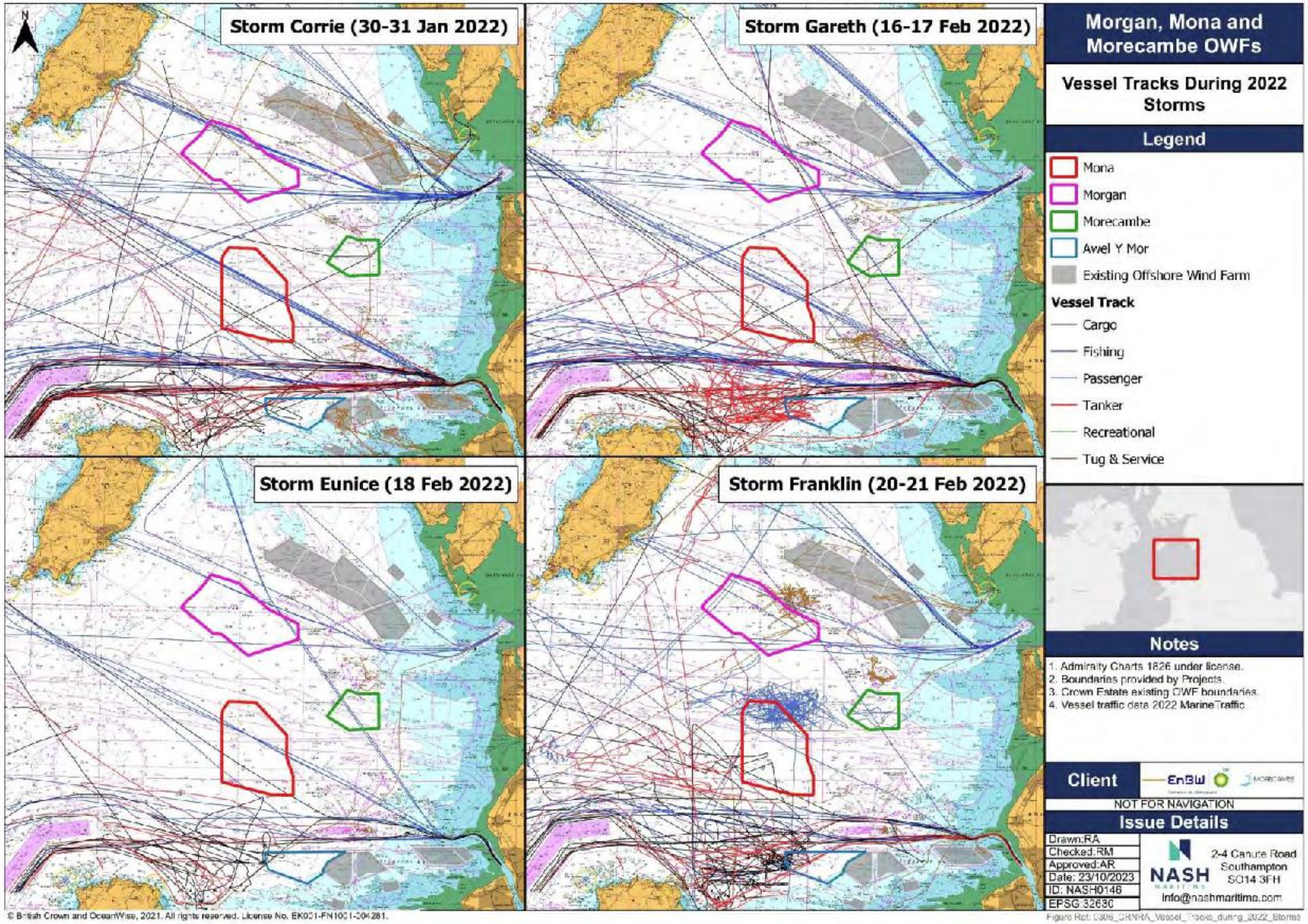


Figure 31: Vessel tracks during Met Office 2022 named storms.

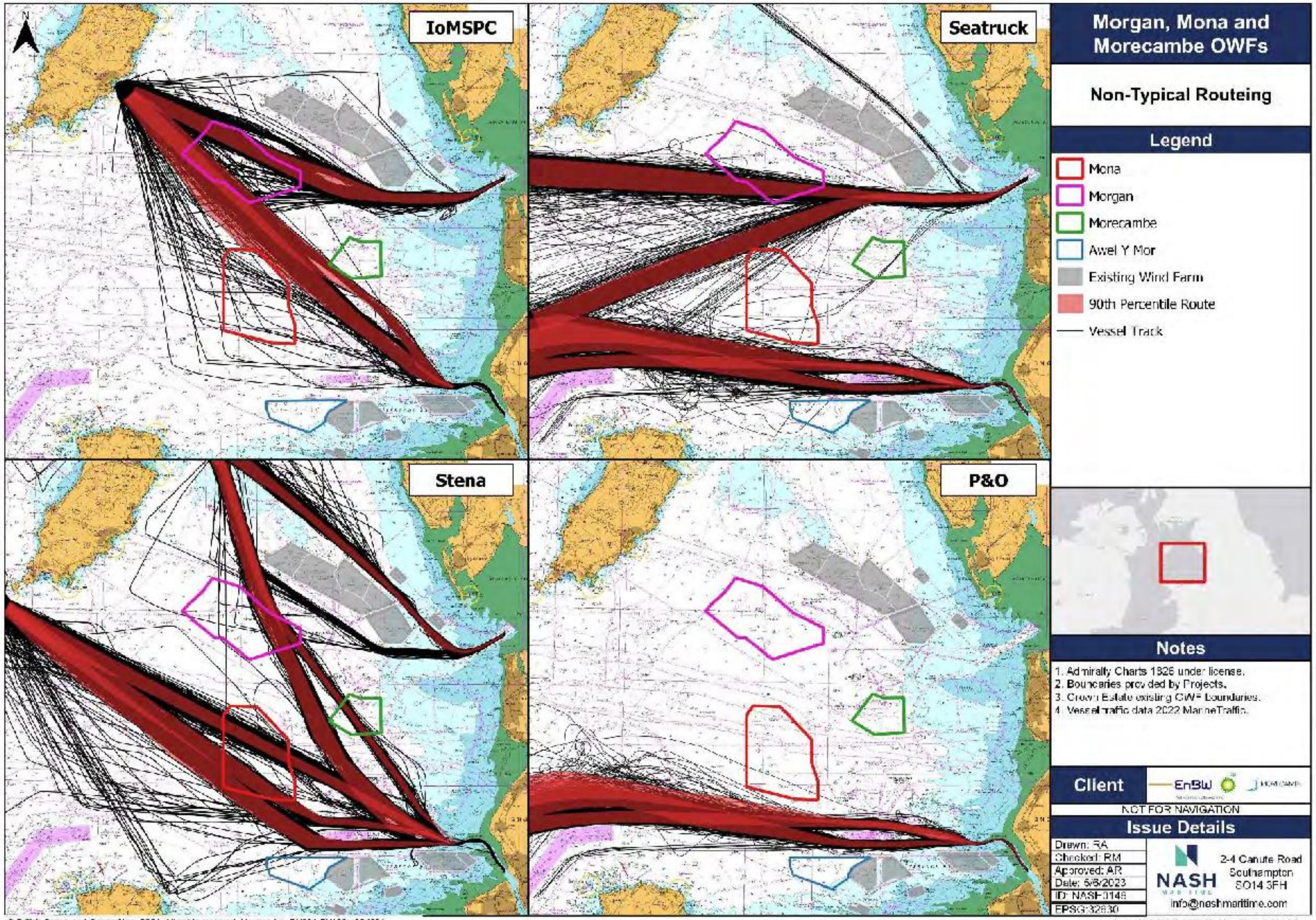


Figure Ref: 0306_CRNRA_Non_Typical_Routeing

Figure 32: Ferries typical 90th percentile routes and non-typical/adverse routes.

5.2.6 Non-Transit Activity (including anchoring and loitering, and out of region pilot transfer)

5.2.6.1.1 Anchored or vessels not in transit are shown in **Figure 33**. The intensity of anchoring has been identified by extracting AIS positions with speeds of less than 0.5 knots for vessels over 100 m in length. Non-Transit tracks have been extracted manually through identifying vessels which are not navigating directly between two locations (as opposed to those shown in **Section 5.2.4**).

5.2.6.1.2 There is significant anchored vessel activity shown off the east coast of Anglesey near the Point Lynas Pilot Boarding Station. Use of this area as an anchorage is not displayed on the navigational chart but is regularly used by crude oil tankers waiting to berth at the Tranmere oil jetty on the River Mersey.

5.2.6.1.3 There is also anchoring activity shown at the designated anchorages to the north and south of the entrance to the River Mersey as well as at Douglas Bay. There is evidence of loitering sporadically through the Project Array Areas.

5.2.6.1.4 During consultation, it was identified that during strong northwesterlies, it was common for vessels to undertake pilotage transfers in the lee of the IoM at Douglas, rather than at Liverpool. A letter from Laxey Towing Company explained that on average 175 ships per year are attended to, although during 2022 this was 76. Through correlation with the 2022 AIS data, **Figure 34** shows the tracks of those considered to have conducted this behaviour, including six over 200 m in length, 50 tankers, 17 cargo ships and eight cruise ships. It is notable that during significant adverse weather events, these transfers can result in convoys of vessels navigating between Liverpool and Douglas. For example, on 13 January 2019, three vessels simultaneously departed the Anglesey anchorage and three departed Liverpool, meeting at Douglas to conduct transfers. Furthermore, on 12 November 2019, five ships took pilots at Douglas and transited together into Liverpool, albeit three took the TSS and two transited directly.

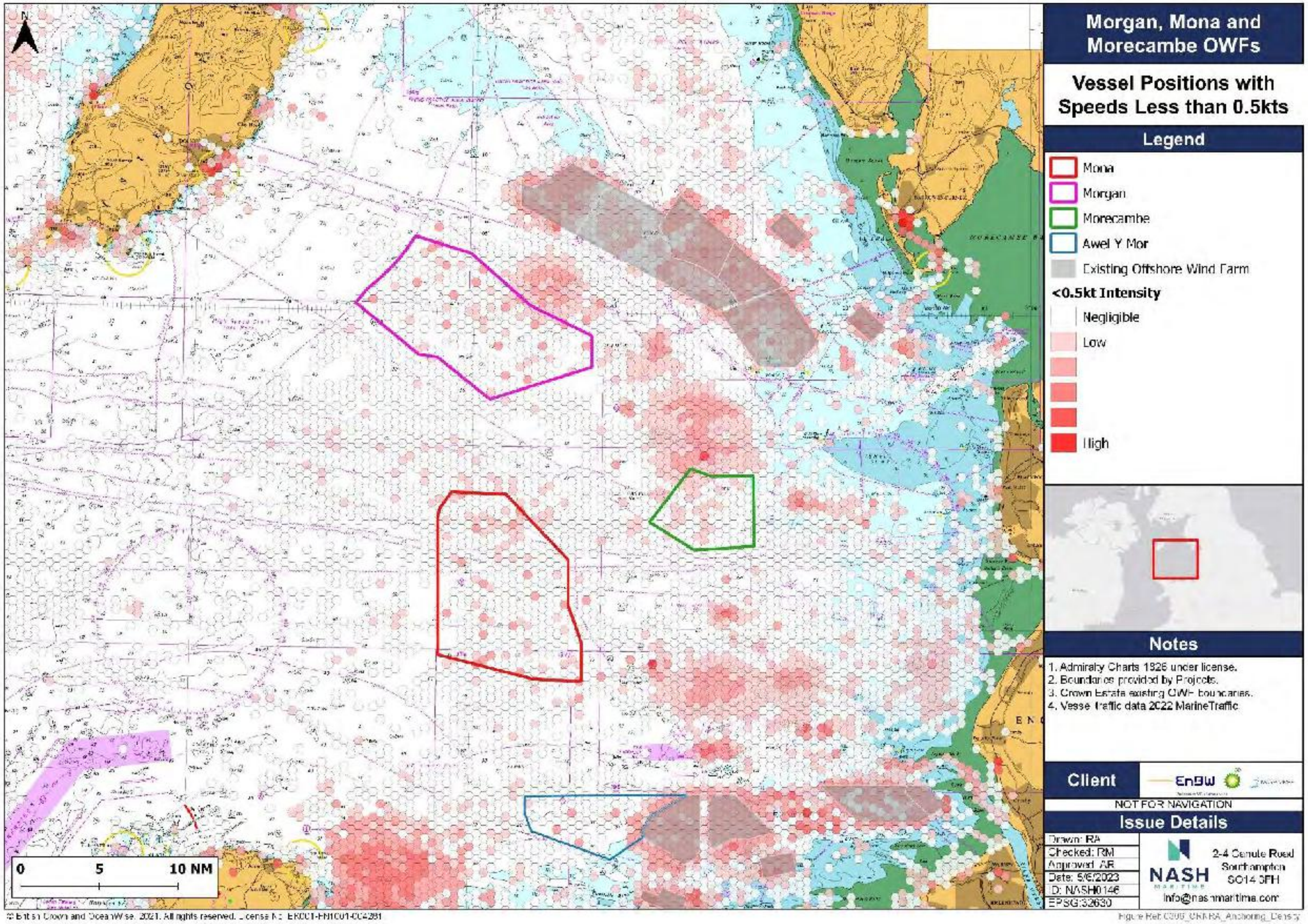


Figure 33: Non-transit vessels (anchored or loitering).

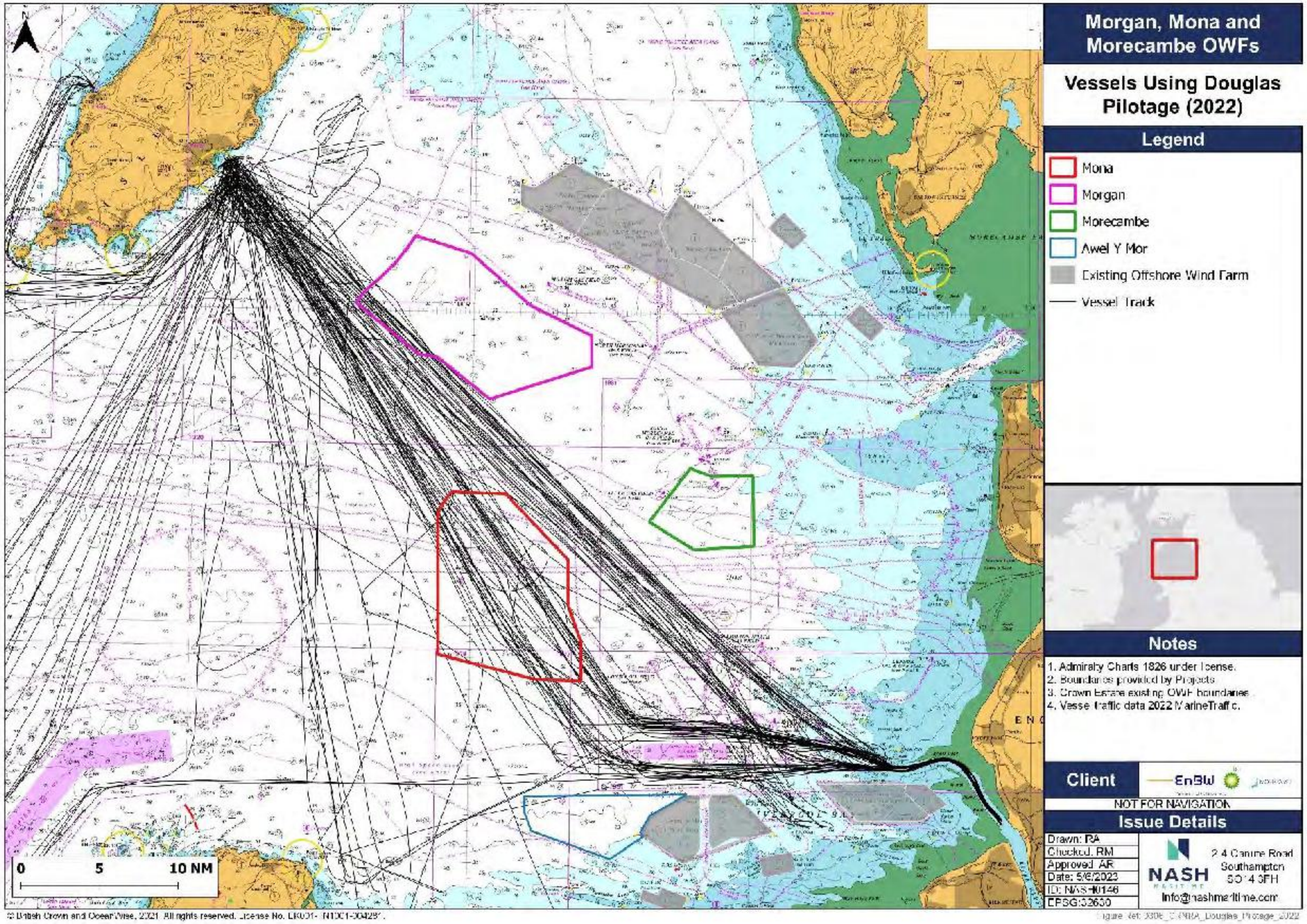


Figure 34: Vessels embarking or disembarking pilots at Douglas.

5.3 INCIDENT ANALYSIS

5.3.1 Incidents Associated with Offshore Wind Farms

5.3.1.1.1 To better understand the types and frequency at which navigational incidents might occur with the Projects in place, analysis was conducted of historical accidents associated with UK operational OWFs. Analysis was conducted of the MAIB database (2010 to 2019), RNLI databases (2008 to 2019), MAIB reports and news reports.

5.3.1.1.2 In total, 69 incidents were identified between 2010 and 2019 (see **Table 18**). This includes six collisions between vessels, 29 allisions of a vessel with a fixed structure, 21 groundings and 13 near misses. Where the information is available, 36% occurred within the array boundary of that project, 43% occurred within ports or harbours and 20% occurred on-transit between the two. 82% of incidents involved project craft (such as CTVs or construction vessels). Few allisions are recorded by a non-project vessel, however, anecdotally there have been more allisions involving fishing and recreational vessels which are unreported.

Table 18: Incident frequency for OWF relevant incidents between 2010 to 2019 in UK.

Vessel	Allision	Grounding	Collision	Collision – Near Miss
Project Vessel	27	21	9	15
Fishing	2	0	0	2
Recreational	0	0	2	4
Other	0	0	1	5

5.3.1.1.3 From the historical incident record and using an estimate of the number of years of operation for UK OWFs, incident rates per an average project are derived (see **Table 19**) (see Rawson and Brito, 2022). The accident return rates are generally low, between 10 and 45 operational years between incidents, the majority accounted for by project vessels. Therefore, over a typical 25 to 35 year operational duration it would be expected that a typical project would experience three allisions, two groundings and one collision or near miss. It is notable that there are no recorded accidents involving large commercial shipping and OWFs in the UK. Nor did any of the recorded navigational incidents across the UK sector result in loss of life.

Table 19: Average incident rate per project between 2010 to 2019 in UK.

Incident Type	Number	Rate/Year (yr)	Return Period
Collision	6	0.022	1 in 45.4yr
Grounding	21	0.077	1 in 13.0yr
Near Miss	13	0.048	1 in 20.9yr
Total Allision	29	0.107	1 in 9.4yr
CTV Allisions	27	0.099	1 in 10.1yr
Fishing Allisions	2	0.007	1 in 136.9yr
Total	69	0.254	1 in 3.9yr

5.3.2 Incidents Within CRNRA Study Area

5.3.2.1.1 **Figure 37** and **Table 21** show navigational incidents recorded in the CRNRA study area between the MAIB (1992 to 2021) and RNLI (2008 to 2020) databases. In processing the incidents, non-navigationally significant incidents have been removed, such as shore-based activities (e.g. people cut off by the tide or swimmers in distress). Furthermore, duplicate values recorded in both databases have been removed.

5.3.2.1.2 In total there were 5,886 incidents identified in the CRNRA study area with 5,079 of these being reported between 2008 and 2020, the vast majority of which were located inshore or in port waters. Due to improved reporting standards and to enable direct comparison of MAIB/RNLI data, the years 2008 to 2020 were used for analysis. In this period there were five incidents in the Morgan Array Area, six in the Mona Array Area and one in the Morecambe Array Area. This equates to 0.38 incidents per year for Morgan Array Area; 0.46 for the Mona Array Area; and 0.08 per year for the Morecambe Array Area. None of the incidents in any of the Project Array Areas resulted in fatalities.

5.3.2.1.3 Three of the five incidents in the Morgan Array Area are mechanical failure or damage to a vessel. Of these two were related to recreational vessels and one involved a fishing vessel. The other incidents in the Array Area were a fire onboard a fishing vessel and a personal injury. The most frequent incident type which occurred in the Mona Array Area was related to mechanical failure or damage to a vessel with five reported out of the six incidents in the area. The other incident was a near miss involving a fishing vessel. There was one incident in the Morecambe Array Area, this involved a mechanical failure or damage to a vessel recreational vessel.

5.3.2.1.4 **Figure 35** shows the number of incidents per year, with approximately 311 RNLI incidents and 61 MAIB incidents reported per year. There appears to have been a gradual increase in reported MAIB incidents over the analysis period. The extent to which this may be influenced by improved reporting standards is unclear, but is reflective of a wider national trend.

5.3.2.1.5 A number of MAIB reports have been prepared for serious incidents within the Irish Sea, these include:

- Foundering of Nicola Faith on 27 January 2021 with three fatalities in Colwyn Bay, North Wales.
- Grounding and loss of the Riverdance on 31 January 2008. A 116 m Seatruck Ferries Ro-Ro sustained a severe list to port in heavy seas off Lune Deep causing the vessel to drift and subsequently run aground off Blackpool. There were no injuries but as salvage attempts failed it was declared a total constructive loss and broken up for removal.
- Foundering of Solway Harvester on 11 January 2000. A 21 m scallop dredger fishing vessel capsized 9.5 nm to the east of the IoM while fishing heavy seas causing the vessel to sink. All seven crew members lost their lives.

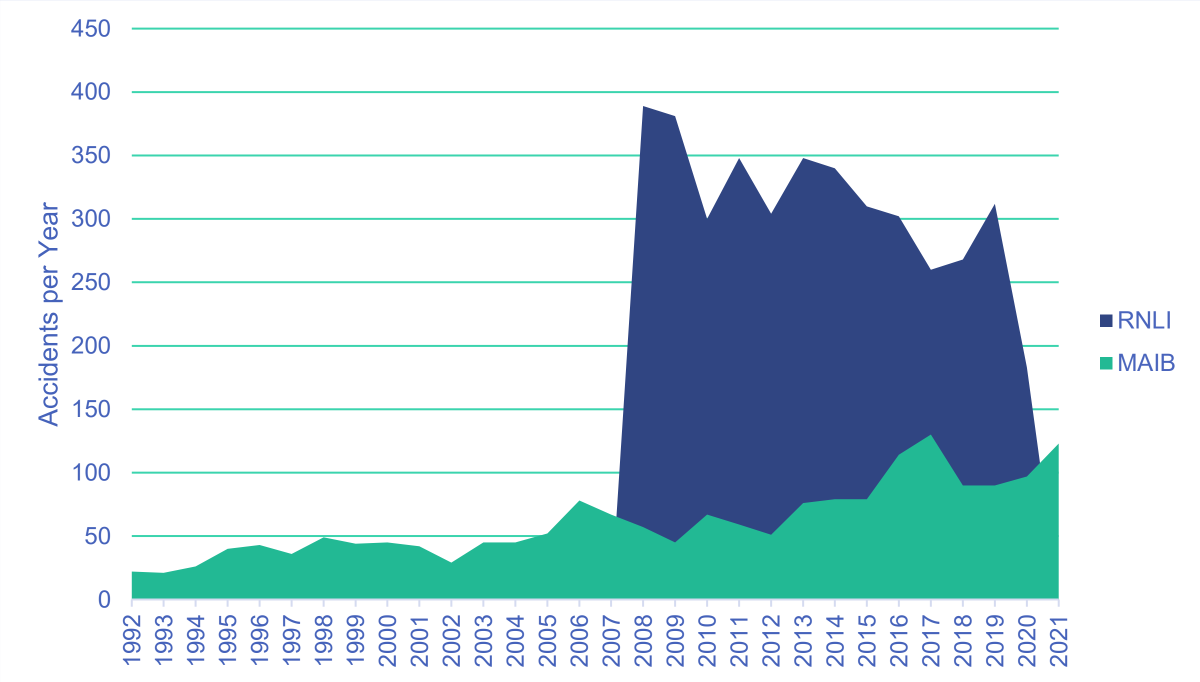


Figure 35: Incidents per year (note RNLI data applicable 2008 to 2020 only).

5.3.2.1.6 The incidents recorded within 10 nm of the Project Array Areas is presented in **Table 20** and **Figure 36**. There were 47 incidents recorded within 10 nm of the Mona Array Area, 60 for Morgan Array Area and 48 for Morecambe Array Area.

5.3.2.1.7 There were three recorded collisions within 10 nm of the Morecambe Array Area, all reported by the RNLI. Two of these incidents involved wind farm support vessels whilst the other vessel incident was recreational. There were three near misses recorded within 10 nm of the Project Array Areas since 2008, two in the Mona Array Area and one in the Morgan Array Area.

Table 20: Incidents per year within 10 nm of Mona, Morgan and Morecambe Array Areas.

Year	All	Within 10 nm of Array Areas		
		Mona	Morgan	Morecambe
2008	446	6	5	7
2009	426	2	6	4
2010	367	2	2	2
2011	407	5	3	4
2012	355	3	4	3
2013	424	3	11	3
2014	419	4	6	6
2015	389	4	1	2
2016	416	7	8	4
2017	390	3	9	3
2018	358	4	1	4
2019	402	2	3	4
2020	280	1	1	2
2021	123*	1	0	0

*Only MAIB data for 2021.

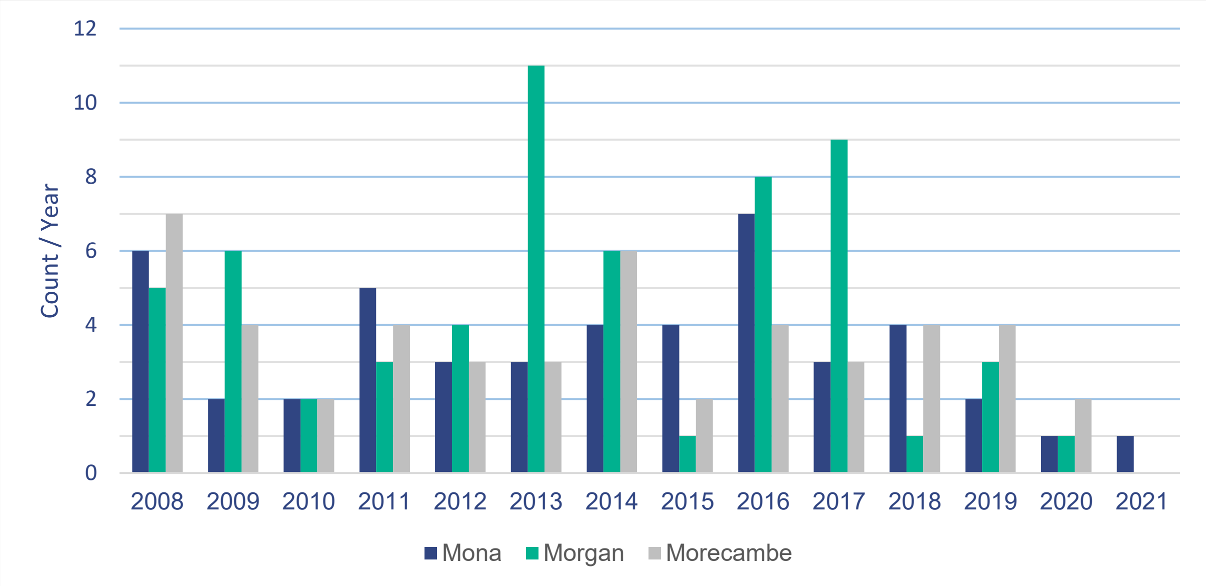


Figure 36: MAIB/RNLI accident frequencies within 10 nm per year (2008 to 2021).

5.3.2.1.8 **Table 22** calculates annual incident rates within 10 nm of each Project Array Areas by vessel type. For all three Project Array Area study areas, the most likely incidents per year are fishing and recreational craft involved in "other" incidents (such as mechanical failure, flooding etc.). Very few incidents involve large commercial vessels or collisions, contacts or groundings.

5.3.3 Consequences of Collision

5.3.3.1.1 International studies have explored the consequences of collision between large vessels. The European Maritime Safety Agency (EMSA) (2015) collision risk model developed for their FSA based on historical incidents estimated that 33% of struck roll-on/roll-off passenger (RoPax) vessels would result in water ingress and 14% of those would result in sinking (joint probability of 4.6%). The Maritime Safety Committee (MSC) 85-17-2 FSA gives probabilities of 16% of collisions being a serious casualty of which 50% of struck vessels would flood, of which 22% would sink and a further 50% split between gradual sinking or rapid capsize (joint probability of the latter being 0.8%).

5.3.3.1.2 Analysis of MAIB data suggests that approximately 1% of collisions would result in loss of life. However, it is likely as most collisions occur within ports and harbours, vessels are navigating at slower speeds than they may do in open sea. Furthermore, there are relatively few incidents in UK waters of significant loss of life following collisions or allisions involving large commercial shipping or ferries. Collisions between commercial vessels, even at speed, often result in only damage and no pollution or injuries (MAIB 7/2018, 28/2015, 3/2017, 15/2013).

5.3.3.1.3 Several consultees noted that a collision between a large cargo/tanker shipping or ferry with a small craft such as fishing boat would likely to result in the loss of the small craft and multiple fatalities (7/2007, 10/2015). However, a more likely outcome is serious damage to the small craft and either no or minor injuries/pollution (MAIB 4/2019, 16/2015, 20/2011, 17/2011).

5.3.3.1.4 During the CRNRA hazard workshop undertaken to inform the PEIR, some consultees, in particular the IoMSPC, made reference to the highly fragile nature of the Manannan high speed ferry's structural integrity, having been designed for high-speed transit and therefore with aluminium build. Therefore, any collision involving this vessel could have a larger potential consequence than other vessel types.

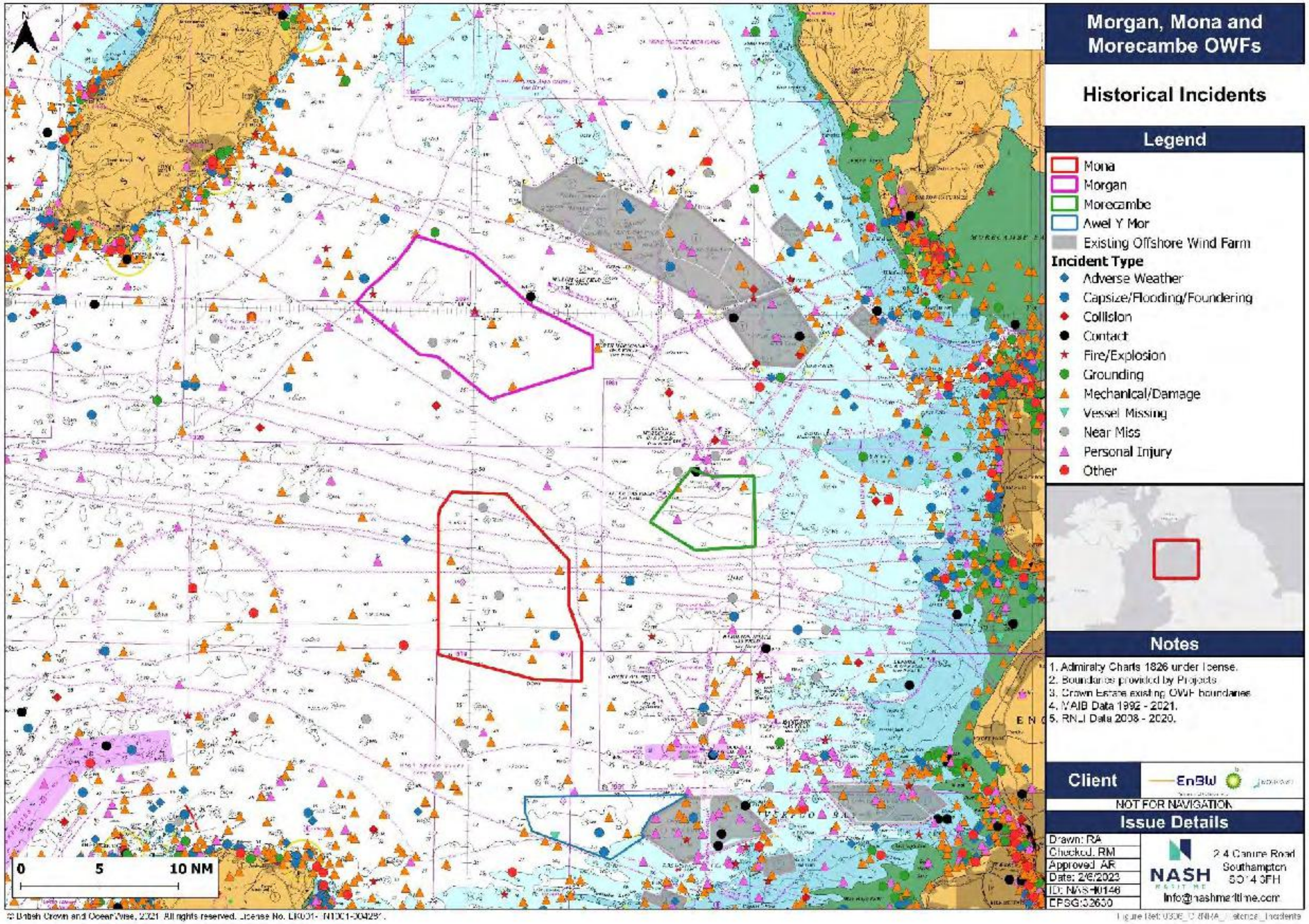


Figure 37: Historical incidents in the CRNRA study area.

Table 21: Total incident count in the CRNRA study area (MAIB 1992 – 2021, RNLI 2008 – 2020).

	Cargo	Fishing	Fixed Installation	Military	Passenger	Recreational	Tanker	Tug and Service	Not Classified	Total
Adverse Weather	-	16	-	-	-	322	-	6	1	345
Capsize/Flooding/Foundering	4	52	-	-	10	297	1	21	6	391
Collision	36	13	1	1	7	25	-	26	2	111
Contact	207	9	2	1	50	23	-	51	3	346
Fire/Explosion	17	10	-	-	32	29	-	40	1	129
Grounding	50	51	-	-	29	367	-	52	7	556
Mechanical/Damage	179	384	-	2	62	1917	-	100	16	2660
Missing	-	6	-	-	-	70	-	-	-	76
Near Miss	17	20	-	-	12	9	-	15	3	76
Personal Injury	124	102	1	-	172	320	2	148	9	878
Other	1	47	-	-	5	253	-	5	8	319
Total	635	710	4	4	379	3632	3	464	56	5887

Table 22: MAIB/RNLI accident frequencies within 10 nm of Project Array Areas per year (2008 to 2020).

	Incident Type	Cargo	Fishing	Fixed Installation	Military	Not Classified	Passenger	Recreational	Tanker	Tug and Service	Total
Mona Array Area	Collision	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Contact	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Grounding	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Other	0.23	1.00	0.00	0.00	0.00	0.08	2.00	0.00	0.23	3.54
	Total	0.23	1.00	0.00	0.00	0.00	0.08	2.00	0.00	0.23	3.54
Morgan Array Area	Collision	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Contact	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08
	Grounding	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.08
	Other	0.08	1.77	0.00	0.00	0.00	0.00	2.00	0.00	0.62	4.46
	Total	0.08	1.77	0.00	0.00	0.00	0.00	2.08	0.00	0.69	4.62
Morecambe Array Area	Collision	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.15	0.23
	Contact	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Grounding	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.08
	Other	0.00	0.23	0.00	0.00	0.00	0.00	2.31	0.00	0.08	2.62
	Total	0.00	0.23	0.00	0.00	0.00	0.00	2.46	0.00	0.23	2.92

5.3.4 Consequences of Allision

5.3.4.1.1 Given the infrequency at which vessels have collided with WTGs/OSPs, there is some uncertainty to the degree of damage that would result from an allision. The degree of damage depends on the vessel characteristics, the type of allision (at speed or drifting), angle of allision (broadside or head-on) and the engineering of the WTGs. Several academic studies using finite element modelling have sought to explore this, including Biehl and Lehmann (2006), VINDPILOT (2008), Dai et al. (2013), Moulas et al. (2017) and Presencia and Shafiee (2018).

5.3.4.1.2 These studies suggest that:

- Ship allisions, even at low speeds, can cause significant damage to WTGs including deformation and buckling.
- Some studies of in-field construction/maintenance vessels (up to 4,000 tons), with allisions at high speeds, did not result in WTGs collapse.
- Modelling of allisions with large commercial ships could result in holing of the vessels hull and cargo release.
- Larger vessels around 30,000 Dead Weight Tonnes (DWT) colliding with the turbine might typically result in the tower collapsing away from the vessel.
- However, some studies suggested that large commercial ships could result in the tower collapsing towards the vessel, with the damage likely to penetrate the deck.

5.3.4.1.3 To better understand the potential consequences of ship allision with WTGs, **Table 23** presents some case studies of past incidents and the resulting impacts to people, property and the environment. It can be concluded that where incidents have occurred, they have been at low speed, involve in-field project vessels and typically result in only minor damage or injuries. However, it is feasible that a serious allision with an OWF might result in turbine collapse, holing and eventual flooding of a vessel and potential loss of life.

Table 23: Case studies of allision.

Date	Project	Vessel	Description
25 April 2023	Gode Wind (Germany)	Petra L – 74 m, 1,162 Gross Tonnes (GT) General Cargo	Vessel missed a turn and collided with a WTG causing significant damage. There were no injuries.
31 January 2022	Hollandse Kust Zuid	Julietta D – 190 m 24,196 GT Bulk Carrier	Disabled vessel in a storm struck the foundation of an OSP jacket that result in minor damage to both the vessel and jacket. There were no injuries or pollution.
23 April 2020	Borkrum Riffgrund	Njord Forseti – 24 m 137 GT	Vessel skipper not keeping proper lookout collided with WTG at speed. Resulted in three injuries (one seriously) and significant flooding of CTV through 0.5 m crack in bow.
10 April 2018	AOWF (Baltic)	Vos Stone – 80 m 4,956 GT Offshore Supply Vessel	Construction vessel casting off from a WTG lost control and was forced against the WTG due to adverse weather. Resulted in 3 minor injuries, dry dock to the vessel and minor damage to platform. There was no pollution.

Date	Project	Vessel	Description
14 August 2014	Walney	OMS Pollux – Stand By Safety Vessel	Whilst conducting inspection work, the vessel collided with a turbine that resulted in no injuries, and minor leaking of marine gas.
21 November 2012	Sheringham Shoal	Island Panther – 17 m 22 GT CTV	CTV made heavy contact with unlit transition piece. Resulted in 5 injuries and damage to the vessels bow.
06 October 2006	Scroby Sands	Jack up	Large jackup barge collided with turbine resulting in damage to a turbine blade.

6. FUTURE CASE TRAFFIC PROFILE

6.1.1.1.1 This section presents the predicted future case traffic profile within the CRNRA study area for cargo, tanker, ferries, oil and gas, fishing and recreational vessel traffic.

6.2 FUTURE CASE (WITHOUT PROJECTS)

6.2.1 Cargo/Tanker Traffic

6.2.1.1.1 DfT data on UK port trade is presented in **Figure 38** and **Figure 39** and show a decline in port freight in 2020 at both the national and port level, respectively (DfT, 2023). The DfT report that UK ports were affected by measures to prevent and reduce the global spread of Covid-19 throughout 2020, as well as the UK exiting the EU at the end of 2020. The DfT report a 9% decrease in tonnage handled by UK ports in 2020 compared to 2019. However, given the lifting of COVID-19 related restrictions, it is anticipated that port freight will continue to return to pre-pandemic levels.

6.2.1.1.2 Port freight activity at the Port of Liverpool steadily increased between 2014 and 2019, before undergoing a significant reduction in 2020, likely due to pandemic related restrictions. It should be noted that an increase in tonnage does not necessarily correlate with an increase in vessels. New build vessels are often larger, capable of carrying more cargo, and ports such as Liverpool have invested in shoreside infrastructure to better handle these larger vessels.

6.2.1.1.3 **Figure 40** shows projected freight traffic into UK major ports, produced by the DfT in 2019. Overall, port traffic is forecast to remain relatively flat in the short term but grow in the long term, with tonnage 39% higher in 2050 compared to 2016. This equates to approximately a 15% increase in national freight tonnage by 2035.

6.2.1.1.4 The long-term growth in port traffic is driven by increases in unitised freight traffic, which compensates for decreases in other freight in the short term. Liquid bulk traffic (principally crude oil) has the largest forecasted decreases, continuing a historical trend. Similarly, general cargo is forecast to decrease, in line with the historic decreasing trend, which is likely driven by increased containerisation of goods. Dry bulk traffic is forecast to have a relatively large decrease in the short term, driven primarily by demand for coal being projected to fall. In the long term, dry bulk traffic is forecast to increase, with other dry bulk, the largest category, continuing to increase as it has done historically (principally biomass). Motor vehicles, twenty-foot equivalent unit (TEU) forecast for lift-on/lift-off (Lo-Lo) and the unit forecast for roll-on/roll-off (Ro-Ro) are all forecast to grow strongly, driven by economic growth.

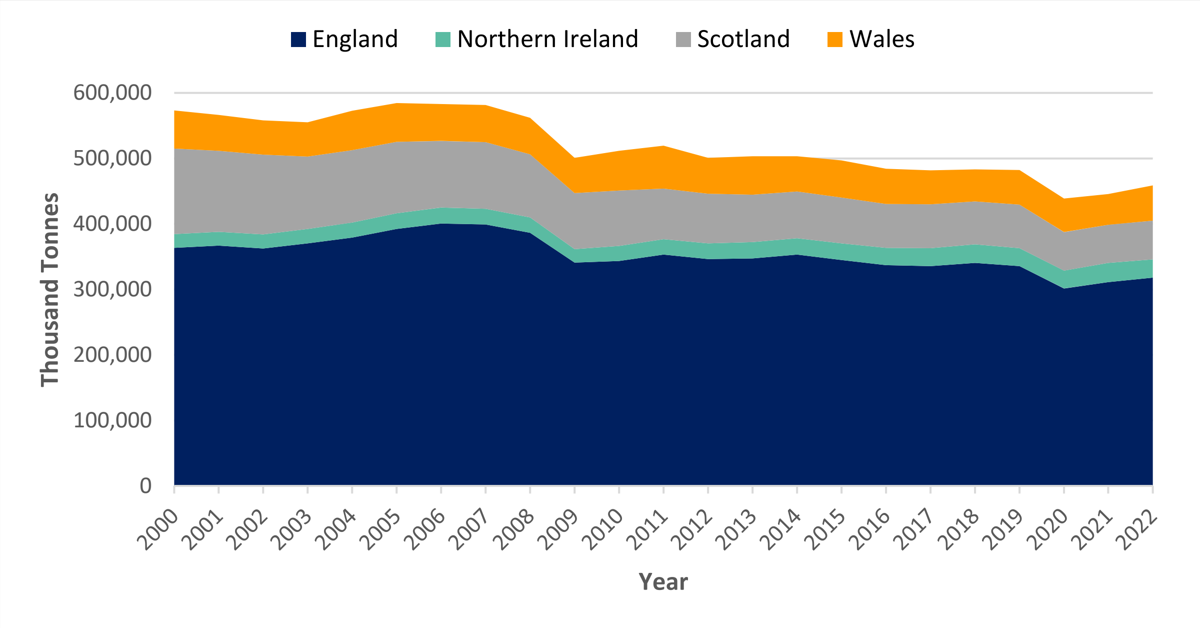


Figure 38 UK major port freight.

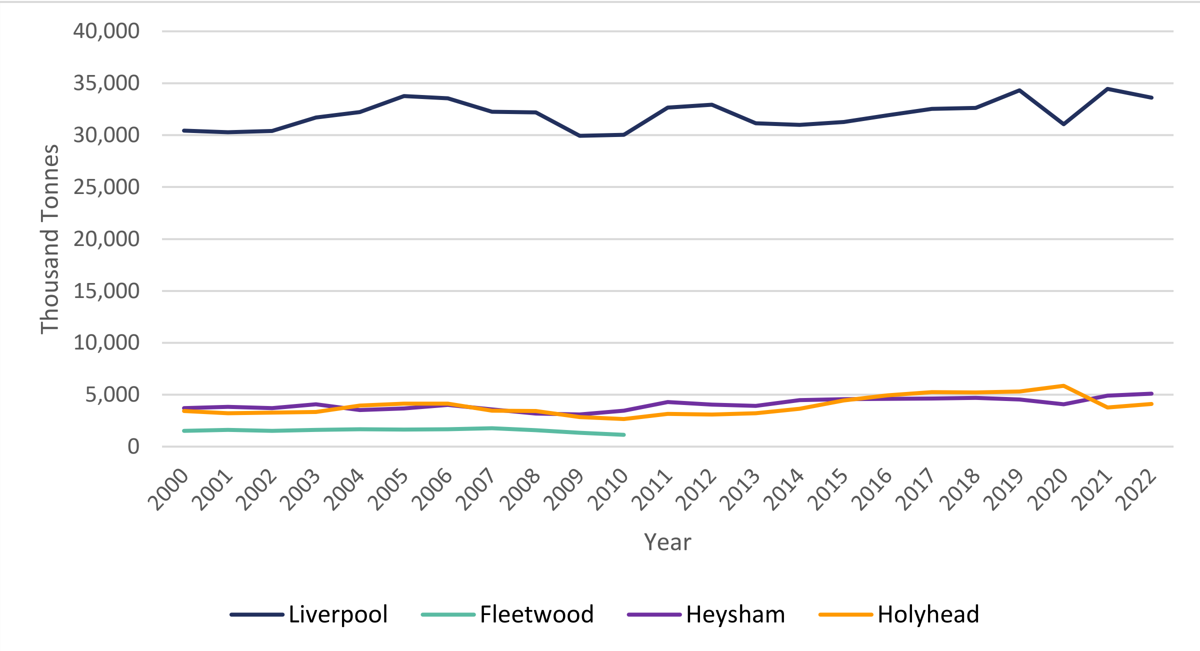


Figure 39 Port freight for UK major ports (Fleetwood ferry service closed at the end of 2010).

6.2.1.1.5 It is also noted that the Douglas Harbour Master Plan (IoM Government, 2018) considers the potential for development of a day-call cruise ship berth, which might increase the number of cruise ship calls to the IoM[1].

6.2.1.1.6 Other future changes that might occur by 2035 could include the increased operation of Autonomous vessels within UK waters. During the course of the CRNRA, autonomous or remote-controlled survey vessels were active within the

[1] https://www.gov.im/media/1360794/harbours-strategy-technical-information-gd2018-0012.pdf.

Project Array Areas and no incidents were recorded. Regulatory bodies have insisted that any introduction of autonomous vessels into UK waters would have equivalent safety standards as conventional crewed vessels.

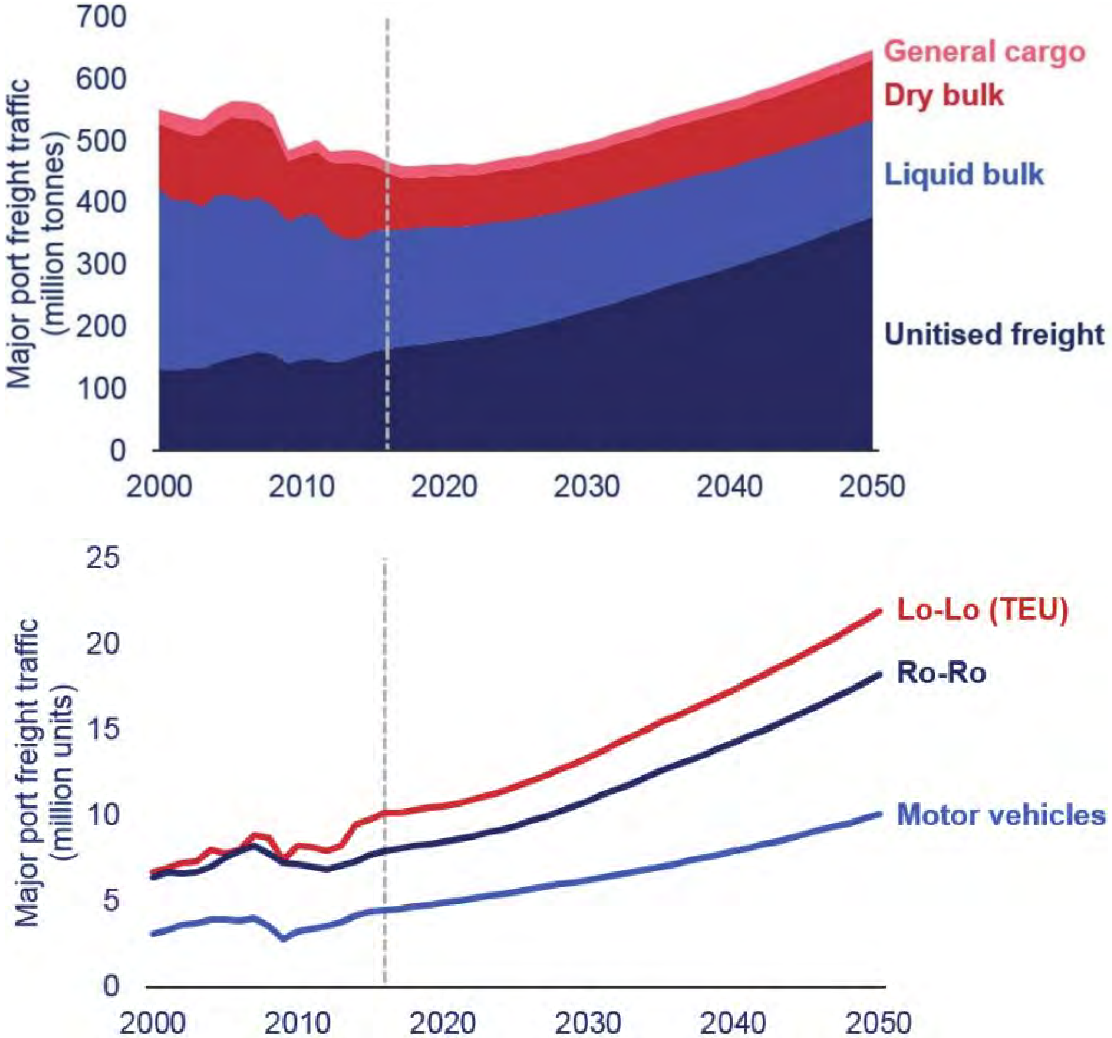


Figure 40: UK port freight projections (DfT, 2019).

6.2.2 Ferries

6.2.2.1.1 Freight and passenger ferries account for a large proportion of vessel movements within the CRNRA study area. These routes are subject to change both in terms of schedule, vessels and the addition of new routes in order to meet market demand. For example, between the 2019 AIS and the 2022 AIS analysis, Stena Line replaced several of their ferries with the new E-flex class. During consultation, each operator was asked on any potential future changes, noting that these were subject to change.

6.2.2.1.2 Seatruck have showed significant growth in demand, in 2018, Seatruck reported a 30% increase in volumes since 2015, with a 10% increase in 2017 alone[2]. The increase in unaccompanied trailer volumes between 2007 and 2018 was reportedly

2 [redacted]

250%[3]. A €100 million investment by Seatruck in 2018 was announced to increase capacity on the Warrenpoint to Heysham route by 30%.

6.2.2.1.3 Both of the IoMSPC vessels are 20 years old and will require replacement before 2035. The Ben-my-Chree will be replaced by the Manxman, introduced during 2023. Consultation with IoMSPC determined that it is reasonable to assume that the Ben-my-Chree and Manxman will have similar handling and endurance capabilities. The Manannan is due for replacement before 31 December 2026[4]. This may be replaced by either a new fast craft or a fast conventional ferry.

6.2.2.1.4 In 2023, it was announced that P&O would cease operating between Liverpool and Dublin, however, it is anticipated that other Irish Sea operators would replace this route with their own capacity.

6.2.2.1.5 Trends for passenger numbers are shown in **Figure 41** and shows that Liverpool-Douglas and Heysham-Douglas have maintained relatively constant passenger numbers between 2003 and 2022 (noting the exception of those figures impacted by COVID-19). Liverpool-Dublin has had a steady decline, meanwhile Liverpool-Belfast has experienced an increase, this is especially the case in the years since the impact of COVID-19 during which time Stena Line replaced ferries with the new E-flex class. Notably, the Liverpool-Belfast passenger number were the least effected of these routes by COVID-19. Predicting how this trend may influence vessel schedules and routes is full of uncertainty. Therefore, in the absence of definitive information, an assumption is made that vessel routes and schedules will be similar in 2035 as to the existing base case but with a likely increase in services.

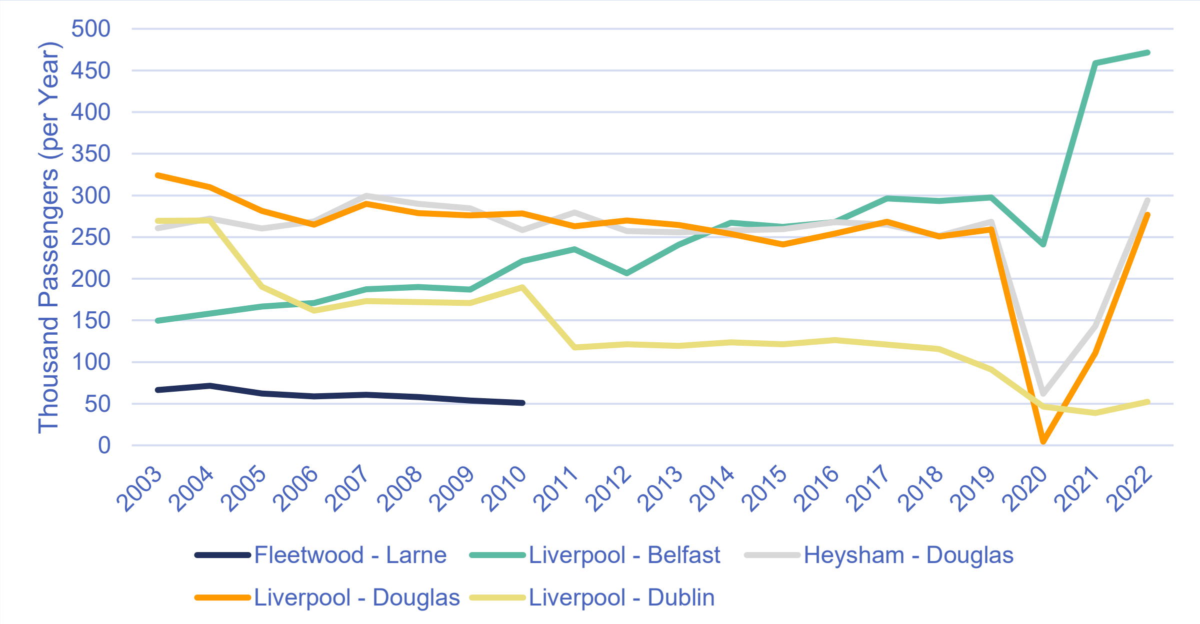


Figure 41 Passenger numbers (Fleetwood ferry service closed at the end of 2010). 2020 figures heavily impacted by COVID-19.

3 [redacted]

4 [redacted]

6.2.3 Oil and Gas

6.2.3.1.1 Irish Sea oil and gas platforms are reaching end of life and it is understood that some platforms may be decommissioned. It is assumed that:

- Millom West and Millom East (Harbour Energy) have ceased production and is undergoing decommissioning with the platform anticipated to be removed by 2030. Decommissioning works of Millom East may extend to 2032.
- The South Morecambe gas field platforms are expected to cease production in 2027 (+/-2 years)). The field includes the platforms DP3, DP4, DP6, DP8 and CPP1 and associated cable, pipeline and umbilical infrastructure. DP3 and DP4 topsides were removed in 2021 and their associated jackets were removed in 2023. Decommissioning of Calder CA1 is also scheduled to complete in 2027 onwards.

6.2.3.1.2 It is noted that the International Guidance for Offshore Marine Operations (GOMO) Section 8.15 recommends that courses are planned so that, where practical, the vessel passes at a distance of at least 1 nm from each facility. However, the familiarity and manoeuvrability of offshore supply ships or Emergency Rescue and Recovery Vessels (ERRVs) may facilitate navigation within large OWFs. This assessment has assumed that there is sufficient space, in suitable conditions, for in-field navigation to take place.

6.2.3.1.3 It is noted that some existing infrastructure may be repurposed for Carbon Capture and Storage.

6.2.4 Fishing Activity

6.2.4.1.1 There is limited information available for future fishing vessel activity on which reliable assumptions can be made. Fishing within the Irish Sea is demonstrably important for both the IoM and UK fisheries. However, fishing activity in the area is not anticipated to change significantly by 2035, with both local and foreign vessels continuing fishing activity in the area.

6.2.4.1.2 Further detail on this is provided in the individual Project commercial fishing chapters.

6.2.5 Recreational Activity

6.2.5.1.1 The RYA Water Sports Participation Survey conducted in 2019 found that the proportion of adults participating in recreational boating activities has fluctuated between 6% and 8% between 2002 and 2018. Between 2008 and 2018, the proportion participating in yacht cruising, motor boating and power boating have remained consistent at 0.8%, 1.1% and 0.7% respectively. More recent data published in the 2021 Water Sports Participation Survey is significantly influenced by COVID-19 with a significant variation between 2021 and 2022 due to national/local lockdowns.

6.2.5.1.2 Therefore, it is unlikely that there will be a significant change in the number of recreational users due to macro trends.

Figure 42: RYA boating participation survey.

6.3 PROJECT VESSEL MOVEMENTS

6.3.1.1.1 The operations and maintenance bases for each of the Projects is not yet known, therefore, assumptions have been made in the MDS as follows in order to provide a basis of where transits will be placed across the CRNRA study area:

- **Morgan Generation Assets** – 719 vessel movements per year from North Wales or northwest England.
- **Mona Offshore Wind Project** – 849 vessel movements per year from North Wales or northwest England.
- **Morecambe Generation Assets** – 384 vessel movements per year from northwest England (832 during a heavy maintenance year).

6.4 REALISTIC TRAFFIC SCENARIOS

6.4.1.1.1 Given the results of this analysis and the traffic surveys, the following realistic traffic scenarios shown in **Table 24** are envisaged for the seven areas in which distinct hazards and impacts are identified (excluding the internal Project Array Areas).

Table 24: Realistic traffic scenarios.

Route	Scenario	Potential Traffic Situation Encountered by a Transiting Vessel	Justification
Between Mona and Morgan Array Areas	Reasonable Day to Day Situation (<50% transits)	2 ferries 1 fishing vessel	Ferries: Reasonable likelihood of meeting another ferry (Seatruck/IoMSPC/Stena) between Mona and Morgan Array Areas. Potential for up to 3 ferries to converge on area. Cargo/Tanker: Anticipated to take TSS and pass Southwest of Mona Array Area. Some small general cargo <150 m may occasionally navigate between Project Array Areas, but infrequently. Tug and Service: Repositioning of standby vessels possible. Fishing: Occasional fishing around Project Array Areas. Radar survey recorded up to 2 fishing boats during summer survey in Project Array Areas. Recreational: Radar surveys showed relatively little recreational in central Irish Sea. Up to 2 recreational craft crossing through Array Area per day from summer surveys (noting negligible during winter survey). Project Vessels: Unlikely to pass between Mona and Morgan Array Areas.
	Unlikely but Occasional Situation (<10% transits)	2 ferries 1 tug and service vessel 1 fishing vessel	
	Reasonable Worst Credible (<1% transits)	3 ferries 1 cargo/tanker vessel 1 tug and service vessel 2 fishing vessels 2 recreational vessels	
Between Mona and Morecambe Array Areas	Reasonable Day to Day Situation (<50% transits)	2 ferries 1 Tug and Service (stationary) vessel 1 Fishing vessel	Ferries: Reasonable likelihood of meeting another ferry (IoMSPC/Stena) between Mona and Morecambe Array Areas. Reasonable potential for up to 2 ferries to converge on area. Cargo/Tanker: Anticipated to take TSS and pass southwest of Mona Array Area. Some small general cargo <150 m may occasionally navigate between Project Array Areas, but infrequently. Tug and Service: Repositioning of standby vessels possible and loitering around existing Hamilton/Conwy fields southeast of Mona Array Area. Fishing: Occasional fishing around Project Array Areas. Radar survey recorded up to 2 fishing boats during summer survey in Project Array Areas. Recreational: Radar surveys showed relatively little recreational in central Irish Sea. Up to 2 recreational craft crossing through Array Area per day from summer surveys (noting negligible during winter survey). Project Vessels: Unlikely to pass between Mona and Morecambe Array Areas.
	Unlikely but Occasional Situation (<10% transits)	2 ferries 1 cargo/tanker vessel 2 Tug and Service (stationary) vessels 1 Fishing vessel 1 Recreational vessel	
	Reasonable Worst Credible (<1% transits)	3 ferries 2 cargo/tanker vessel 2 tug and Service (stationary) vessels 2 fishing vessels 2 recreational vessels	

Route	Scenario	Potential Traffic Situation Encountered by a Transiting Vessel	Justification
Between Morgan Array Area and Walney OWF	Reasonable Day to Day Situation (<50% transits)	1 ferry 1 tug and service (stationary) vessel 1 fishing vessel	Ferries: Unlikely to meet another ferry (IoMSPC vs Stena), given Stena's infrequent transit to east of IoM. Cargo/Tanker: AIS analysis showed minimal passage to west of Walney OWF (less than once per day). Tug and Service: Repositioning of standby vessels possible and loitering around existing Millom Field. Fishing: Occasional fishing around Project Array Areas. Radar survey recorded up to 2 fishing boats during summer survey in Project Array Areas. Significantly greater density within IoM waters to northwest of Morgan Array Area. Recreational: Radar surveys showed relatively little recreational in central Irish Sea. Up to 2 recreational craft crossing through Array Area per day from summer surveys (noting negligible during winter survey). Project Vessels: Morgan Generation Assets CTVs likely to cross area or transit through it, generally together or in a convoy. Likely that passage does not coincide with this activity.
	Unlikely but Occasional Situation (<10% transits)	2 ferries 1 tug and service (stationary) vessel 1 fishing vessel 1 recreational vessel	
	Reasonable Worst Credible (<1% transits)	2 ferries 1 cargo/tanker vessel 1 tug and service (stationary) vessel 2 fishing vessels 2 recreational vessels 6 Project vessel crossings	
East Morecambe Array Area	Reasonable Day to Day Situation (<50% transits)	No traffic	Ferries: Current adverse weather passage plans can take ferries through the Morecambe Array Area (once or twice a year), unlikely to continue with Array Area in place. Cargo/Tanker: AIS analysis showed minimal passage to east of Morecambe Array Area. Considered less likely in future case given reduced sea room. Tug and Service: Repositioning of standby vessels possible from Morecambe fields. Fishing: Occasional fishing around Project Array Areas. Radar survey recorded up to 2 fishing boats during summer survey in Project Array Areas. Significantly greater density within IoM waters to northwest of Morgan Array Area. Recreational: Radar surveys showed relatively little recreational in central Irish Sea. Up to 2 recreational craft crossing through Array Area per day from summer surveys (noting negligible during winter survey). Project Vessels: Morecambe Offshore Windfarm CTVs likely to cross to east. Likely that passage does not coincide with this activity.
	Unlikely but Occasional Situation (<10% transits)	1 fishing vessel 1 recreational vessel 1 tug and service vessel 2 Project vessel crossings	
	Reasonable Worst Credible (<1% transits)	1 tug and service vessel 2 fishing vessels 2 recreational vessels 2 Project vessel crossings	
South Mona Array Area	Reasonable Day to Day Situation	2 ferries 3 cargo/tanker vessels	Ferries: Confluence of Stena/P&O routes, likely to meet another ferry, albeit separated between routes from Anglesey/IoM.

Route	Scenario	Potential Traffic Situation Encountered by a Transiting Vessel	Justification
	(<50% transits)	1 service vessel 1 fishing vessel	Cargo/Tanker: Major shipping route through TSSs. Likely to meet multiple ships. Tug and Service: Movement of tug and service craft into Liverpool or between the oil and gas fields may be encountered. Fishing: Occasional fishing around Project Array Areas. Radar survey recorded up to 2 fishing boats during summer survey in Project Array Areas. Recreational: Radar surveys showed relatively little recreational in central Irish Sea, concentrated inshore to south. Up to 2 recreational craft crossing through Array Area per day from summer surveys (noting negligible during winter survey). Likely to keep clear of shipping lanes, and further inshore. Project Vessels: Mona Offshore Wind Project CTVs likely to cross area or transit through it, generally together or in a convoy. Likely that passage does not coincide with this activity.
	Unlikely but Occasional Situation (<10% transits)	2 ferries 5 cargo/tanker vessels 1 tug and service vessel 1 fishing 1 recreational 6 Project vessel crossings	
	Reasonable Worst Credible (<1% transits)	3 ferries 8 cargo/tanker vessels 1 tug and service vessel 2 fishing vessels 2 recreational vessels 6 Project vessel crossings	

7. CUMULATIVE IMPACT ASSESSMENT

7.1 IMPACT IDENTIFICATION

7.1.1.1.1 Following consultation with stakeholders, analysis of data and a review of guidance, 11 potential cumulative impacts of the Projects were identified on shipping and navigation, as relevant from the cumulative perspective for the CRNRA and are documented in **Table 25**.

Table 25: Potential impact identification.

ID	Potential Impact	Description
1	Potential impact to recognised sea lanes essential to international navigation	The Projects could impede access into major international sea lanes.
2	Potential impact of arrays on ferry routeing	The Projects could necessitate deviations to ferry routeing increasing distances resulting in additional cost and time for the passage.
3	Potential impact of arrays on cargo/tanker vessel routeing	The Projects could adversely impact routeing of cargo/tanker vessels, making services unviable.
4	Potential impact of arrays on small craft navigation and safety	The Projects could interfere with the activities and safety of small craft navigation such as cruising.
5	Potential impact of arrays on compliance with guidance and best practice	The Projects could result in routes between them that fail to meet guidance or industry best practice with respect to available sea room.
6	Potential impact on vessel encounters and collision avoidance	The Projects could result in greater frequency at which vessels meet one another between the array areas.
7	Potential impact on modelled risk of collision and allision	The Projects could increase the risk of collision between navigating vessels or allision with infrastructure, such as through the creation of choke points, reduced sea room or increased vessel movements.
8	Potential impact of arrays on vessel emergency response	The Projects could adversely impact a vessels ability to respond to an emergency.
9	Potential impact of arrays on search and rescue	The Projects design could inhibit search and rescue access for vessels or aircraft during an emergency.
10	Potential impact of arrays on oil and gas activities and safety	The Projects could disrupt or impede oil and gas activities or safety of installations or vessels.
11	Potential impact of arrays on communications, radar and positioning systems	The Projects infrastructure could interfere with shipboard or land-based equipment essential to navigation, communications or positioning.

7.1.1.1.2 Additional potential impacts have been identified that relate to the construction or operation of the windfarm as well as the activities of operations and maintenance vessels which are considered within the individual Project NRAs. Furthermore, three other potential impacts were identified by stakeholders, which are not considered within the scope of the CRNRA as described below:

- **Socio-economic effects due to disruption of ferry or other commercial services**. Several stakeholders raised concerns on how cancellation or disruption to services as a result of increased steaming time could impact the IoM through the transport of goods in a Just-In-Time economy, medical supplies and tourists or business travellers amongst others. The potential socio-economic impacts of the Projects are considered separately within the Environmental Statement chapters of each project.
- **Environmental effects**. The presence of the OWF increases the travel distance of vessels which increases their fuel consumption and emissions of greenhouse gases. Measures such as the Energy Efficiency Existing ship Index (EEXI) introduced by the IMO could therefore be impacted. These potential effects are considered separately within the Environmental Statement chapters of each Project.
- **Optioneering for future routes**. The presence of the OWF reduces the opportunities for operators to develop new routes where market conditions allow, by increasing the transit distance and makes them less attractive. These aspirations and developments are commercially sensitive and the Projects are unable to assess the viability of any future routes.

7.2 POTENTIAL IMPACT TO RECOGNISED SEA LANES ESSENTIAL TO INTERNATIONAL NAVIGATION

7.2.1.1.1 United Nations Convention on the Law of the Sea (UNCLOS) Article 60, NPS EN-3 and the Electricity Act 1989 recognise that offshore developments should not interfere with the use of recognised sea lanes essential to international navigation.

7.2.1.1.2 The TSS Liverpool Bay and TSS Off Skerries are promulgated and provide the only route for large ships into Liverpool so would meet the definitions as sea lanes essential to international navigation. The Mona Array Area is located to the northwest of the Liverpool TSS at 4.4 nm distance, albeit by extending the limits of the traffic lane westward, the lateral distance is 2.1 nm. This is substantially further than the 0.5 nm separation from Gwynt y Môr OWF.

7.2.1.1.3 **Figure 43** identifies the 2022 vessel tracks navigating the TSS. With the Mona Array Area in place, the majority of tracks from the west Off Skerries TSS would pass clear to the southwest of Mona Array Area with no direct impact. For those arriving from the northwest, they would necessarily deviate to the southwest of Mona Array Area, but have continued access into Liverpool TSS (see **Section 7.3** and **7.4**). Therefore, given that the presence of the Projects does not prevent access into Liverpool through the TSS, it is not considered that the requirements of safeguarding sea lanes essential to international navigation are breached. Passage adjacent to an OWF poses increased risk of collision or allision as described in the following sections.

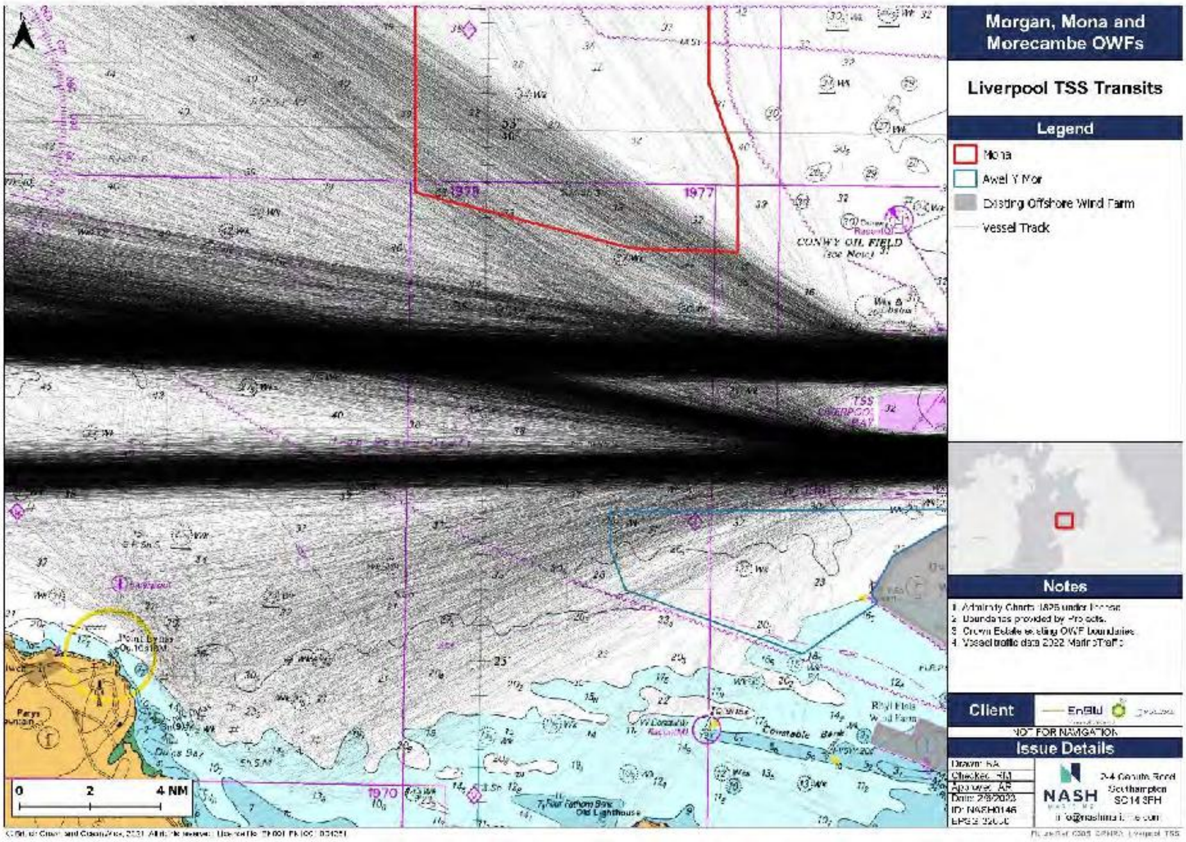


Figure 43: Tracks of vessels using Liverpool TSS.

7.2.1.1.4 During consultation, several stakeholders asserted that historic routes between two ports are necessarily "recognised sea lanes" and therefore could not be impacted. A review of UNCLOS Article 22 determines that: "*4. The coastal State shall clearly indicate such sea lanes and traffic separation schemes on charts to which due publicity shall be given*". Therefore, the onus is on the MCA to put forward a proposed sea lane to IMO who would formally designate it. Given that this has not occurred, and no such routes are indicated on charts, Article 60 and NPS EN-3 2.6.161 would not apply. Furthermore, given that alternative routes exist around the OWFs, albeit at a greater transit distance (see **Section 7.3** and **7.4**), they do not provide unique access and so cannot be regarded as "essential". These principals were set out within the application of the Thanet Extension OWF and were reaffirmed by the Examining Authority in their Recommendation Report[5]. In addition, it is notable that historic wind farms within the Irish Sea (such as West of Duddon Sands) have impacted upon these same routes, without being refused consent under the Electricity Act 1989 Section 36B.

[5] THANET EXTENSION OFFSHORE WIND FARM Examining Authority's Report of Findings and Conclusions and Recommendation to the Secretary of State for Business, Energy & Industrial Strategy.

7.3 POTENTIAL IMPACT OF ARRAYS ON FERRY VESSEL ROUTEING

7.3.1 Introduction

7.3.1.1.1 OWFs can impact on vessel routeing by creating an obstacle in otherwise navigable waters that requires a deviation of their route. For regular runners such as ferries, this has the potential to result in a significant increase in costs or make schedules unviable. Furthermore, impacts on routeing may result in increased risks, which are considered in **Sections 7.7** and **7.8.2**. During consultation, ferry operators raised several existing operational constraints which should be considered in conjunction with the increased distance to clear an OWF:

- **Schedules**: Existing schedules are developed to maintain consistent arrival and departure times per 24-hour period. This may not be achievable with increased transit time on some routes.
- **Increased fuel**: Increased transit distance necessitates an increase in fuel burn which has a direct additional cost to operators. Furthermore, this would increase the environmental impact of their operations through increased emissions.
- **Hours of Rest**: The Maritime Labour Convention requires ten hours of rest in any 24-hour period, in a maximum of two periods, of which at least six hours must be uninterrupted. Existing schedules enable this requirement to be met, but increased transit duration could make compliance with the convention impossible without compromising schedules or hiring additional crew.
- **Safe Manning**: Navigation in routes between OWFs could be treated as constrained navigation and require additional senior officer presence on the bridge for greater proportions of crossings.
- **Reduced Vessel Speed**: Vessels operating in routes, performing additional turns or encountering other vessels more frequently may need to reduce speed, compounding any additional transit distance on vessel schedules.
- **Turnaround times**: Turnaround times within ports are constrained to enable safe loading and unloading. During busy periods, it may not be possible to reduce this duration to make up lost time due to increased transit duration, resulting in some freight being left behind.
- **Berth/port constraints**: Several ports have clear operational constraints where delays might result in missing crucial arrival windows. Heysham has a tight entrance, which in combination with strong tides and wind conditions, makes berthing challenging. The harbour is also dredged but occasionally arrival at spring low tides is not achievable with sufficient under keel clearance, requiring amendments to timetables. Douglas can be challenging when berthing in certain wind conditions. Warrenpoint is tidally constrained. Belfast is limited by the number of vessels operating on a route. Liverpool is constrained by lock timings and other vessel movements. Dublin has recently relocated freight terminals further from the seaward entrance, increasing transit duration.

7.3.2 Ferry Routeing in Normal Conditions

7.3.2.1.1 Passenger or freight ferry services have been identified operating through the CRNRA study area (see **Section 5.2.2.3**). Therefore, the development of these areas would necessitate re-routeing of these ferry services. It is recognised that previous offshore wind projects in the Irish Sea (Barrow, Ormonde, Walney, West of Duddon Sands) have each impacted upon ferry routeing since 2004 (Anatec, 2016). Operators have necessarily had to adjust their passage plans to accommodate operational OWFs and the nature of these OWFs has not made any existing routes unviable.

7.3.2.1.2 **Figure 44** shows the anticipated outline routes that operators would take were the Projects to be in place. These were developed following a review of the current passage plans provided by each operator and a review of the potential impacts of the Project Array Areas upon them. Each revised passage plan was developed by the NASH project team, including master mariners, and account for existing decision making principles (such as passing at least 1.5 nm from a WTG) that were obtained during consultation with operators. These passage plans were also tested during navigation simulations undertaken to inform the Environmental Statement with the Masters of each respective ferry company. These passage plans are shown in **Appendix C**.

7.3.2.1.3 Based on these anticipated routes, **Table 26** summarises the additional transit distance and time as a result of clearing the Projects, given their average vessel speed taken from the 2022 AIS data. This analysis does not quantify any additional effects of the Projects, such as reduced speed due to increased number of turns or during vessel encounters. It was noted during the navigation simulations that during complex encounter situations, a frequent course of action taken by the bridge teams was to reduce speed which would add additional journey time. The key findings of this analysis are summarised for each of the respective operators below.

7.3.2.1.4 Stena Line operate a route between Liverpool and Belfast (West of IoM). The majority of crossings between Liverpool and Belfast have not used the TSS Off Liverpool when departing or arriving the Mersey. A revised passage plan was developed which assumed these vessels would navigate between Mona and Morecambe Array Areas, pass between Mona and Morgan Array Areas before altering course to pass to the southwest of the IoM. The additional distance and service speed would result in approximately 4.5 minutes of additional transit time. Within the 2022 dataset, a small proportion of Stena Line vessels choose to take the TSS when departing or arriving to Liverpool. With the Projects in place, this would necessitate between three and six minutes of additional transit to pass south of Mona Array Area depending on which TSS lane was taken. Where the vessel chooses to pass to the east of the IoM, they would need to pass either to the east or west of Morgan Array Areas (east of Morgan Array Area is shown in **Figure 44**). The additional distance and service speed would result in approximately 13 to 16 minutes of additional transit time dependent on which route through the Morecambe gas field had previously been taken.

7.3.2.1.5 The Stena Line Liverpool to Belfast routes advertised service is 8 hours (480 minutes), with AIS analysis suggesting that the average crossing duration (limited to the extent of the CRNRA study area) is 260 minutes. There is some variation in transit time but 72% of 2022 trips were within 20 minutes of the average. Therefore, given the crossing duration of several hours, a natural variation in crossing of up to 20 minutes and natural variation in turnaround times within port, between 4.5 and 16 minutes of additional transit time is not considered to render this service unviable but could increase pressures on the operator. It may however make the route east of the IoM less attractive and increase the frequency at which the ferries choose to past westabout the IoM. Stena Line operating between Heysham and

Belfast is unaffected during normal conditions (transiting between West of Duddon Sands and Barrow OWFs).

7.3.2.1.6 The IoMSPC operate a route between Heysham and Douglas (assuming Ben-my-Chree). This would necessarily pass between Morgan Array Area and Walney OWF, with a small alteration of course to clear the north of the Morgan Array Area. The additional distance and service speed would be approximately 1.6 minutes of additional transit time. The advertised service is 3:45 hours (225 minutes), with AIS analysis suggesting that the average crossing duration is 180 minutes. There is some variation in transit time but 92% of 2022 trips were within 15 minutes of the average. Therefore, given the crossing duration of several hours, a natural variation in crossing of up to 15 minutes and natural variation in turnaround, 1.6 minutes of additional transit time is not considered to render this service unviable.

7.3.2.1.7 The IoMSPC operate a route between Liverpool and Douglas (assuming Manannan). The route between Liverpool and Douglas would require a small alteration of course to pass between Mona and Morgan Array Areas, and along the west boundary of Morgan Array Area. The additional distance and service speed would result in a 0.5 minute increase in journey time. The advertised service is 2:45 hours (165 minutes), with AIS analysis suggesting that the average crossing duration is 135 minutes. There is some variation in transit time but 90% of 2019 trips were within 15 minutes of the average. Therefore, given the crossing duration of several hours, a natural variation in crossing of up to 15 minutes and natural variation in turnaround times, 0.5 minutes of additional transit time is not considered to render this service unviable.

7.3.2.1.8 Seatruck operates routes between Heysham and Ireland. Both routes would pass between Mona and Morgan Array Areas, requiring minor alterations of course (amended waypoints) to clear both Projects. The route between Heysham and Dublin has a negligible 0.3 minute deviation whilst the Heysham to Warrenpoint route would require a 4.3 minute deviation, assuming the passage plan is through the centre of the route between Mona and Morgan Array Areas. The advertised service is 8 hours (480 minutes), with AIS analysis suggesting that the average crossing duration (limited to the extent of the CRNRA study area) is 260 minutes for Heysham to Warrenpoint and 280 minutes for Heysham to Dublin. There is a large variation in transit time with 72% of 2022 trips were within 30 minutes of the average for Heysham to Warrenpoint and 42% within 30 minutes of the average for Heysham to Dublin. Therefore, given the crossing duration of several hours, a natural variation in crossing of up to 30 minutes and natural variation in turnaround times, between 0.3 and 4.3 minutes of additional transit time is not considered to render these services unviable.

7.3.2.1.9 P&O and Seatruck routes between Liverpool and Dublin are not directly affected by the Projects.

7.3.2.1.10 The Morgan Offshore Wind Project's offshore booster station would not materially impact upon most of the routeing decisions made by Irish Sea ferries, given its proximity to both the Morecambe Array Area and existing oil and gas platforms. However, for Stena Line routes to the east of the Isle of Man, it could necessitate an additional minor deviation were it to be located within the most westerly portion of the search areas to maintain suitable clearances.

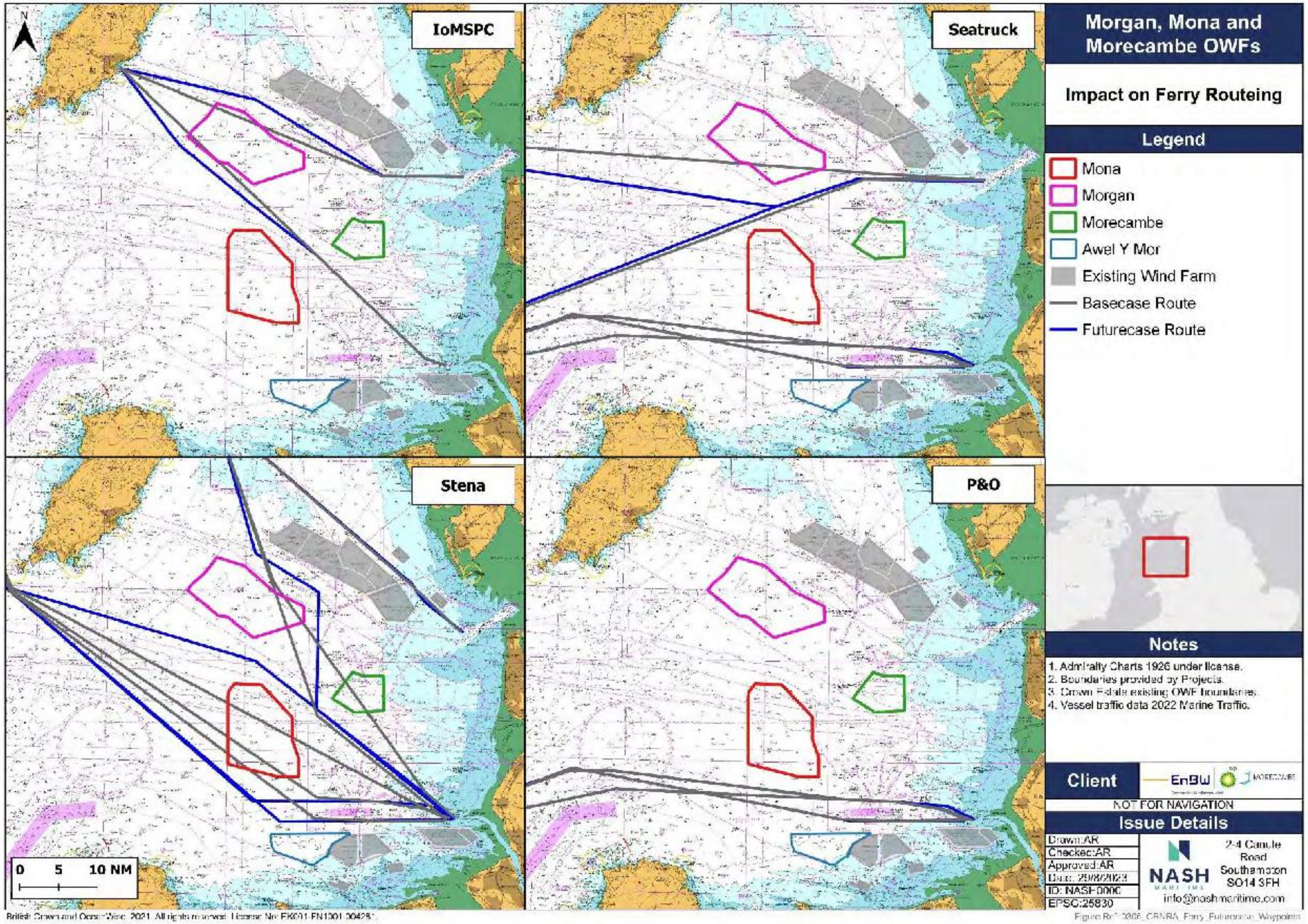


Figure 44: Impact on ferry routeing.

Table 26: Impact on vessel routeing in normal conditions.

Operators	Routes	Example Vessels	Approximate Annual Crossings (2019)	Approximate Annual Crossings (2022)	Baseline Distance (nm)	Baseline Time (Minutes)	Service Speed (Knots)	Total Distance with Project (nm)	Additional Distance with Projects (nm)	Additional Time with Projects (Minutes)
IoMSPC	HEY – DOUG	ARROW	86	107	46.8	225	13.2	47.3	+0.5	+2.1
		BEN-MY-CHREE	1286	1275			17.2			+1.6
		MANANNAN	0	69			28.8			+1.0
	LIV – DOUG	MANANNAN	628	590	56.9	165	28.8	57.2	+0.3	+0.5
		BEN-MY-CHREE	46	3			17.2			+0.8
Stena	LIV – BEL W of IOM & No TSS	STENA EDDA / STENA EMBLA STENA ESTRID (2022 Only) STENA HORIZON (2019 Only) STENA LAGAN (2019 Only) STENA MERSEY (2019 Only) STENA FORECASTER STENA FORERUNNER (2019 Only) STENA FORETELLER (2022 Only)	1442	1098	113.3	480	18.7	114.7	+1.4	+4.5
	LIV – BEL W of IOM & East TSS		0	226	115.9			117.1	+1.2	+3.9
	LIV – BEL W of IOM & West TSS		0	166	115.2			117.3	+2.1	+6.8
	LIV – BEL E of IOM (E of Calder)		153	196	113.9			118.9	+5.0	+16.0
	LIV – BEL E of IOM (W of Calder)		200	194	114.9			118.9	+4.0	+12.7
	HEY – BEL (E of IOM)	STENA HIBERNIA / STENA SCOTIA	1150	1094	No Change					
Seatruck	HEY – WAR	SEATRUCK PERFORMANCE SEATRUCK PRECISION	967	1099*	100.3	480	15.4	101.4	+1.1	+4.3
	HEY – DUB	SEATRUCK PACE SEATRUCK PANORAMA	523	606**	109.3	480	15.0	109.4	+0.1	+0.3
	LIV – DUB	CLIPPER PENNANT / SEATRUCK PACE / SEATRUCK POWER CLIPPER (Seatruck) PROGRESS SEATRUCK PANORAMA (2019 Only)	1800	2091	No Change					
P&O	LIV – DUB	MISTRAL / NORBANK / NORBAY	1600	1162						

7.3.3 Ferry Routeing in Adverse Weather

7.3.3.1.1 **Section 7.3.2** has been limited to an assessment of routeing in typical weather conditions. Where significant adverse weather is encountered, ferries may take less direct routes to take advantage of lees from land masses, avoiding dangerous sea states or minimising the motions onboard. **Figure 45** shows anticipated adverse weather routeing with and without the Projects in situ. The 2019 and 2022 AIS data has been used to approximate the transit speeds and decision making in adverse weather (**Table 27**). Each revised passage plan was developed by the NASH project team, including master mariners, and account for existing decision-making principles and passage plans where provided by operators (such as passing at least 1.5 nm from a WTG) that were obtained during consultation with operators. These were further developed during the navigation simulations undertaken to inform the Environmental Statement involving Masters from each ferry company. These passage plans are shown in **Appendix C**.

7.3.3.1.2 **Stena Heysham to Belfast** route may choose not to transit between West of Duddon Sands and Barrow and pass to the west of West of Duddon Sands where there is greater sea room and weather routeing optionality. This was estimated during navigation simulations to occur with significant wave heights between 3 m and 3.5 m (occurring approximately monthly on average during winter months). Within the 2022 data, vessels choosing to do so incurred approximately 40-70 minutes of transit time, albeit with significant variation in crossing duration. With the Project Array Areas in place, and were the route between Morgan Array Area and Walney OWF not deemed navigable in adverse weather, they may choose to pass to the west of Morgan Array Area before proceeding north (to the east of IoM). This is estimated to incur a further increase in transit times by 63 minutes of transit, a total delay of approximately +103 to +133 minutes to the normal route. Alternatively, vessels may elect to continue further west and pass to the east of IoM, with a reduced transit distance but more exposed to the elements, (this is not shown in **Figure 45** as the existing datasets show a dominance of adverse weather routing to the east of IoM).

7.3.3.1.3 **Stena Line Liverpool to Belfast.** The Stena Line ferries are susceptible to excessive roll motions with seas in excess of 3 m Hs on the beam (occurring approximately monthly on average during winter months), posing a risk to passengers and crew. The existing practice in such conditions would be for vessels to alter course to the southwest to find a more comfortable heading. Within the 2022 data, this accounted for approximately an additional 20 to 60 minutes in additional distance and reduced speed, albeit with significant variation in crossing duration. The footprint of the Mona Array Area is clear of the key adverse weather routes taken by Stena Line, however, the presence of the Projects may require Stena Line to more frequently take this adverse weather route, increasing journey times. Routes to the east of the IoM are used in adverse weather and an updated passage plan is shown in **Figure 45** on this basis with the Project Array Areas in place (passing between Morecambe and Mona Array Areas, and Morgan and Mona Array Areas) although if the routes between the Project Array Areas are not considered navigable in adverse weather then they may elect to navigate using the west of IoM route described above given the far greater journey time this would necessitate.

7.3.3.1.4 **IoMSPC Heysham and Douglas.** The Ben-my-Chree is constrained in heavy seas on the beam, which can cause large roll motions. During navigation simulations, it was determined that with significant wave heights of approximately 3 m on the beam, the roll exceeds 10 degrees and occasionally 30-degree motions which would be unsafe for passengers and cargo. Analysis of 2022 AIS data showed that in such conditions, the vessel tracked southwest of its usual course to minimise roll and this accounted for approximately an additional 10 to 23 minutes of journey time, albeit with significant variation in crossing duration. Given that the presence of Morgan Array Area prevents this action from being taken, the navigation simulations concluded that in conditions greater than approximately 2.5 m Hs (equating to monthly summer and fortnightly winter conditions) the vessel would choose to pass south of Morgan Array Area. This would necessitate a further increase in transit times by 24 minutes in journey times, a total delay of at least 34 minutes to the normal route.

7.3.3.1.5 **IoMSPC Liverpool and Douglas.** The Manannan is most constrained with wind and sea on its bow, which can cause large pitch and roll motions. During the navigation simulations undertaken to inform the Environmental Statement, it was concluded that the most effective mitigation was to reduce speed to half ahead, which would generally result in a reduction of 30% speed over ground. During navigation simulations, it was determined that with significant wave heights of approximately 2.5 m on the beam, there was a need to take some action. However, by adverse weather routeing to the south, full speed could be maintained within lee of Anglesey for longer, noting that this action could take the Manannan clear of the development area of the Mona Array Area. Analysis of 2022 AIS data showed that in such conditions, the vessel tracked southwest of its usual course and this accounted for approximately an additional 10 to 33 minutes of journey time, albeit with significant variation in duration. In order to clear the Mona Array Area, a further increase in journey times by 13 minutes is required, a total delay of at least 23 minutes to the normal route.

7.3.3.1.6 **Seatruck** adverse weather routeing was generally limited within the vicinity of the Project Array Areas and this was confirmed during the navigation simulations. Within the 2022 AIS data, tracks diverged approximately west of the Mona and Morgan Array Areas, accounting for approximately an additional 28 minutes of journey time for both routes, albeit with significant variation in duration. The additional deviation required to avoid the Project Array Areas was minor. However, it was noted that on rare occasions as a result of particular metocean conditions, adverse weather routes passed through the Morecambe Array Area and such transits would necessarily need to follow the more frequent route between Mona and Morgan Array Areas.

7.3.3.1.7 The increase in delays during adverse weather has several implications for the vessel schedules that could increase the number of cancellations. This includes hours of rest requirements for the bridge teams and schedule/turn around constraints described above.

7.3.4 Summary

7.3.4.1.1 **Section 7.2** has described how the Projects might impact upon ferry operations and routeing in both normal conditions and adverse weather. Whilst the impacts vary by operator, the results suggest that in normal conditions the additional transit duration is not likely to significantly impact upon ferry operations. However, in adverse weather, the reduced sea room and increased duration of journey, particularly if vessels elect to deviate around all three Project Array Areas, could necessitate additional operational constraints and could result in cancellations to some services.

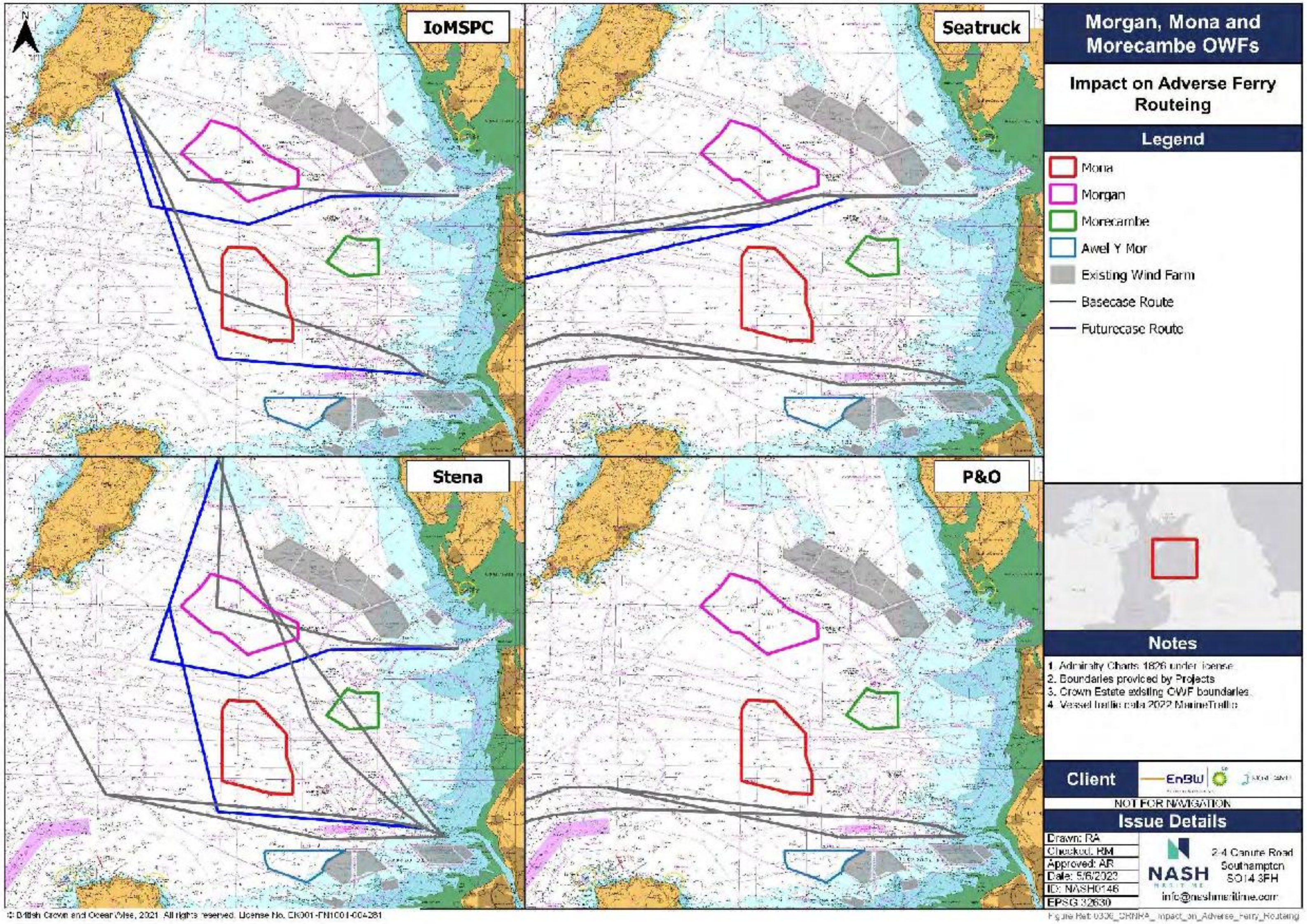


Figure 45: Impact on ferry routes in adverse weather.

Table 27: Number of non-typical vessel transits (outside 95th/99th percentiles) and increased transit duration.

Operator	Route	Example Vessels (2019 to 2022)	Approximate Annual Crossings Effected	Baseline Distance (nm)	Baseline Time (Minutes)	Total Delay Base case (Minutes)	Future case Distance (nm)	Additional Project Delays on Base case (Minutes)	Total Delay with Projects Will be at Least (Minutes)
IoMSPC	HEY – DOUG	Ben-my-Chree	17-21	50.1	225	+10 to +23	56.4	+24	+34 to +47
	LIV – DOUG	Manannan	31-34	61.2	165	+10 to +33	66.6	+13	+23 to +46
Stena Line	LIV – BEL W	Stena Edda Stena Embla Stena Mersey Stena Horizon Stena Lagan Stena Forecaster Stena Forerunner	15-20	121.2	480	+20 to +60	121.2	+0	+20 to +60
	LIV – BEL E (W of Calder)		8-13	114.0	480	+0 to +30	134.8	+70	+70 to +100
	HEY – BEL	Stena Hibernia Stena Scotia	24-69	106.9	480	+40 to +70	123.8	+63	+103 to +133
Seatruck	HEY – WAR	Seatruck Performance Seatruck Precision	38-44	102.0	480	+27	102.2	+1	+28
	HEY – DUB	Seatruck Pace Seatruck Panorama	25-27	110.8	480	+28	110.8	+0	+28

7.4 POTENTIAL IMPACT OF ARRAYS ON CARGO/TANKER VESSEL ROUTEING

7.4.1 Introduction

7.4.1.1.1 OWFs can impact on vessel routeing by creating an obstruction in otherwise navigable waters that requires a deviation of their route. For commercial vessels this has the potential to result in a significant increase in costs or make schedules unviable. Furthermore, impacts on routeing may result in increased risks, which are considered in **Sections 7.7** and **7.8**.

7.4.2 Cargo/tanker Shipping Routeing in Normal Conditions

7.4.2.1.1 **Figure 46** show the anticipated changes in cargo/tanker ship routeing. **Table 28** shows the increase distance transited for each of the identified routes in order to clear the Project Array Areas. Each revised passage plan was developed by the NASH project team, including master mariners, and account for existing decision making principals (such as passing at least 1.5 nm from a WTG).

7.4.2.1.2 The most significant shipping routes in the CRNRA study area (more than one vessel per day) are between Off Skerries TSS and Liverpool Bay TSS. These are relatively unaffected by the Projects with no additional transit duration. The routes from the west of the IoM and Liverpool Bay TSS would necessitate a minor deviation around the southwestern corner of Mona Array Area.

7.4.2.1.3 Less trafficked routes are more dispersed within the CRNRA study area and therefore greater deviations are encountered. The most impacted routes are between Douglas and Liverpool TSS with an additional 6.5 nm steaming and between Off Skerries TSS and Heysham with an additional 4.8 nm of steaming. However, less than one vessel per week utilises these routes. The majority of other affected routes are of similarly low intensity and typically are routeing between the Mona and Morgan Array Areas or deviating to the southwest of Mona Array Area. Some routes have minor reductions in distance where less direct routes routinely used to avoid traffic or weather are no longer possible. Furthermore, this necessitates greater course changes to pass between the Project Array Areas, or as is the case for Route 15a, necessitates not utilising the Liverpool TSS when they previous would have.

7.4.2.1.4 Given the low intensity of the most impacted routes, their greater distance travelled and the lower criticality of their schedules, provided the routes between the Projects are safe, these impacts are unlikely to make their operations unviable.

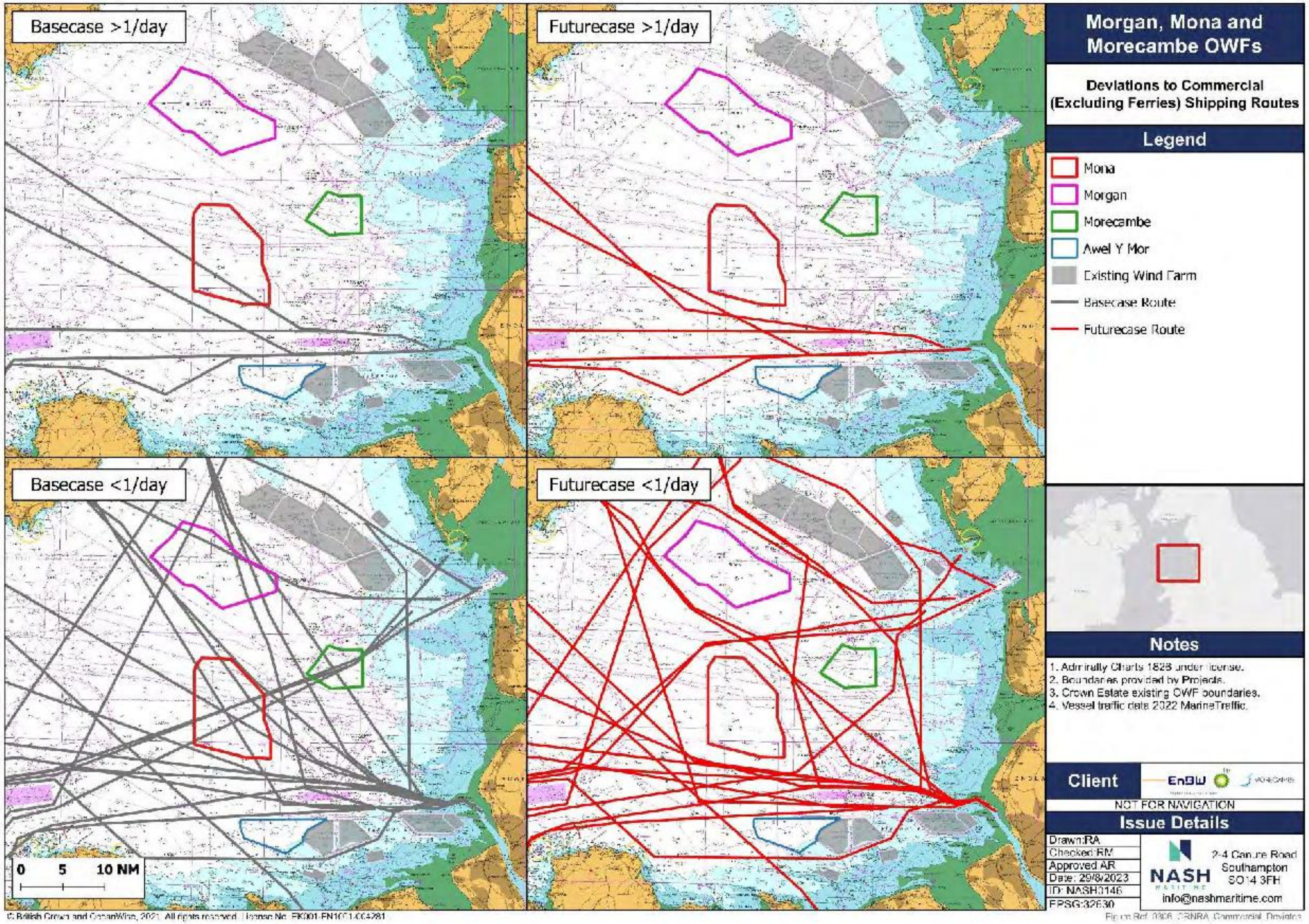


Figure 46: Change in cargo/tanker shipping routes with Projects Array Areas.

Table 28: Increase in distance for impacted routes with Project Array Areas in place.

ID	Route	Approximate Annual Crossings (2022)	Baseline Distance (nm)	Future Case Distance	Additional Future Case Distance (nm)	Total Additional Distance per Year (nm)
6	Off Skerries TSS to Heysham (east)	23	59.9	64.7	4.8	110.4
7	Barrow € to Off Skerries TSS	4	72.7	73.9	1.2	4.8
8	Heysham to Off Skerries TSS (west)	7	62.0	64.9	2.9	20.3
13	Liverpool TSS to W IoM (west)	533	67.6	69.7	2.1	1,119.3
15a	Liverpool to E I–M - west	10	83.6	87.1	3.5	35
15b	Liverpool to E I–M - central	54	77.3	78.0	0.7	37.8
15c	Liverpool to E I–M - east	14	75.9		2.1	29.4
16	Douglas to Heysham	6	45.4	46.1	0.7	4.2
18	Liverpool to west IoM	153	66.3	69.0	2.7	413.1
19	Douglas to Liverpool TSS (east)	9	67.4	73.9	6.5	58.5
21	Off Skerries TSS to Solway Firth	42	73.2	74.3	1.1	46.2
22	Douglas to Liverpool TSS	8	59.8	60.2	0.4	3.2
26	Liverpool TSS to Northern Irish Sea (W)	55	65.2	65.9	0.7	38.5
27	Douglas to Liverpool	6	58.9	58.3	-0.6	-3.6
Total						1,879.3

7.4.3 Cargo/tanker Shipping Routeing in Adverse Weather

7.4.3.1.1 Analysis of adverse weather routeing in **Section 5.2.5.1** during 2019 and 2022 named storms did not identify any particular changes to typical routes. There was a greater demand for the anchorages along the Welsh coast, and no discernible impacts of the Projects are identified for the availability of anchorages for vessels to seek shelter in adverse weather. Some vessels were recorded loitering both to the west and within the Projects, likely riding the conditions before they could berth. There is sufficient clear sea room to the west of the Projects for this practice to continue.

7.4.4 Adverse Weather Pilotage

7.4.4.1.1 **Section 5.2.6** highlighted that during strong northwesterlies, pilots may be overcarried or boarded at Douglas on the IoM using the lee of the island. There is 12 nm clear sea room between Morgan Array Area and Douglas, and therefore these operations would not be directly impacted during disembarkation or embarkation. However, it was noted that the Projects can impact these activities in two ways.

7.4.4.1.2 Firstly, this activity can result in convoys of multiple commercial vessels navigating between Douglas and Liverpool. This has a significant, short-term increase in density and collision risk, particularly where they are routed between the Projects. The 2019 AIS data indicated that half of the identified transits navigated through the Liverpool Bay TSS, and therefore would naturally pass to the west of Mona Array Area. It is reasonable to assume that not all of these convoys would pass between the Project Array Areas, and therefore, the increased collision risk within the routes would be manageable.

7.4.4.1.3 Secondly, if commercial vessels were to navigate through the TSS and to the west of Mona Array Area, this would increase their transit distance by approximately 7 nm which would equate to an additional transit time of approximately 30 minutes. This may have commercial impacts on the ports provision of pilots, albeit this occurs relatively infrequently and the requirement for pilots to transfer between Douglas and Liverpool (before or after the pilotage movement) would be a more significant constraint on time.

7.4.4.1.4 During the navigation simulations undertaken to inform the Environmental Statement, these scenarios were tested to create complex, multi-vessel traffic situations. In all cases, it was demonstrated that there was sufficient sea room for collision avoidance activities to maintain a suitable Closest Point of Approach (CPA) from other vessels and fixed structures. However, in some instances this action resulted in the vessels reducing speed which would have operational impacts.

7.4.5 Summary

7.4.5.1.1 Commercial shipping routes are concentrated into the Port of Liverpool, and therefore minor deviations around the Mona Array Area are required. Minor routes with fewer than three vessels per week would have greater deviations, but provided the routes between Projects were safe, this is not considered to make such operations unviable.

7.5 POTENTIAL IMPACT OF ARRAYS ON SMALL CRAFT NAVIGATION AND SAFETY

7.5.1 Recreational

7.5.1.1.1 The analysis of recreational vessel transits presented in **Section 5.2.4** identified relatively few cruising routes passing across the CRNRA study area; most are concentrated near shore and/or clear of the Projects Array Areas. Therefore, the Mona, Morecambe, and Morgan Array Areas show a low density of AIS tracks compared to the adjacent waters. During consultation with the RYA, it was noted that recent evidence from AIS data suggests that yachts avoid transiting through an OWF less than previously thought based on responses to surveys. The 2022 AIS data show that 79% of cruising vessels that sail between Morecambe Bay and Douglas avoided transiting through the existing offshore windfarms (Walney and West of Duddon Sands) by taking a longer southerly route. Much of this evidence has been collected from earlier Round 1 and 2 OWFs, where turbines were generally closer together. The greater turbine spacing for Round 4 projects may promote greater navigation through these Projects.

7.5.1.1.2 Vessels sailing along this route would be able to avoid transiting through the Morgan Array Area without significantly increasing the passage time. However, this may increase the number of recreational crafts navigating between the Projects, albeit that the density of recreational traffic near to the Projects is low.

7.5.1.1.3 Cruising vessels sailing between Whitechapel and Anglesey can also avoid the northwestern boundary of Mona Array Area with a small westward deviation. Even though this does not add significant distance to the passage, vessels that avoid the Mona Array Area are forced to sail adjacent to the relatively more trafficked waters surrounding Douglas, increasing the risk of collision. The route connecting Liverpool and Douglas crosses the centre of the CRNRA Study area through a route between the Morgan, Morecambe, and Morgan Array Areas. The Projects could also interfere with the annual LYC IoM Midnight race from Liverpool to Douglas, which usually has around 10 vessels participating, but had 40 vessels in 2019 (10th anniversary of race). Sailing along this route through the CRNRA study area in rough conditions could also increase the risk of collision or contact with the offshore windfarm structures and create a heavily trafficked route between Liverpool and Douglas. The vessels cruising along the other major identified routes adjacent to the Projects (Douglas to Conwy and Conwy to Morecambe Bay) should not be significantly affected by the offshore windfarm structures.

7.5.1.1.4 Where yachts choose to navigate through the OWF, there is a risk of colliding with other craft, due in part to the reduced sea room between rows of turbines. This is partly exacerbated by the greater difficulty in visually, or through radar, identifying other craft once within an OWF. Where yachts choose to navigate parallel to an OWF, they may do so within a route which is created between the three Project Array Areas. This waterway is shared with large commercial operators and therefore there is a greater risk of collision. The vessel traffic surveys identified relatively few offshore cruising vessels navigating between Ireland, the UK and IoM. On most days of radar collection, no recreational craft were observed, even in summer. Therefore, it would be reasonable to conclude that the increase in risk of collision would be minor.

7.5.2 Fishing

7.5.2.1.1 A number of commercial fisheries operate within the CRNRA study area, with boats based across Welsh, English, Scottish, Northern Irish and IoM harbours, as well as several internationally based vessels (see **Section 5.2.2.6**). A recent study by the National Federation of Fishermen's Organisations (NFFO) and Scottish Fishermen's Federation (SFF) has highlighted the potential loss of fishing grounds which OWFs might cause, referred to as "Spatial Squeeze" (NFFO, 2022). Such an effect may result in boats currently fishing within the footprints of the Projects being offset into the adjacent routes, interacting with other passing traffic and increasing the risk of collision.

7.5.2.1.2 The 2022 AIS data was reviewed to identify what fishing activities take place in the existing OWFs, for example, Walney Extension and Gwynt y Môr OWFs. It was clear that there is extensive fishing taking place in both of these OWFs. Except during construction or major maintenance, whereby Safety Zones are required, there is no restriction on the ability of fishermen to use mobile or static gear within an OWF. Skippers would need to consider any hazards, particularly snagging of subsea cables, or risk of allision with WTGs or collision with CTVs.

7.5.2.1.3 The majority of the fishing activity in the area is carried out using static gear, which requires less space than mobile gear, which is actively towed and may require the vessel to manoeuvre between each turn. However, it should be noted that the spacing between the WTGs at Walney Extension and Gwynt y Môr OWFs is under 1,000 m. The spacing between structures for all three Project Array Areas would be over 1,400 m, offering even greater sea room. This may offer greater potential for fishermen to work mobile gear within the Project Array Areas than has been the case historically. Furthermore, during consultation with fishermen, there is an expectation that fishermen would continue to fish within the Project boundaries during the OWF operation. The Projects are also working with fishermen to develop mitigation and design principles to facilitate co-existence.

7.5.2.1.4 Current fishing activity described in **Section 5.2.2.6** is reflective of where the most favourable fishing areas are located. Fishermen strategically target known fish-rich areas in order to optimise their catch potential and ensure efficient utilization of their time and resources. Upon the completion of the wind farm projects, it is expected that fishermen will continue to fish in the same areas as before, as these areas have been identified as productive fishing grounds. This has been supported through consultation with fishing representatives. If fishing activities are displaced from the wind farm areas, it is unlikely that fishermen will concentrate their efforts in the areas between the Projects, as these locations are already being targeted and there is a need not to overfish the stocks. Furthermore, for static fishermen, placing gear in navigational routes may result in greater loss of gear which is costly to replace.

7.5.2.1.5 Fishing activities between the Project Array Areas is anticipated to remain low, with limited numbers of vessels operating at a low speed (i.e., less than two knots). Furthermore, it has been demonstrated through navigation simulations undertaken to inform the Environmental Statement that the widths of the sea area between each Project would be sufficient sea room to enable passing distances of more than 1 nm (1,852 m) from fishing vessels. As a result, there is abundant space available for other marine users, in particular ferries, to navigate and avoid potential conflicts with the fishing operations in these areas.

7.5.3 Tug and Service

7.5.3.1.1 Vessels operating between operations and maintenance bases and oil and gas platforms may pass near to or adjacent to the Project Array Areas. There is at least 1 nm of suitable clearance between turbines and platforms such that the Projects do not impede on oil and gas activities.

7.5.3.1.2 The routes to be taken by operations and maintenance vessels are not known and therefore assumptions have been made for each of the Projects. Historical incident analysis at other projects suggests that an allision between a CTV and a WTG occurs approximately once every ten years (see **Section 5.3**). These risks can be managed through the application of existing risk control measures.

7.5.3.1.3 A clear additional risk of the Projects are the additional vessel movements supporting operations and maintenance and their interaction with other traffic. In particular, it is likely that multiple CTVs will cross between the Projects and interact with other passing traffic, including ferries and fishing boats. Additional risk controls should be identified to deconflict CTV movements with other passing traffic, such as through passage planning.

7.6 POTENTIAL IMPACT OF ARRAYS ON COMPLIANCE WITH GUIDANCE AND BEST PRACTICE

7.6.1 Introduction

7.6.1.1.1 In this section, the safety aspect of navigating between Mona, Morgan and Morecambe Array Areas is reviewed.

7.6.1.1.2 Given the routeing assumptions identified in **Sections 7.3** and **7.4**, **Table 29** and **Figure 47** show the anticipated number of vessels navigating through each of the key routes. Small craft estimates are determined based on the MGN654 traffic surveys undertaken for each Project, the actual numbers of vessels vary depending on time of day and season. Project vessel numbers are worst credible assumptions based on the MDS and potential operations and maintenance bases.

Table 29: Predicted traffic numbers per CRNRA routes.

Route	Season	Passenger/ Year (2022 Per Day)	Cargo/ Tanker Year (Per Day)	Small Craft Per Day**	Project Per Day***	Total Per Day
Between Mona and Morgan Array Areas	Annual	3,432 (Average: 9, Max:16)	136 (Average: 0.4, Max: 4)	0 to 1 recreational vessels 0 to 2 fishing vessels 0 to 1 service vessels	0	10 to 24
	April to October*	Average: 11 Max: 16				
Between Mona and Morecambe Array Areas	Annual	2,081 (Average: 6, Max: 10)	146 (Average: 0.4, Max: 4)	0 to 2 recreational vessels 0 to 2 fishing vessels 0 to 1 service vessels	0	7 to 19
	April to October*	Average: 7 Max: 10				

Route	Season	Passenger/ Year (2022 Per Day)	Cargo/ Tanker Year (Per Day)	Small Craft Per Day**	Project Per Day***	Total Per Day
Between Morgan Array Area and Walney OWF	Annual	1,851 (Average: 5, Max:11)	171 (Average: 0.5, Max: 5)	0 to 2 recreational vessels 0 to 2 fishing vessels 0 to 1 service vessels	3	9 to 24
South of Mona Array Area	Annual	3,849 (Average: 10.5, Max: 17)	5370 (Average: 14.7, Max: 29)	0 to 2 recreational vessels 0 to 2 fishing vessels 0 to 1 service vessels	3	28 to 54
East of Morecambe Array Area	Annual	4 (Average: 0.01, Max: 1)	75 (Average: 0.2, Max: 2)	0 to 2 recreational vessels 0 to 2 fishing vessels 1 to 2 service vessels	2	3 to 11

Notes: *Manannan operates April to October, ** Estimates based on radar traffic surveys, ***Estimates based on worst case MDS

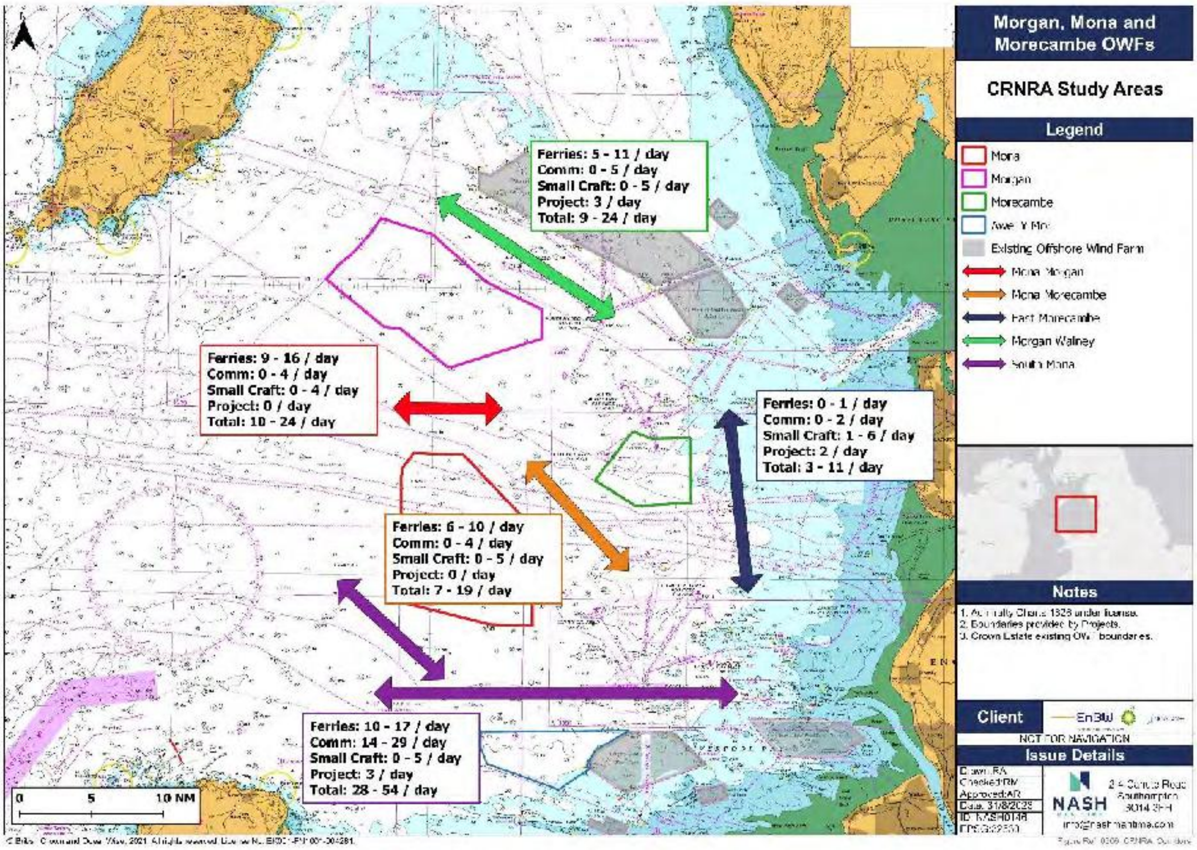


Figure 47: Predicted movement numbers per route.

7.6.2 Application of Guidance

7.6.2.1.1 Two principal guidance documents describe how routes between adjacent OWFs should be developed (see **Figure 48**). Firstly, MGN654 proposes a 20 degree rule, namely that during transit in adverse weather conditions, vessels could be deviated by up to 20 degrees from their route. Therefore, a route of 10 nm in length would require a width of at least 3.6 nm.

7.6.2.1.2 Secondly, the World Association for Waterborne Transport Infrastructure (PIANC) WG161 guidance stipulates a route should consist of:

- A traffic lane that is between 4x ship lengths and 8x ship lengths depending on traffic volume.
- Sufficient space to perform a round turn in an emergency manoeuvre which is given as 6x ship lengths plus 0.3 nm.
- 500 m safety zones from the WTGs/OSPs.

7.6.2.1.3 **Table 30** compares the routes between Mona, Morgan and Morecambe Array Areas with MGN654 and PIANC guidance documents described above. **Figure 49** visualises the PIANC guidance for 300 m length design vessels applied to each OWF.

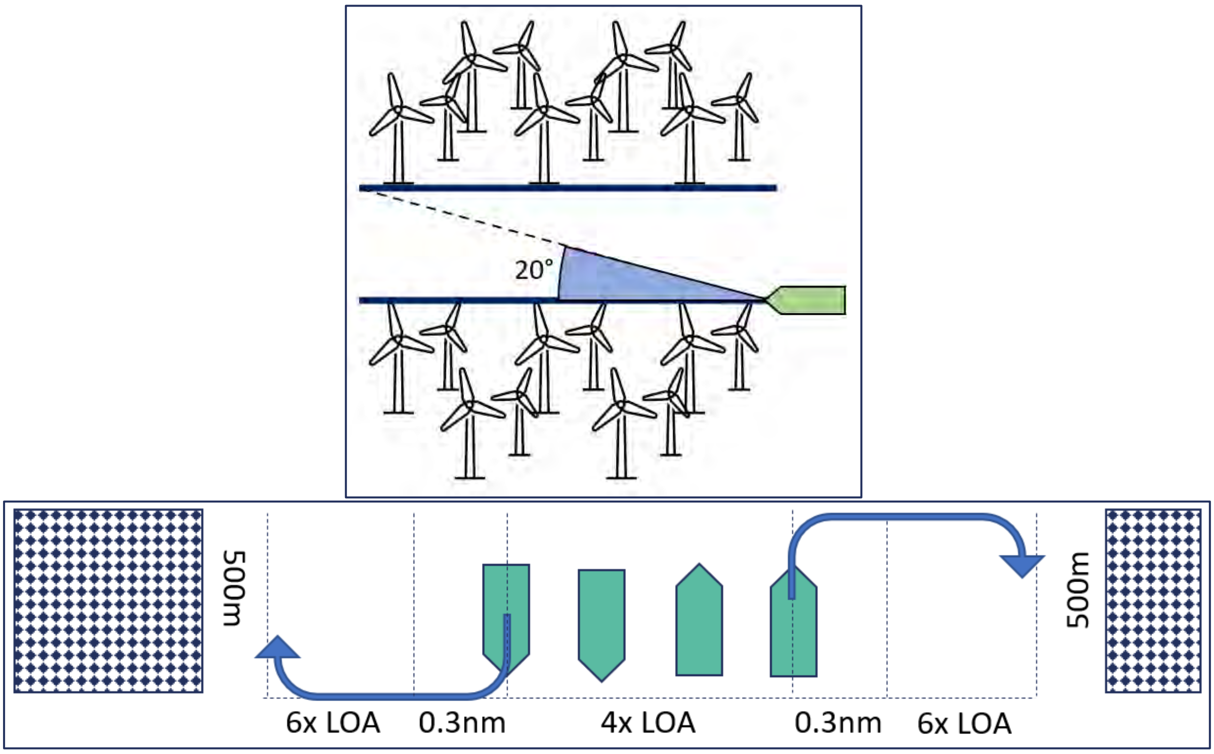


Figure 48: Comparison of MGN654 (top) and PIANC WG161 (bottom) guidance.

7.6.2.1.4 All three routes comply with the 20-degree rule recommended by the MCAs MGN654 and the PIANC guidance for both 200 m and 300 m design vessels, given the volume of traffic. Whilst the average vessel sizes for all three routes is less than 200 m, some vessels up to 300 m do transit these routes. Furthermore, sensitivity analysis was undertaken to increase the number of vessels from the <4,400 to >4,400 categories in the PIANC guidance, which requires a greater traffic lane width. All three routes meet guidance even with increased vessel numbers and design vessel size.

Table 30: Comparison of CRNRA routes with guidance (green = complies, orange=does not comply).

Route	Narrowest Width	Length	MGN654 Degrees	Transits/ Year	Average Vessel	Max Vessel	PIANC 200 m Target	PIANC 300 m Target	PIANC 300 m Target (> Vessel Numbers)
Between Morgan Array Area and Walney OWF	4.5 nm	11.5 nm	21.4	2,022	132 m	215 m	2.9 nm	3.7 nm	4.1 nm
Between Mona and Morgan Array Areas	6 nm	5.5 nm	48	3,568	155 m	289 m	2.9 nm	3.7 nm	4.1 nm
Between Mona and Morecambe Array Areas	5.7 nm	5.0 nm	49	2,227	173 m	289 m	2.9 nm	3.7 nm	4.1 nm

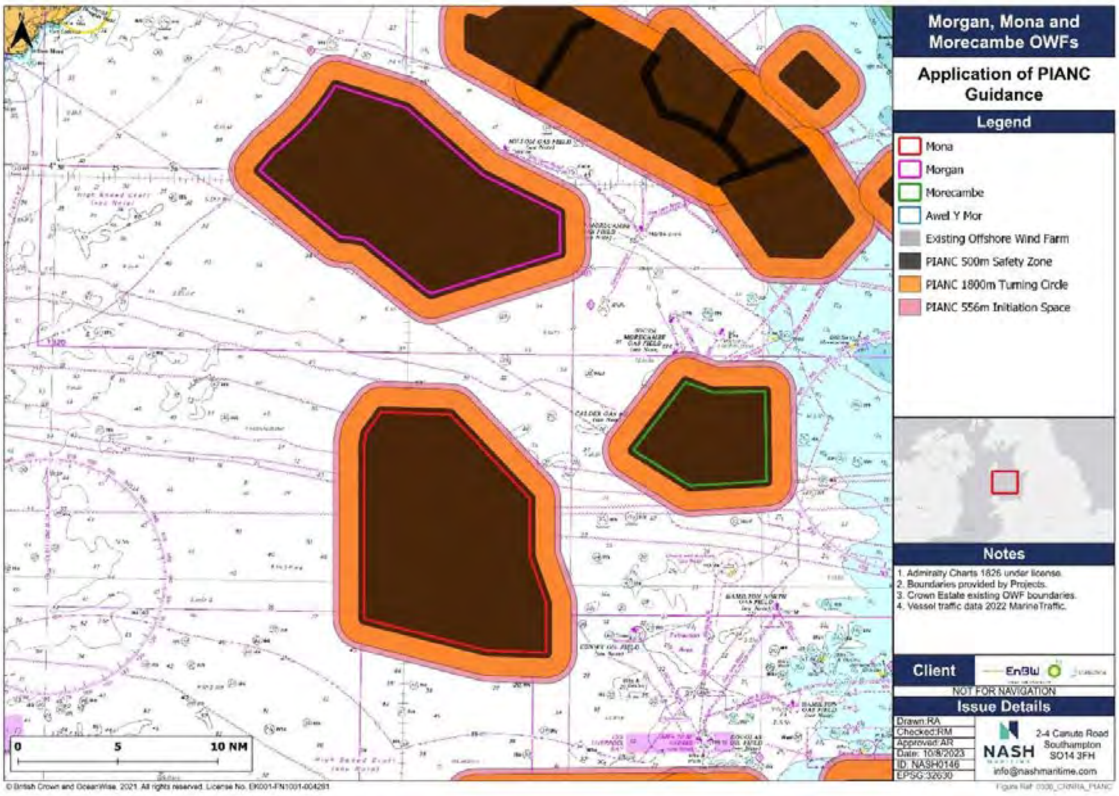
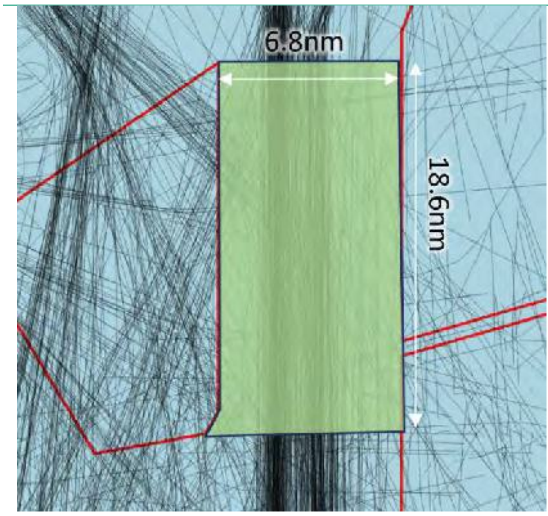


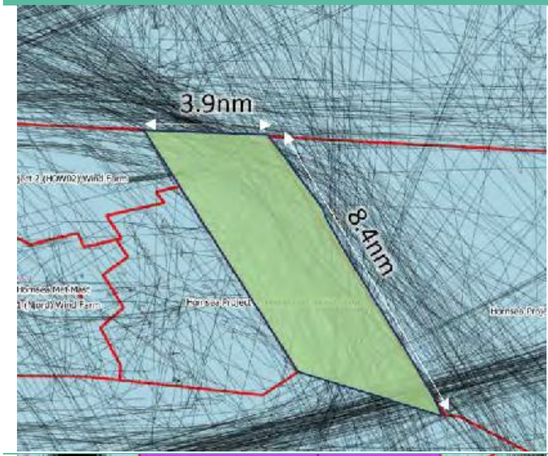
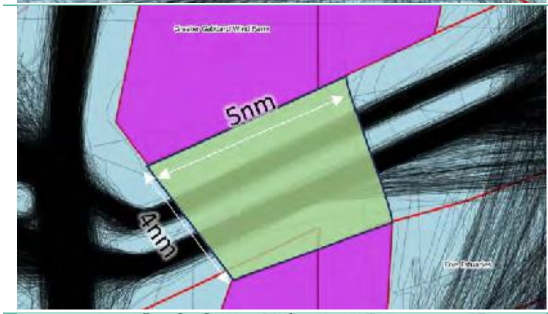
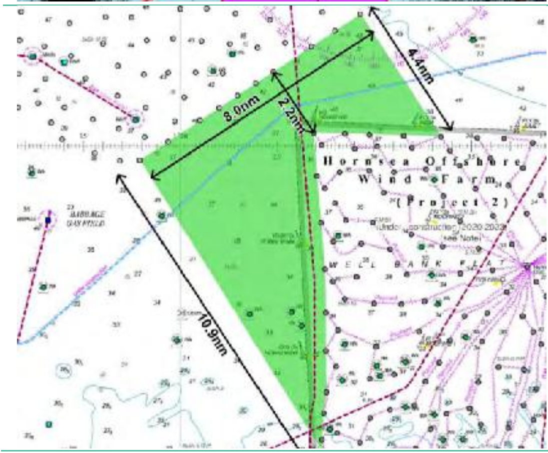
Figure 49: Comparison of PIANC guidance for safety buffers for 300 m.

7.6.3 Historical Precedent within the UK

7.6.3.1.1 To further test the feasibility of the resultant routes, a review of historical precedent elsewhere in the UK has been undertaken (see **Table 31**). Whilst the specific situation, geometry and traffic numbers of each are different and case dependent, the Hornsea Zone routes in particular have similarities in dimensions and traffic volume.

Table 31: Routes between UK OWFs.

Route	Description
	**Name**: Ormonde/Barrow-Walney/West of Duddon Sands **Dimensions**: 2.2 nm by 7.7 nm. **Approximate** Transits/Year: 1,333 Average Vessel Size: 125 m Maximum Vessel Size: 142.5 m Route is marked by a series of cardinal marks approximately 600 m from the WTGs. Route is principally used by Stena Line Ferries between Heysham and Belfast (approximately three per day). Some commercial traffic but less than 100 m LOA (less than one per day). Most recreational and fishing on transit (and higher density inshore to east of Ormonde/Barrow). Significant CTVs crossing route from Barrow to OWFs.
	**Name**: Vanguard-Boreas **Dimensions**: 6.8 nm by 18.6 nm. Approximate Transits/Year: 4,745 Average Vessel Size: 155 m Maximum Vessel Size: 399 m Proposed route between the Vanguard and Boreas sites. This route safeguards the existing Deep Water Route via DR1 light-buoy used by large commercial shipping.

Route	Description
	**Name**: Hornsea Three-Hornsea One **Dimensions**: 3.9 nm by 8.4 nm Approximate Transits/Year: 1,716 Average Vessel Size: 133 m Maximum Vessel Size: 333 m Proposed route between Hornsea One and Hornsea Three. This route enables the regular freight services between the UK and Europe to continue.
	**Name**: Galloper-Greater Gabbard **Dimensions**: 4 nm by 5 nm Approximate Transits/Year: 5,851 Average Vessel Size: 182 m Maximum Vessel Size: 400 m Route exists on the east arm of the Sunk TSS and therefore traffic is bound by Rule 10 of the COLREGs, with Cardinal Marks providing a safe buffer from the OWFs.
	**Name**: Hornsea Four-Hornsea Two **Dimensions**: 2.2 nm (at narrowest) by 8 nm. Approximate Transits/Year: 2,190 Average Vessel Size: 165 m Maximum Vessel Size: Unknown Gap between Hornsea Two and Hornsea Four has a minimum route width of 2.2 nm, including a DFDS regular service. During consultation and the hazard workshop, it was considered by both commercial and regulatory consultees that the gap was sufficient for the frequency and types of vessels navigating this route. Image source: Hornsea Four Application.

7.6.4 Summary

7.6.4.1.1 The routes created between Mona and Morgan Array Area, Mona and Morecambe Array Area and Morgan Array Area and Walney OWF have been tested against guidance and precedent. All three routes are of sufficient width and design that it meets the relevant guidance. Furthermore, the routes are wider or comparable to other OWFs elsewhere in the country with similar traffic profiles and constraints, both constructed and consented.

7.7 POTENTIAL IMPACT ON VESSEL ENCOUNTERS AND COLLISION AVOIDANCE

7.7.1 Commercial Vessel Meeting Situations

7.7.1.1.1 A key factor in the risk of collision is the frequency at which two vessels would meet in the same areas of sea at the same time, necessitating some action to be taken by the vessels. By modelling how vessel routes may change with the Project Array Areas, and taking into account vessel timetables, the concurrent frequency of two commercial vessels meeting can be calculated. For example, were a vessel to depart Liverpool, the presence of the Mona Array Area could require a deviation to the south through the TSS, resulting in new meeting situations which would not have previously occurred.

7.7.1.1.2 The analysis is conducted for the waters between the three Project Array Areas, as shown in **Figure 50**. Given the low proportion of fishing and recreational vessels which carry AIS, only cargo, tankers and passenger vessels (including ferries) have been included in this analysis. Furthermore, as this analysis focusses on ship routes, non-direct transits such as loitering or pilot boarding have not been captured. All commercial vessel tracks within the 2022 AIS data were processed and deviated around the Project Array Areas. For every minute of the year, a count was performed of the number of vessels present in each region. Over the total year, the percentage of time in which zero, one, two or more vessels were predicted is then given.

7.7.1.1.3 **Figure 51** compares the resulting frequencies. For the sea area between Mona and Morgan Array Areas, no commercial vessels are predicted for 75% of the time and 25% of the time one or more vessels would navigate this route. For 2.4% of the year there would be two or more vessels navigating and for 0.1% of the year there would be three or more vessels navigating. With a 6 nm gap, with a low frequency of vessel encounters, the risk of collision is likely to be low. Furthermore. the majority of these vessels would be ferries who are familiar with the route and the passage plans of other vessels so could plan accordingly. Of those routes Seatruck vessels do not typically meet one another within this location (generally meeting to the southwest of IoM and in the approaches to Heysham) and Stena Line typically also meet to the southwest of the IoM.

7.7.1.1.4 For the sea area between Morgan Array Area and Walney OWF, no commercial vessels are predicted for 80% of the time and 20% of the time there would one or more vessels navigating this route. For 0.6% of the year there would be two or more vessels navigating. With between a 4.3 nm and 5.1 nm gap, with a low frequency of vessel encounters, the risk of collision is likely to be low. Furthermore. the majority of these vessels would be ferries (specifically Stena and IoMSPC) who are familiar with the route and the passage plans with other vessels so could plan accordingly.

7.7.1.1.5 For the route between Mona and Morecambe Array Areas, no commercial vessels are predicted for 88% of the time and 12% of the time there would be one or more vessels navigating this route. For 0.6% of the year there would be two or more vessels navigating and rarely would there be three or more vessels (0.01%). With a minimum distance of 5.7 nm, with a low frequency of vessel encounters, the risk of collision is likely to be low.

7.7.1.1.6 For the route with the TSS south of Mona Array Areas, this consists of a busier route with the main approaches to Liverpool for traffic using the TSS and passing to the west of the IoM. No commercial vessels are predicted for 35% of the time and 65% of the time there would be one or more vessels navigating within this gap. 31.6% of the time there would be two or more vessels within this route, 12.2% there would be three or more and 3.8% there would be four or more. The Project boundaries result in vessel traffic approaching Liverpool from the west of the IoM entering this route earlier. Therefore, whilst the absolute numbers of commercial vessels in this region does not increase, they would spend longer transiting within the TSS and its approaches, potentially encountering more traffic.

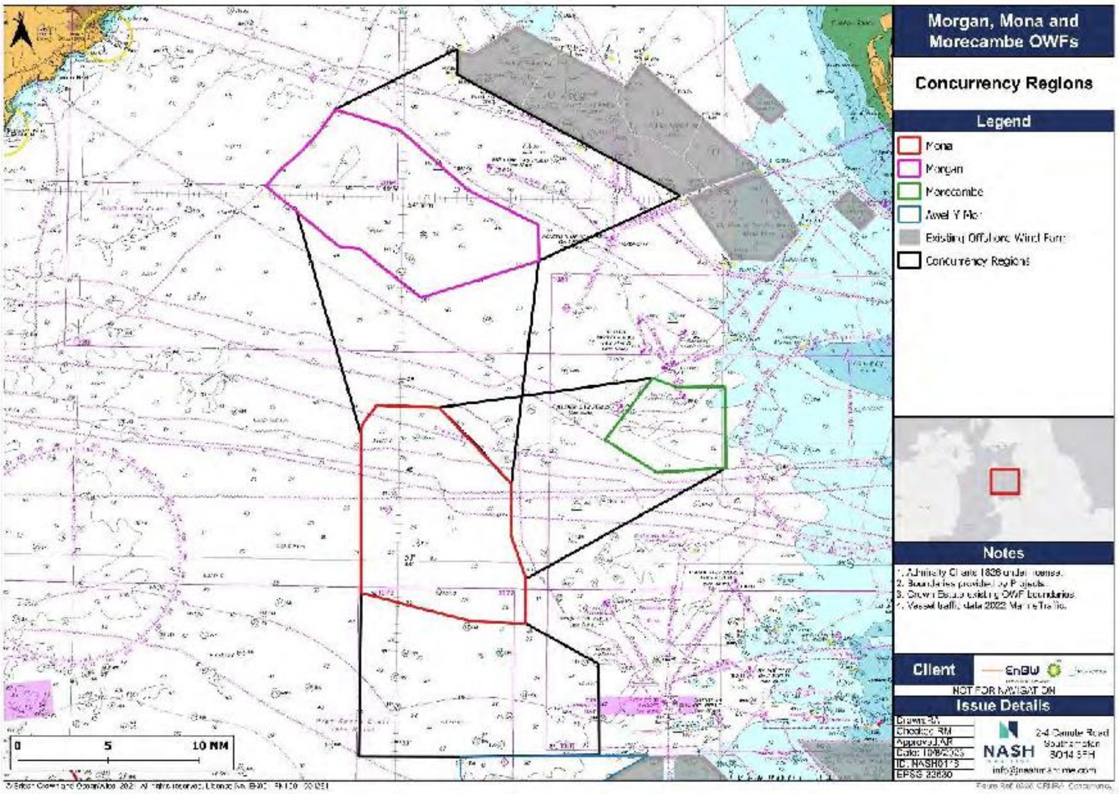


Figure 50: Concurrency regions assessed for analysis.

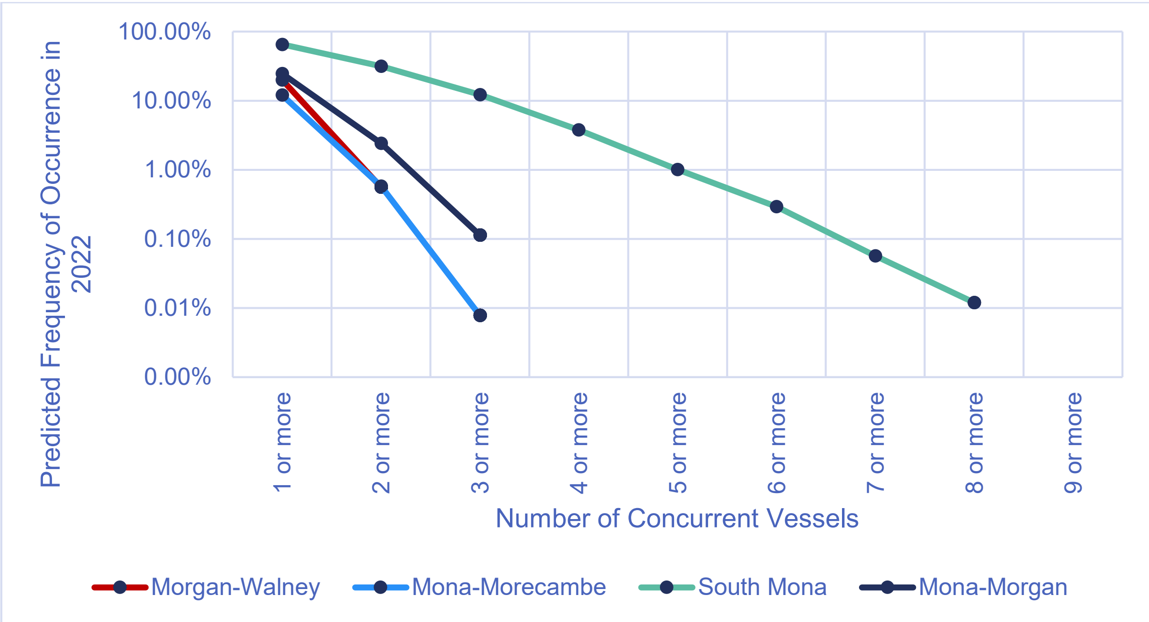


Figure 51: Predicted frequency of concurrent activity of cargo, tanker and passenger vessels (logarithmic scale).

7.7.2 Increased Vessel Encounters

7.7.2.1.1 Ship encounter modelling was undertaken to compare the number of meeting situations before and after the construction of the Projects. A key advantage of encounter modelling is including the temporal element to vessel timetables that are not normally assessed in conventional quantitative maritime risk models. The model uses the concept of a "ship domain", an area of water around a vessel which the master wishes to keep clear. Where a vessel breaches this domain, an encounter occurs, and whilst not necessarily a near miss, could reasonably interpreted to indicate a potential risk of collision. By comparing the number of encounters before and after the construction of an OWF, an appreciation of the greater frequency of meeting situations is derived.

7.7.2.1.2 The ship domain model was developed based on a combination of academic research and a review of existing passing arrangements between vessels within the shipping and navigation study area. A dynamic domain was developed that included speed and vessel length. A vessel travelling faster would maintain a greater area clear ahead to respond to a collision situation. A larger vessel may be less manoeuvrable so would maintain a greater clearance from other vessels to give adequate time to respond.

7.7.2.1.3 The domain was formed of an oval consisting of a:

- A forward domain of three minutes modified by vessel size.
- A port/starboard/aft domain of a function of both speed and length.

7.7.2.1.4 **Figure 52** shows an example of the base case encounter model, with different sized domains reflective of different vessel sizes and speeds. For example, a 187 m ferry travelling at 18 knots would have a domain of 2.3 nm by 0.7 nm whereas a small workboat travelling at a similar speed would have a domain of

0.5 nm by 0.1 nm. A stationary vessel has a domain equal to twice the vessel length.

7.7.2.1.5 Many encounter situations between vessels, such as overtaking, may occur over several minutes. To avoid multiple counting of the same encounter event, only the position at which the encounter with the Closest Point of Approach (CPA) was retained. The modelling was limited to the sea areas around the Projects, and excludes the constrained waterways in harbours/approach channels where vessels naturally come close together (e.g. the Mersey).

7.7.2.1.6 For the base case scenario, without the Projects in place, the model was run and the number of encounters between vessels assessed. Future case route modelling was used to develop the future case scenario and the assessment repeated. All re-modelling was conducted on 2022 AIS data and therefore has the potential to underrepresent with small craft. Further discussion of collision risk involving small craft is contained in **Section 7.5**.

7.7.2.1.7 Across the CRNRA study area, in total, 12,255 encounters were recorded during the 2022 base case (33.6/day). Of these, 33% involved ferries and 25% involved cargo/tankers. 62% occurred south of the westbound lane of the Skerries TSS with a high concentration in the approaches to ports and harbours (see **Figure 53**). Risk controls have been adopted (such as TSS/pilotage) to manage this risk in these busy locations. Less than 2% occurred within the boundaries of the Project Array Areas.

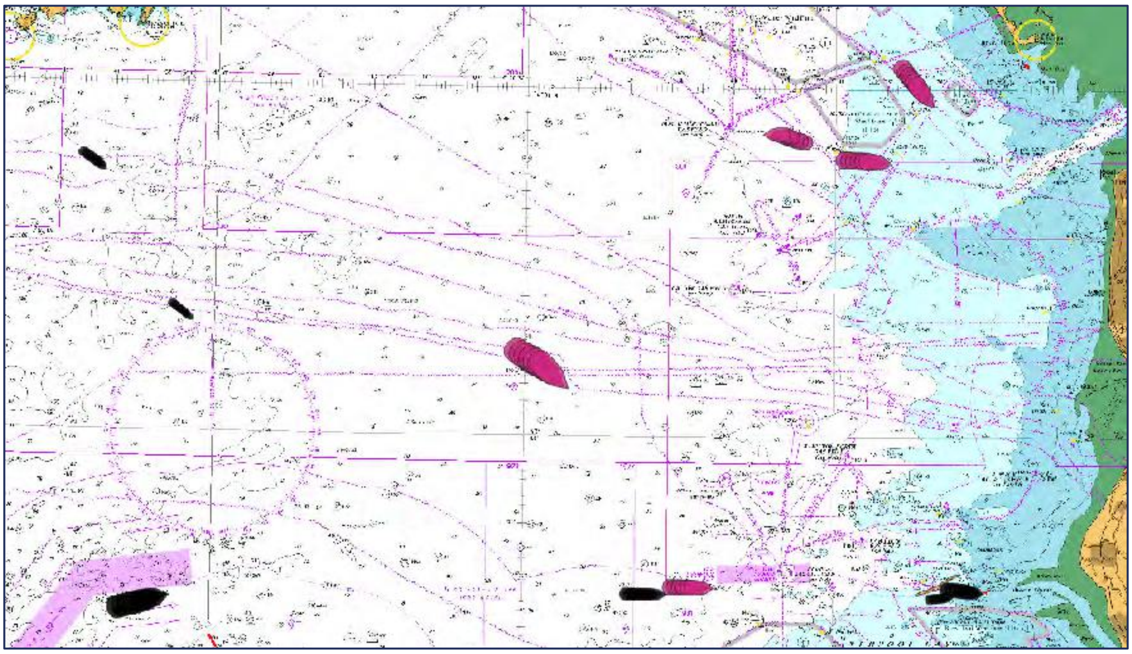


Figure 52: Example of domain model.

7.7.2.1.8 With the future case scenario, a total of 12,497 encounters occurred, a 2% increase on the base case. This constitutes:

- Ferry encountering ferry/cargo/tanker exhibited a 15% increase.
- Cargo/tanker encountering cargo/tanker exhibited an 8% increase.
- Ferry/cargo/tanker encountering small craft exhibited a 2% decrease.

- Small craft encountering other small craft exhibited a 0% change.

7.7.2.1.9 Whilst hot spots of encounters are visible in **Figure 53** between the Project Array Areas, these are largely offsetting existing meeting situations which currently occur within the footprint of the Project boundaries to the sea areas between the OWFs. These largely involve ferries with other ferries or small craft (fishing and recreational).

7.7.2.1.10 The 15% increase in encounters involving ferries is the equivalent of the total number of encounters involving the Ben-my-Chree. Therefore, it could be concluded that the additional number of meeting situations as a result of the Projects is approximately the same as introducing one additional ferry service into the Irish Sea.

7.7.2.1.11 The decrease in collisions between large vessels and small craft is the result of modelling deviating ships away from the Project Array Areas whilst assuming that small craft can continue to operate between the WTGs. Therefore, the potential meeting situations are reduced.

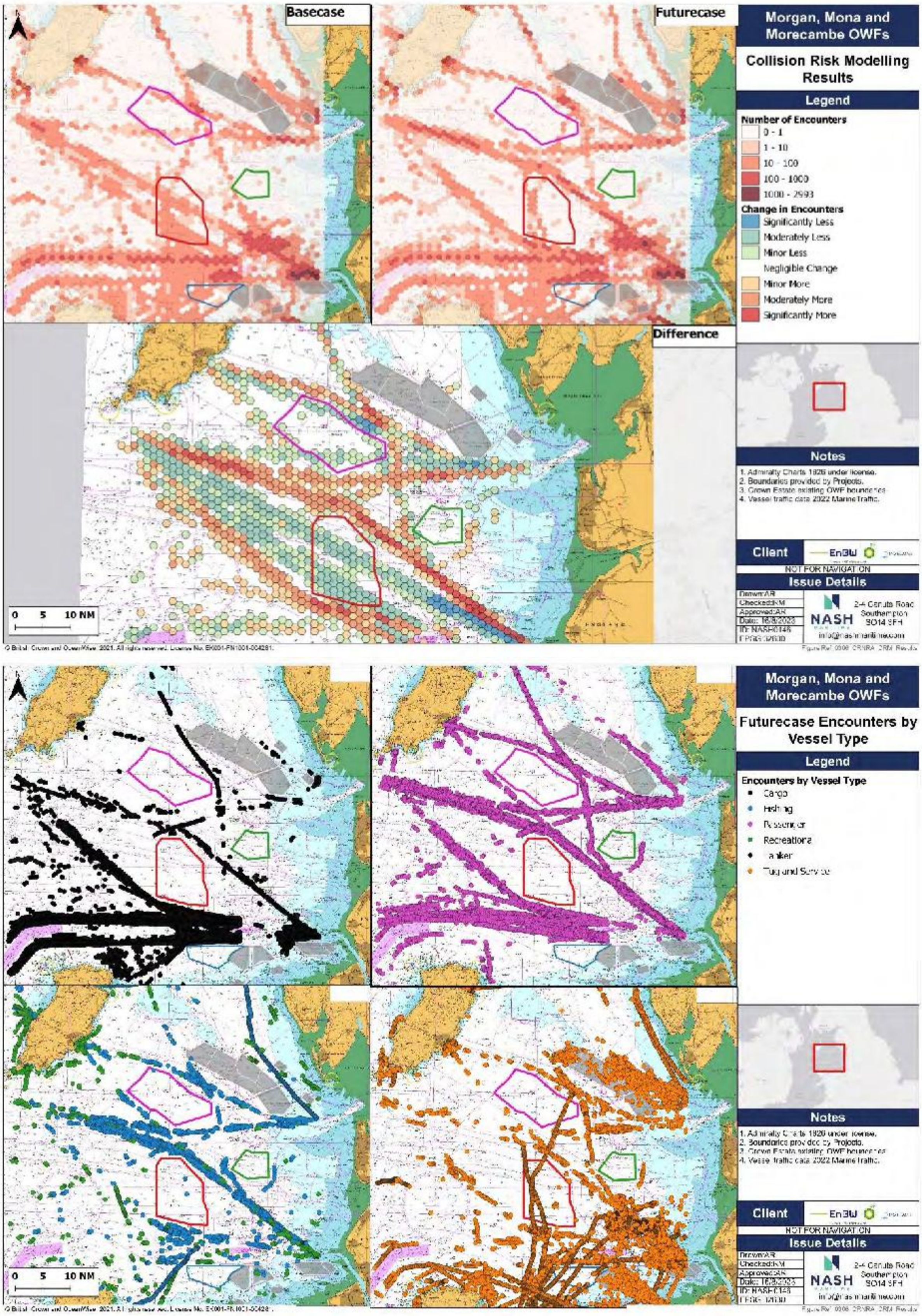


Figure 53: CRNRA encounters modelling.

7.7.3 Potential Impacts of Projects on Visual Navigation and Collision Avoidance

7.7.3.1.1 MGN654 notes that an OWF could block or hinder the view of other vessels or any navigational feature such as the coastline or AtoNs. This may result in "blind spots" between vessels which could increase the risk of collision by reducing the capability for early and effective collision avoidance.

7.7.3.1.2 Firstly, each individual WTG is approximately 10 m in diameter and whilst vessels transit past the Array Areas, any two vessels may come in and out of visibility temporarily. Furthermore, there may be challenges identifying the vessels through radar (see **Section 7.11**) and targets would be visually less distinct amongst the turbines. Assuming that most prudent mariners would pass more than 1 nm from the boundary of an OWF, the likely meeting situations are described in **Figure 54**. For a small craft, such as fishing boat or yacht transiting at 6 knots, from emergence from the OWF, it would take 10 minutes for the vessels to meet. For a high-speed craft such as CTV, transiting at 25 knots, this is less than 3 minutes. The latter vessel type are highly likely to carry AIS which will improve their visibility to other vessels. This would provide some opportunity to avoid a collision, however, would be significantly reduced beyond what would be the case pre-construction in open sea. Such challenges currently exist for the established Irish Sea OWFs but are being successfully managed with no reported collisions as a direct result of reduced visibility of emerging vessels.

7.7.3.1.3 Secondly, the geometries of the OWFs would reduce the visible appreciation of other vessels, particularly where routes converge or the corners of Array Areas. For example, two vessels proceeding north to the west and east of Mona Array Area to pass between Mona and Morgan Array Areas would not have visual sight of one another until potentially within the more constrained sea area. The COLREGs describe obligations for collision avoidance and the appreciation of navigational lights (port/starboard) are necessary in determining the correct response to crossing, overtaking and head-on situations. However, larger vessels would be identifiable from AIS and therefore passing arrangements could be agreed.

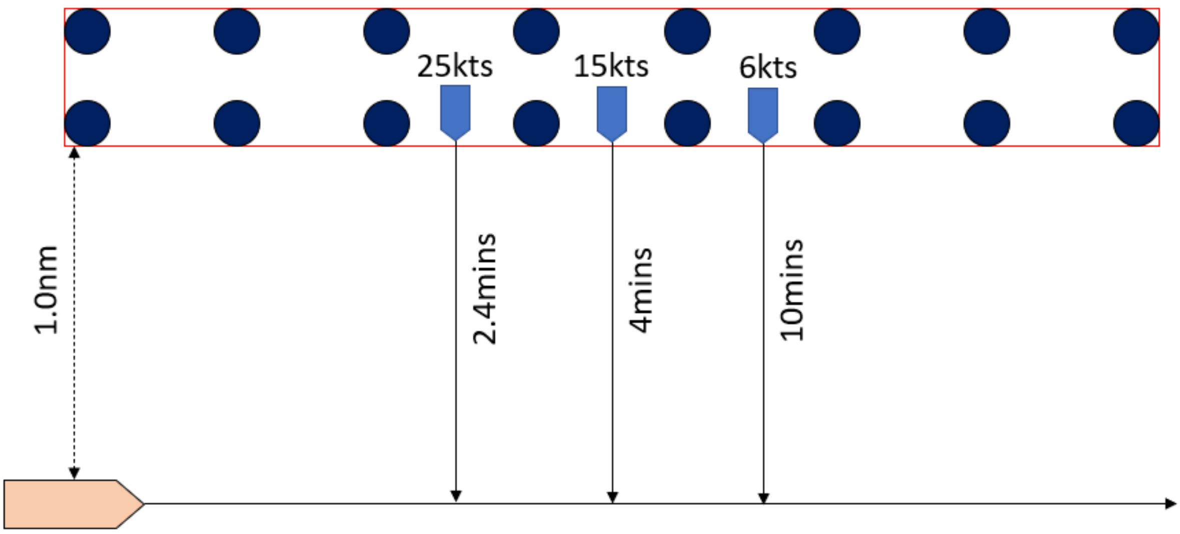


Figure 54: Calculated meeting times for vessels emerging from OWFs.

7.7.3.1.4 Thirdly, concerns were raised by stakeholders about collision appreciation during night navigation, particularly as a result of vessel navigational lights lost amongst the turbine backscatter. Rule 22 of the COLREGs describe the minimum visibility of lights with vessels under 12 m requiring masthead/sternlights of greater than 2 nm and for vessels over 12 m (but less than 50 m) having 5 nm and 2 nm respectively. Therefore, it is reasonable that vessels within an OWF that would have previously been visible to passing vessels may be obscured or would be less prominent amongst the OWF lighting. In particular, masthead lights for approaching vessels, or single red lights displayed on yachts may be less conspicuous amongst white AtoNs fixed to the WTGs, and this may to some extent contribute to an increase risk of collision. This impact was tested through the navigation simulations undertaken to inform the Environmental Statement which demonstrated that vessels could still be identified within and adjacent to the OWFs. Such impacts have been successfully managed at existing OWFs, elsewhere in the UK, with similar passing vessel numbers and vessels would still be identifiable through other means.

7.8 POTENTIAL IMPACT ON MODELLED COLLISION AND ALLISION RISK

7.8.1 Introduction and Methodology

7.8.1.1.1 The presence of the Projects Array Areas could result in increased vessel meeting situations or transits closer to infrastructure which would increase the risk of collision and allision respectively. These risks have been quantitatively assessed in this section.

7.8.1.1.2 The IALA Waterway Risk Assessment Program (IWRAP Mk II) is a quantitative tool for calculating the frequency of collisions, groundings and allisions for navigating vessels in a given waterway. The tool was developed by IALA to support coastal states in conducting risk assessments to address obligations under Safety of Life at Sea (SOLAS) Chapter V. The tool has been presented at the IMO (e.g. NAV 52/17/2 and SN.1/Circ.296) and used by Coastal States (including UK, Denmark and Sweden) to support the assessment of new routeing measures (e.g. NCSR 5/INF.3). The tool has also had widespread use in assessing risk, both in the UK, Norway and elsewhere. IALA (2017) Guideline G1123 contains guidance on implementing the tool and the underlying mechanics are presented in Friis-Hansen (2008).

7.8.1.1.3 IWRAP modelling has a number of stages:

- Data preparation:
  - Vessel traffic legs are created that represent shipping routes and data is used to determine the volume and types of traffic, and distribution across that leg.
  - These legs are connected into a network with waypoints where legs cross or join together.
  - Other hazards, such as bathymetry and fixed installations are inputted into the model.
- Risk calculation:
  - Where these legs intersect with one another or obstructions (such as WTGs), the proportion of traffic on that leg which might interact with the obstacle is calculated.
  - To account for the ability of the crew to avoid these hazards, a causation factor is used (in the order of 1 in 10,000) to represent the probability of human error or mechanical failure leading to an incident. The default causation probabilities which are lower for passenger vessels have been changed to consistent values to allow a direct comparison between ferries and other commercial vessels, reflecting a more precautionary approach given the stringent standards to which passenger vessels must operate and their enhanced redundancy.

7.8.1.1.4 The IWRAP risk modelling tool has been utilised to assess the likelihood of collision and allision within the CRNRA study area. All modelling was undertaken on indicative layouts that may not represent the final constructed layouts. Given future traffic projections discussed in **Section 6**, the likelihood with a 15% estimated increase in traffic is also given. For the purposes of modelling, the Morgan Offshore Wind Project's offshore booster station has not been included given the uncertainty on its position relative to the search areas.

7.8.2 Results

7.8.2.1.1 The 2022 AIS data was used to develop the base case (with existing routes and infrastructure) and future case (with modified routes and additional structures) models. For the future case model, several amendments were made:

- Addition of indicative layouts of Mona, Morgan and Morecambe Array Areas.
- Removal of DP3.
- Conflation of routes between Morgan Array Area and Walney OWF, Mona and Morecambe Array Areas, and Mona and Morgan Array Areas.
- Deviation of routes south of Mona Array Area.

7.8.2.1.2 **Table 32** shows the summarised results of the IWRAP modelling, comparing the base case and future case scenarios. **Figure 55** and **Figure 56** show a visual representation of the collision and allisions results. Collisions in IWRAP are modelled as head-on or overtaking collisions on legs, or crossing collisions where legs meet. The likelihood of collision increases where routes are compressed between obstructions or where more traffic is added to legs, both of which increase the frequency at which vessels meet and therefore collision.

7.8.2.1.3 It should be noted that IWRAP models the likelihood of a collision or allision, and as noted in **Section 5.3**, the majority of these would result in minor consequences. Furthermore, given underrepresentation of small craft using AIS, these have not been presented on an individual basis and are considered in **Section 7.5**.

Table 32: IWRAP modelling results (years between incidents).

Hazard	Vessel Type	Base case Return Periods	Future case (with Mona, Morgan and Morecambe) Return Periods	Future case Return Periods with 15% increase in traffic
Collision	Ferries vs Ferries	243y	199y	173y
	Cargo/tanker vs Ferries	197y	187y	163y
	Cargo/tanker vs Cargo/tanker	1,267y	1,073y	933y
	Total	100y	88y	67y
Allision	Ferries	333y	233y	203y
	Cargo/tanker	154y	105y	91y
	Total	105y	72y	63y

7.8.2.1.4 The modelling indicates an increase in the likelihood of collision across the Irish Sea from once in 100 years to once in 88 years, due to the concentration of traffic between the Projects described in **Section 7.7**. The increase in ferry-ferry collisions, from once in 243 to once in 199 years, is driven by the concentration of ferries onto similar routes (such as between Mona and Morecambe Array Areas) which increase the likelihood of meeting situations. The increase in cargo/tanker-ferry collisions, from once in 197 to once in 187, is accounted for by the relatively low density of commercial vessel routes within the areas affected by the Projects and therefore the minimal effect routeing changes would have on the overall risk profile. An increase in cargo/tanker vs cargo/tanker collisions, is largely accounted for by the increased time that cargo/tanker vessels would spend interacting within the approaches to Liverpool in order to clear the southern boundary of Mona Array Area, however the return periods are low with <1,000 years likelihood. The TSS are acting to deconflict commercial vessel traffic which results in relatively low likelihood scores.

7.8.2.1.5 **Figure 55** shows the distribution of collision likelihood in the base case and future case scenarios. It is noted that the areas of highest collision probabilities in both the base case and future case models were located in the approaches to Liverpool and the TSS and were relatively unaffected by the impacts of the developments. There is a marked increase in the likelihood of collision between Mona and Morecambe Array Areas, and, Mona and Morgan Array Areas, as several vessel routes are concentrated onto a single route and therefore more likely to meet one another.

7.8.2.1.6 Allisions can occur in one of two ways. Firstly, due to mechanical breakdown such as steering or engine failure a vessel may become disabled and drift towards the turbines. For a vessel in the centre of a 5 nm route, this would allow a 2.5 nm drift before an allision would occur. High side vessels such as ferries could drift in excess of two knots and therefore there would be less than an hour to take action. This could include conducting repairs or deploying an anchor. Such hazards exist for vessel routes adjacent to pre-existing OWFs such as Walney, West of Duddon Sands and Gwynt y Môr amongst others.

7.8.2.1.7 Secondly, due to human error with vessels failing to appreciate the available sea room in proximity to the WTGs due to fatigue or failing to keep a proper lookout. For larger vessels, and in particular ferries who would have significant experience of operating these routes, this is less likely than might be the case for smaller craft. Allisions between small craft such as yachts and fishing boats with WTGs is known to occur on other project Array Areas, with these vessel types potentially less familiar with the hazards. Whilst the Projects per se do not necessarily increase the risk of human error, the greater number of turbines provide more obstacles for which an allision could occur.

7.8.2.1.8 The IWRAP modelling suggests that the likelihood of allision could increase from once in 105 years to once in 88 years. Whilst this increase is relatively large, this is principally due to approximately a 50% increase in the number of structures in the Irish Sea. Both ferries and cargo/tanker allision likelihoods increase by similar amounts, but the significant proximity of large cargo/tanker vessels close to Mona Array Area and the high redundancy of passenger vessels modelling in IWRAP have resulted in lower ferry allision scores.

7.8.2.1.9 **Figure 56** shows the distribution of allision probability between the base case and future case scenarios. The base case allision probability is greatest on the northern structures of the existing OWFs adjacent to Liverpool and the existing oil and gas platforms where there is the greatest traffic density. The addition of the Projects shows that the most southerly WTGs of the Mona Array Area, adjacent to the main shipping routes have the greatest likelihood of allision. Furthermore, WTGs at the periphery of the southern area of Morgan Array Area, and western area at Morecambe Array Area have relatively higher allision scores. The rerouteing of traffic between Morgan Array Area and Walney OWF have also resulted in higher risks with turbines at West of Duddon Sands and Walney Extension OWFs. It is also evident that the future case scenario shows lower allision scores for Millom

West and the Morecambe Gas Field platforms due to reorientation of the existing shipping routes away from these structures.

7.8.2.1.10 With an estimated 15% increase in traffic, the resultant likelihoods increased from once in 88 to once in 67 years for collision and once in 72 to once in 63 years for allision.

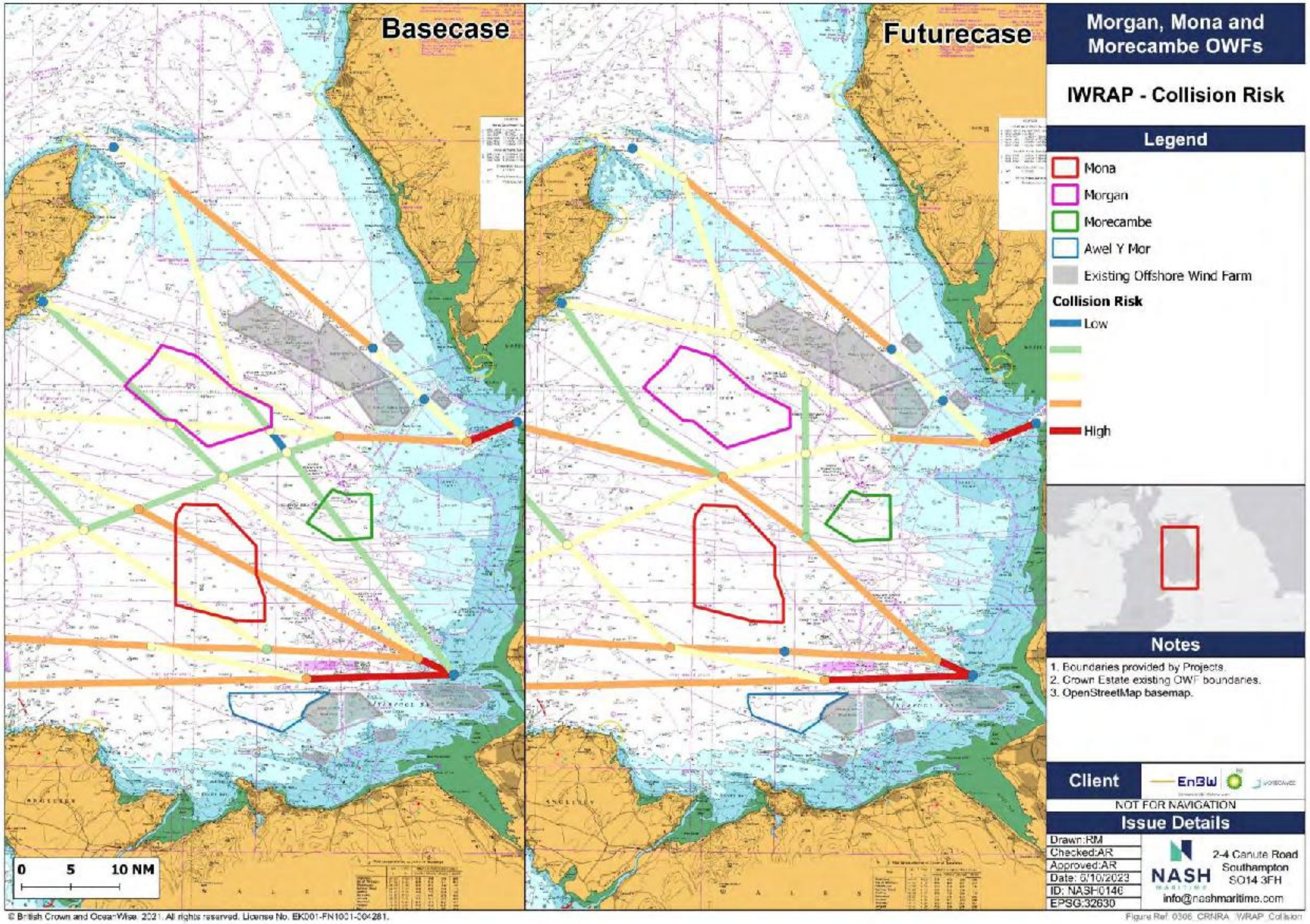


Figure 55: IWRAP modelling results for collision.

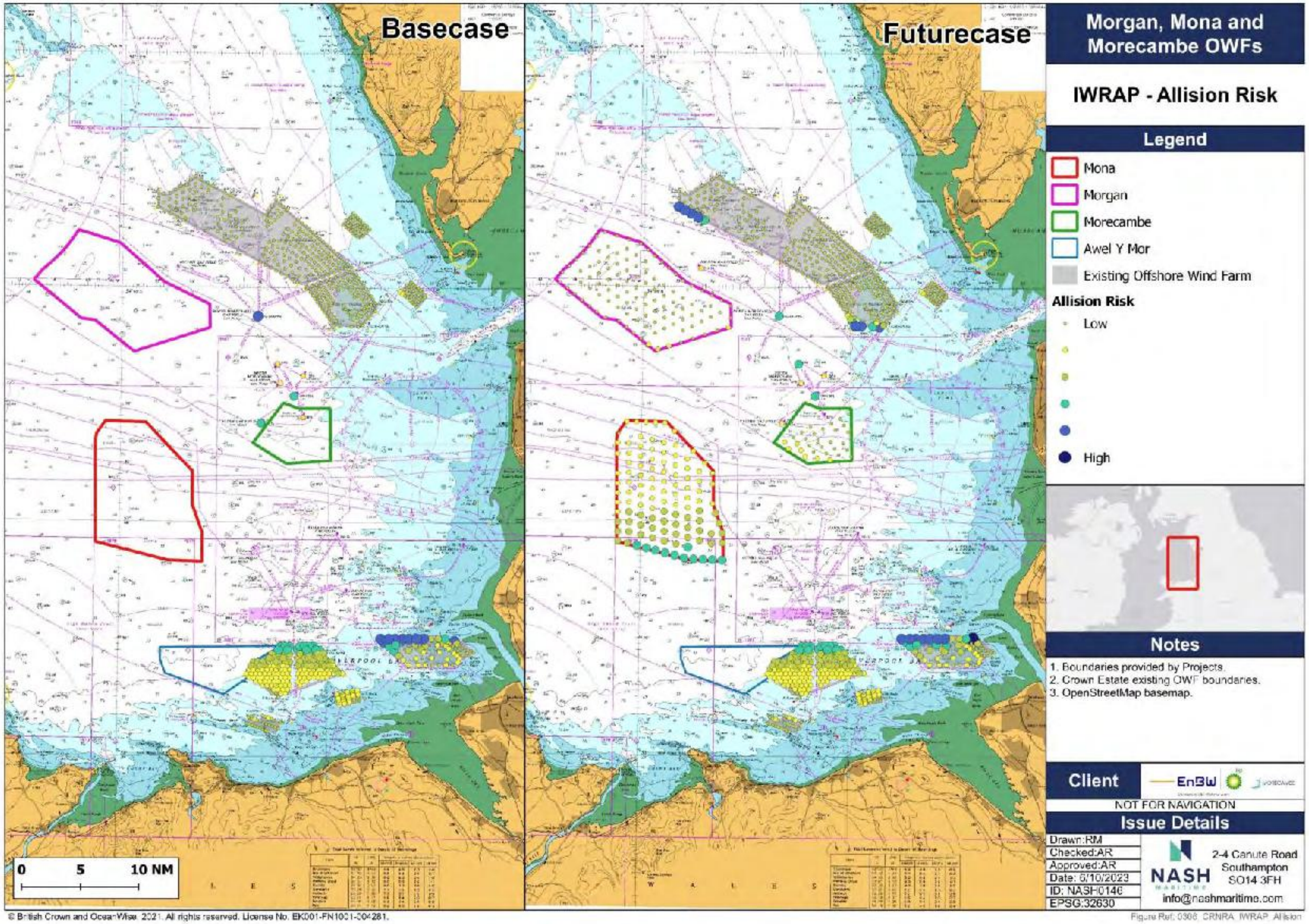


Figure 56 IWRAP modelling results for allision.

7.9 POTENTIAL IMPACTS OF ARRAY ON VESSEL EMERGENCY RESPONSE

7.9.1 Introduction

7.9.1.1.1 Potential impacts of the OWFs on vessel emergency response were identified amongst consultees, such as the ability to manage cargo shift scenarios, fire or man overboard situations.

7.9.2 Vessel Rolling and Cargo Shift

7.9.2.1.1 During adverse weather, with large waves and strong winds, vessels can roll so excessively as to cause cargo to break free from its securing's and injuries to passenger or crew. This is particularly the case when the seas are directly on the vessel's beam, hence the requirement for variation in vessel course observed in **Section 5.2.4.3** to mitigate the ship's heading to the seas. With the Projects in place, routes between the Projects would impact the capability for vessels to alter course to safely manage this.

7.9.2.1.2 The navigation simulations undertaken to inform the Environmental Statement (see **Section 2.3.5**) tested the safety of transits in adverse weather for each route. It was noted that the prevailing southwesterlies necessitated near beam on navigation across the conditions given the orientation of the route between Morgan Array Area and Walney OWF, and Mona and Morecambe Array Areas in southeast/northwest directions. As a result, in several runs Marginal or Fail scores were reached in gale and storm force conditions due to excessive rolling, exceeding 20 degrees. This was considered to be both uncomfortable and hazardous to passengers, but also have the potential to shift cargo and cause damage.

7.9.2.1.3 Given this conclusion, it would be reasonable to expect ferries to take a more circuitous route around the OWFs rather than between them during marginal weather conditions which would increase journey times, as described in **Section 7.3**. However, were a Master to choose not to take an adverse weather route, any deterioration in conditions could be more challenging to mitigate due to the presence of the OWFs. For example, as excessive roll starts to be experienced, the master may wish to turn into the wind but in doing so may approach closer to the OWFs than desired.

7.9.2.1.4 Cargo shift situations have occurred within the CRNRA study area, most notably the Ro-Ro cargo vessel Riverdance in January 2008. This occurred in adverse weather and resulted in the grounding on the Shell Flats and total constructive loss but without injuries.

7.9.3 Responding to Vessel Emergencies

7.9.3.1.1 Concerns were raised by stakeholders relating to the ability of vessels to conduct emergency manoeuvres within the routes between the OWFs. During the navigation simulations undertaken to inform the Environmental Statement, two types of scenarios were tested and discussed with ferry Masters. Firstly, medical emergencies are relatively common on-board passenger ferries and there may be a requirement for a vessel to conduct a helicopter transfer which necessitates the vessel taking a defined course for a period of time. It was concluded that the minimum time between launching an HMCG helicopter and arriving on scene, was significantly greater than the transit time a vessel would spend in the vicinity of a Project. Furthermore, the likely first course of action of the Master would be to make best speed towards the closest harbour given that it is not guaranteed that an HMCG helicopter would be available to respond. This gives the Master the opportunity to reposition the vessel clear of any hazards.

7.9.3.1.2 Secondly, some emergencies on board, particularly fire or a man overboard, require immediate action by the bridge teams. For example, during fire, it may be necessary to turn the vessel into the wind such that the smoke does not blow across the passenger decks, or action may be needed to reduce the roll of the vessel to make it easier for the crew to respond. Whilst the Projects do not necessarily impact upon the likelihood that fire may occur, their presence constricts the sea room to perform these manoeuvres, and may increase the resulting consequences. The ability to hold a heading may be hampered in adverse weather conditions such as a large sea state or wind speed, particularly where the vessel needs to maintain a minimum speed to ensure steerage or control. Consultation has identified that these incidents infrequently occur on board ferries in the CRNRA study area (in the order of less than once a year to once in ten years). The likelihood of these incidents occurring, during strong adverse weather and it also occurring during a temporary transit of the routes (which makes up less than 5% of most routes), is highly unlikely. Furthermore, whilst the sea room is reduced, at least several nautical miles would exist to undertake some degree of mitigation, greater than vessels would have available elsewhere such as the approaches to ports for example. In addition, the vessels could in an emergency enter the OWF given that there is at least 1,400 m spacing between rows of WTGs which may offer a contingency of last resort.

7.10 POTENTIAL IMPACTS OF PROJECTS ON SEARCH AND RESCUE

7.10.1.1.1 In the unlikely event of an incident, SAR assets are required to access the Array Area or surrounding area without risk to themselves. In particular, WTGs can pose a hazard to SAR helicopters and therefore the design of the wind farm should be such to enable helicopter access and therefore safeguard HM Coastguard obligations to SAR within the UK SAR Region. An ERCoP is required to facilitate information sharing regarding the OWF and SAR organisations. The principals of SAR access for OWFs are contained in MGN654 Annex 5, and can be summarised as:

- **Lines of Orientation** – developers should maintain two lines of orientation unless a safety case is produced, and additional mitigation is proposed, that one line of orientation is tolerable. This allows multiple directions for aircraft entry and improves access, whilst a linear regular grid is both more efficient and safer for conducting SAR.
- **SAR Lanes** – to be of sufficient width to enable safe transit of an SAR helicopter between the turbines. MGN654 Annex 5 recommends turbine spacing (blade tips to blade tips) of greater than 500 m.
- **Helicopter Refuge Areas** – in larger developments (>10 nm width), a refuge area clear of turbines may be required to enable aircrews to reorientate themselves and change direction safely.
- **Turbine Preparation** – to support winching of a casualty, the WTG needs to be configured to a specific position as requested by the SAR crew. This might include rotating the nacelle to 90 degrees from the wind, and both locking and positioning the blades to facilitate SAR access (e.g. Y configuration – see MGN654 Annex 5).

7.10.1.1.2 Several trials have been conducted by HMCG and MCA in SAR at OWFs (see MCA, 2005; 2019). They found that searching within an OWF is more complex than in open sea and there may be a delay for entry into an OWF whilst the crew familiarise themselves with the Array Area and layouts. During poor visibility, the importance of linear SAR lanes of sufficient width was identified as of great importance. When transiting through an OWF, all communications and navigation equipment was reported to be operated successfully with WTGs identifiable through radar. Unfamiliarity with transiting and winching in vicinity of WTGs results in slower speeds and delays which increases fuel consumption and may make searches less effective. Concerns have also been raised regarding visual identification of casualties as WTGs block the view, particularly during rough weather.

7.10.1.1.3 The Projects have committed to two lines of orientation and the spacing between structures will be at least 1,400 m. Therefore, there would be sufficient space for SAR helicopter access through the Array Areas, and far greater space than existing OWFs in the Irish Sea. The project design should also enable surface SAR assets (such as RNLI lifeboats) to safely navigate through the Array Area and between the WTGs. These commitments will be secured through the DCO and in particular the requirement for a layout plan to be approved in consultation with the MCA and Trinity House.

7.10.1.1.4 A review of DfT SAR helicopter data between 2015 and 2023 showed that the SAR base at HMCG Caernarfon responded to 90% of all casualties recorded within the Projects Array Areas, although HMCG helicopters from other regions were recorded on occasion in the area. Assuming a 30 minute mobilisation time (to raise the alarm and launch the SAR asset), and the S-92 SAR helicopters transit speed, it would take between 45 and 55 minutes for the SAR helicopter to reach the Project Array Areas.

7.10.1.1.5 Similarly, a review of the RNLI data between 2008 and 2022 showed that incidents within Morgan Array Area were responded to by Douglas station, incidents within Morecambe Array Area were responded to by Fleetwood and incidents within Mona Array Area were responded to by Moelfre, Fleetwood and Llandudno. Each of these stations have all weather lifeboats capable of transiting at 25 knots (either Shannon, Mersey or Tamar Class). Assuming a 30 minute response time (to raise the alarm and launch the SAR asset), and the estimated time to reach a casualty within the Project Array Areas, it could take between 80 and 90 minutes before a RNLI lifeboat could be on scene to assist a casualty.

7.10.1.1.6 Given the above, it should be noted that the location of the OWFs in the centre of the Irish Sea have relatively long response times of between 45 and 55 minutes for SAR helicopters and between 80 and 90 minutes for RNLI lifeboats. Therefore, in many cases it is likely that the first responders to any casualty will be from Project vessels (such as CTVs) which are well equipped with rescue apparatus and therefore may offer immediate casualty care until other SAR assets arrive on scene.

7.11 POTENTIAL IMPACTS OF ARRAY ON OIL AND GAS ACTIVITIES AND SAFETY

7.11.1.1.1 In addition to the risk of a vessel coming into contact with a WTG, is the increased risk of coming into contact with oil and gas infrastructure. The key platforms for which this may be the case are (see **Figure 5**):

- **North Morecambe gas field** – the existing HEY-DOUG route passes between 0.4 nm to the north of this platform already. The presence of the Morgan Array Area would necessitate vessels passing further to the north to clear the Morgan Array Area. Furthermore, the routes to the west from Heysham would need to pass further south to clear the Morgan Array Area. Therefore, the risk of allision is likely reduced.
- **South Morecambe gas field** – all existing routes from Heysham pass clear to the north of this field. The presence of the Morgan Array Area may have a minor effect of offsetting traffic closer to the platforms but this is not anticipated to significantly impact allision risk. Furthermore, it is anticipated that some of these platforms would be decommissioned prior to the operational phase of the OWFs.
- **Millom Gas Field** – anticipated to be decommissioned in 2032 (with the Millom West platform removed by 2030) and there would be minimal overlap in activities. The existing Heysham-Douglas route regularly passes within 1 nm of the platform and the presence of the Morgan Array Area would likely offset this traffic further northeast reducing the allision risk.
- **Conwy gas field** – the presence of the Mona and Morecambe Array Areas would necessitate traffic to pass clear to the east of this platform in the future.
- **Hamilton North gas field** – existing traffic routes clear these platforms; the presence of Morecambe and Mona Array Areas would likely have little impact on vessel routeing passed these platforms.
- **Calder Gas Fields** – the presence of the Morecambe Array Area would deviate routes further west of this platform than they currently do so.

7.11.1.1.2 A contact between a ferry or other large vessel and a platform carries the potential for a far greater consequence that with a WTG. Some platforms are manned which increases the potential for loss of life but also the potential pollution outcomes. Whilst there is significant uncertainty regarding timescales, it is likely that several of these platforms will be decommissioned prior to the 2035 scenario and therefore the risk of allision will be removed.

7.11.1.1.3 The platforms require marine access corridors which are free of obstructions for vessels and helicopters. Radar Early Warning System (REWS) are used by the platforms to monitor vessel traffic in the vicinity of the infrastructure and provide early warning for evacuation should a hazard, such as a drifting vessel, be identified.

7.11.1.1.4 Further details of specific deconfliction between the Projects and Oil and Gas operators is detailed in the Applications of the respective Projects. This includes specific REWs assessments to quantitatively assess the potential impacts of the Projects on oil and gas platform safety.

7.12 POTENTIAL IMPACTS OF PROJECTS ON COMMUNICATIONS, RADAR AND POSITIONING SYSTEMS

7.12.1 Introduction

7.12.1.1.1 MGN654 notes that an OWF may have adverse effects on the equipment used for navigation, collision avoidance or communications. A significant body of work has been conducted to examine these potential impacts in detail, and reference is made to the following studies:

- MCA and QinetiQ (2004). Results of the electromagnetic investigations and assessments of marine radar, communications and positioning systems undertaken at the North Hoyle wind farm by QinetiQ and the MCA.
- BWEA (2007). Investigation of Technical and Operational Effects on Marine Radar Close to Kentish Flats OWF.
- Ocean Studies Board's Division on Earth and Life Studies (2022). Wind Turbine Generator Impacts to Marine Vessel Radar.

7.12.1.1.2 **Table 33** provides a summary of these potential impacts, with further consideration of the potential impacts on marine radar explored in **Section 7.12**.

Table 33: Summary of potential impacts on equipment.

Impact on	Overview
VHF	VHF is essential for the communication between vessels and shore. VHF radio waves could be blocked or interfered with by the presence of turbines. The 2004 MCA and QinetiQ study found no noticeable effect on VHF communications both ship-shore and ship-ship within or adjacent to the wind farm. A trial aboard SAR helicopters (MCA, 2005) also determined no significant impact on VHF direction finding capabilities. Therefore, no significant impact on VHF communications is anticipated.
AIS	AIS enhances the identification between vessels for collision avoidance. AIS signal could be blocked or interfered with by the presence of turbines. The MCA and QinetiQ study found no noticeable effect on AIS reception. Therefore, no significant impact on VHF communications is anticipated.
Global Navigation Satellite System (GNSS)	GNSS (such as GPS) is used for satellite positioning systems and navigation. Satellite reception could be impacted by the presence of turbines. The MCA and QinetiQ study found no noticeable effect on GPS reception, even in very close proximity to the WTGs. Therefore, no significant impact on GPS is anticipated.
Shore Radar	Similar to marine radars, shore radars could be impacted by the WTGs. Morgan, Mona and Morecambe Array Areas are well clear of any ports and harbours, and any VTS coverage. Therefore, no significant impact on shore radar for managing navigational safety is anticipated.
Noise	The sound generated by the turbines could mask navigational sound signals from vessels or AtoNs. Whilst turbines make an audible sound whilst rotating, the low density of shipping and distance to other navigational marks makes this potential impact negligible. Furthermore, maritime regulations for audibility of a ship's whistle are well in excess of the typical WTG sound emissions even at very close range. Therefore, no significant impact on navigation safety from increased noise is anticipated.
Compass	Compasses are used for vessel navigation. These are potentially impacted by electromagnetic interference from the WTGs or cables. The degree of this

Impact on	Overview
	impact is related to the depth of water, cable design and alignment with the earth's magnetic field. Whilst this has impact has not been directly observed in studies, it is possible that small vessel compasses could be impacted near to cable landfall. However, it is considered likely that small craft would navigate visually near to cable landfall and therefore the impact on navigation safety is reduced. Therefore, no significant impact on navigation safety from electromagnetic interference is anticipated.

7.12.2 Marine Radar

7.12.2.1.1 Marine radar is used for both collision avoidance and vessel navigation. WTGs, like other structures, can result in spurious returns such as side lobes, echoes, reflections and blanketing. These effects were studied extensively in both the MCA and QinetiQ (2004), and British Wind Energy Association (BWEA) (2006) studies. Both studies determined that the reduced capability to track small vessels within OWFs and the risk of losing acquired targets should be considered by mariners navigating adjacent to OWFs. Some of these effects can also be mitigated by careful adjustment of radar controls, such as Gain.

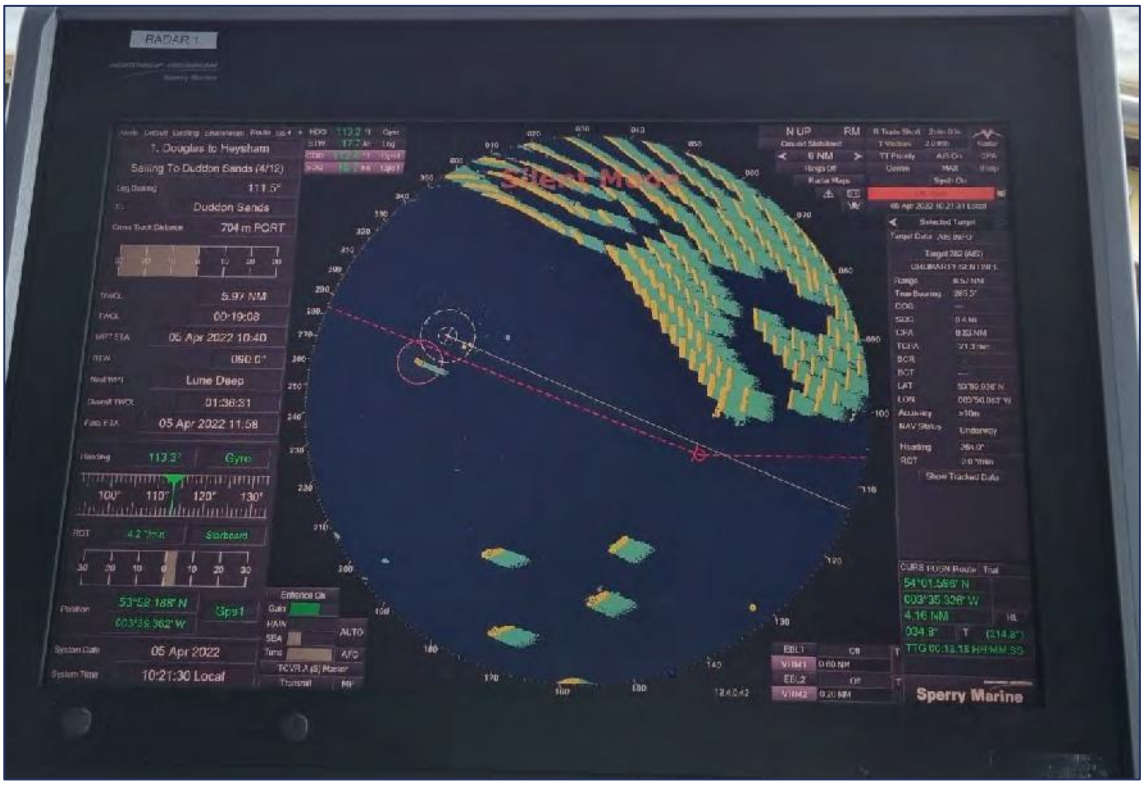


Figure 57: Radar screen of the Ben-my-Chree (Source: NASH 05 April 2022).

7.12.2.1.2 Based on this, the MCA developed a shipping route template (MGN654) that placed the extent of these effects at up to 1.5 nm, increasing as the vessels transit closer to the turbines. Intolerable impacts may be experienced up to 0.5 nm from the OWF. Historical evidence suggests that most vessels pass more than 0.5 nm from an OWF and therefore these effects are lessened.

7.12.2.1.3 **Figure 58** shows how the Project Array Areas relate to the region of potential radar effects. There is sufficient sea room between the Projects for radar effects to be avoided should vessels navigate the centre of the routes. Analysis of historical vessel traffic throughout this CRNRA demonstrates that vessels routinely pass within 1 nm of OWFs, particularly West of Duddon Sands, Gwynt y Môr and Burbo Bank. Therefore, any effects on radar are already encountered and should be well understood by bridge teams.

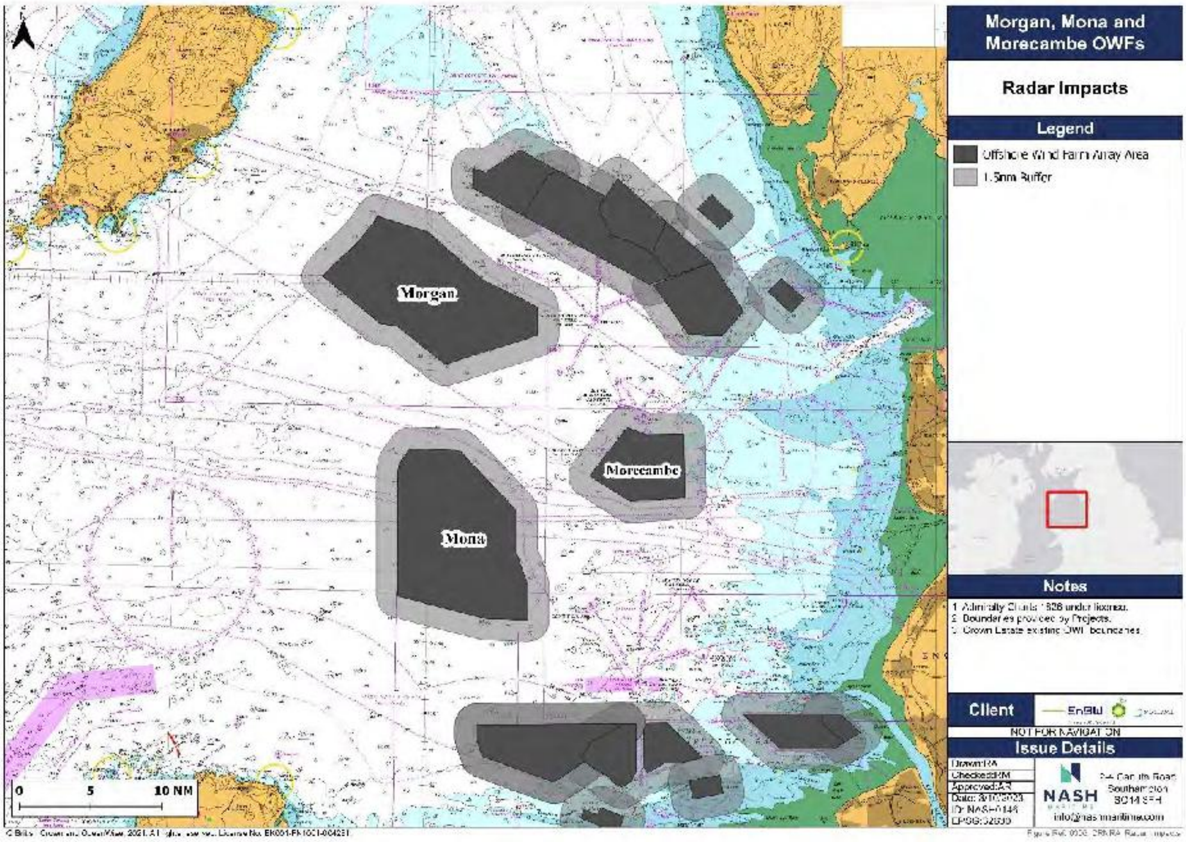


Figure 58: MGN654 radar impacts.

7.12.3 Shore Based Radar

7.12.3.1.1 The Project Array Areas are outside of the port limits, VTS and pilotage areas and therefore whilst shore-based radar may have partial coverage of the Array Areas, it would not be actively monitored. Therefore, the presence of the Projects would not compromise vessel traffic monitoring obligations.

8. CUMULATIVE REGIONAL NAVIGATION RISK ASSESSMENT

8.1 INTRODUCTION

8.1.1.1.1 The CRNRA has been produced in accordance with MGN654 and follows the IMO's FSA (IMO, 2018). The MGN654 requires that an NRA contain a hazard log of shipping and navigation hazards caused or changed by the project which includes an assessment of risk with embedded controls in place (those controls designed and included in the project which are commonly accepted as industry good practise - see **Section 3** for a list of embedded risk controls), and an assessment of risk for the project with possible additional risk controls in place if they are warranted (**Section 8.7**).

8.1.1.1.2 The development of the CRNRA, hazard log and associated risk scoring process is based on the following data, analysis, modelling and expertise of the project team:

- Collection of data, consultation and navigation simulations (see **Section 2**).
- Projects description (see **Section 3**).
- Overview of baseline environment (see **Section 4**).
- Description of existing marine activities (see **Section 5**).
- Future case vessel traffic profiles (see **Section 6**).
- Potential impact assessment (see **Section 7**).

8.1.1.1.3 In addition to above a key component of an NRA is engagement with regulators and local stakeholders to confirm baseline shipping and navigation characteristics and elicit judgement on the levels of navigation risk with the project in place.

8.1.1.1.4 The following sections outline the:

- Overarching methodology of the risk assessment.
- Details of the hazard workshop.
- Process of hazard identification.
- Embedded (or designed in) risk controls measures.
- Results of the assessment of risk with the embedded risk controls in place.
- Possible additional risk control measures which may reduce risk to acceptable levels.

8.1.1.1.5 The risk assessment methodology follows the IMO FSA and is based on the principles set out in IALA Guidelines 1018 and 1138 which are endorsed by the IMO in SN.1/Circ.296 in December 2010 and is as shown in **Figure 2**. The methodology also closely follows MCA MGN654 guidance.

8.1.1.1.6 Navigation hazards are identified through consultation and data analysis, before being assessed in terms of their likelihood and consequence of risk. A risk matrix is then utilised to identify the significance of each hazard with possible additional risk controls identified based on the resultant risk score to reduce the risks to acceptable levels.

8.1.1.1.7 A description of the FSA process is as follows:

- **FSA Step 1: Hazard Identification (HAZID)**: The project team identifies navigation hazards related to defined and agreed assessment parameters, such as geographic areas, marine operation, or vessel type. This is achieved using a suite of quantitative (e.g., statistical vessel traffic analysis) and qualitative (e.g. consultation with stakeholders) techniques which enables an evidentially robust identification of navigation hazards.
- **FSA Step 2: Risk Analysis**: A detailed investigation of the causes, including the initiating events, and consequences of the hazards identified in Step 1 is undertaken. This is completed using a risk matrix, and enables ranking of hazards based on navigation risk, and a determination of hazard acceptability tolerability. This process allows attention to be focused upon higher-risk hazards enabling identification and evaluation of factors which influence the level of risk.
- **FSA Step 3 & 4: Risk Controls**: The identification of existing risk controls measures (which are assumed to be embedded in the assessment of navigation risk), and the identification of possible additional risk controls, not currently in place for the assessment parameters is undertaken. Possible additional risk control measures are identified based on prioritising mitigation of higher-risk hazards. During this stage risk control measures may be grouped into a defined and thought-out risk mitigation strategy.
- **FSA Step 5: Findings**: The assessment findings are developed and documented into a technical report and then presented to the relevant decision makers in an auditable and traceable manner. The findings are based upon a comparison and a ranking of all hazards and their underlying causes; the comparison and ranking of possible additional risk control options as a function of associated costs and benefits; and the identification of those options which mitigate hazards to acceptable or ALARP.

8.2 SCORING CRITERIA

8.2.1.1.1 Having identified all relevant potential impacts and hazards as a result of a project, a hazard log is constructed as described in MGN654 Annex 1 (Annex D). Whilst there is no generally accepted standard for risk matrices, the following is proposed as suitable for the project, meets IMO and IALA guidance, and is consistent with industry best practice.

8.2.1.1.2 Each hazard was scored for the likelihood of occurrence (**Table 35**) and expected consequence (**Table 34**) for two scenarios, the “realistic most likely” and “realistic worst credible”. Severity of consequence with each hazard under both scenarios is considered in terms of damage to:

- **People** – hazards may result in injuries or fatalities.
- **Property** – hazards may result in damage or loss of vessels or structures.
- **Environment** – hazards may result in environmental pollution such as oil spills.
- **Commercial and Reputation** – hazards may result in loss of economic output, impact on vessel routes, interruption of supply/generation capacity and adverse media coverage.

8.2.1.1.3 This CRNRA, in considering and assessing navigation risk, assumes that vessels will be compliant with international (e.g. Convention on the International Regulations for Preventing Collisions at Sea (COLREGS) and Standards of Training, Certification and Watchkeeping for Seafarers (STCW)), and National regulations and Guidance (e.g. UK Merchant Shipping Act 1995, and MCA Marine Guidance Notes) regulations.

Table 34: Severity of consequence categories and criteria.

Rank	Definition	Description			
		People	Property	Environment	Commercial and Reputation
1	Negligible	Minor injury.	Less than £10,0000	Minor spill no assistance required.	Minimal impact on activities.
2	Minor	Multiple minor injuries.	£10,000-£100,000	Tier 1 (Local/in-house assistance required)	Local negative publicity. Short term loss of revenue or interruption of services to ports/OWF/oil and gas/ferries and other marine users.
3	Moderate	Multiple major injuries.	£100,000-£1million	Tier 2 Limited external assistance required	Widespread negative publicity. Temporary suspension of activities to ports/OWF/oil and gas/ferries and other marine users.
4	Serious	Fatality.	£1million-£10million	Tier 2 Regional assistance required	National negative publicity. Prolonged closure or restrictions to ports/OWF/oil and gas/ferries and other marine users.
5	Major	Multiple fatalities.	>£10million	Tier 3 National assistance required	International negative publicity. Serious and long-term disruption to ports/OWF/oil and gas/ferries and other marine users.

Table 35: Frequency of occurrence criteria.

Rank	Definition	Description	Definition
1	Remote	Remote probability of occurrence at Project and few examples in wider industry.	<1 occurrence per 1,000 years
2	Extremely unlikely	Extremely unlikely to occur at Project and has rarely occurred in wider industry.	1 per 100 – 1,000 years
3	Unlikely	Unlikely to occur at Project during project lifecycle and has occurred at other OWFs.	1 per 10 – 100 years
4	Reasonably probable	May occur once or more during OWF lifecycle.	1 per 1 – 10 years
5	Frequent	Likely to occur multiple times during OWF lifecycle.	Yearly

8.3 RISK MATRIX

8.3.1.1.1 The combination of the frequency and consequence scores are then combined to produce a risk score (**Table 36**).

8.3.1.1.2 The assessment of risk is calculated eight times for each identified hazard; four times for the “realistic most likely” occurrence for each consequence category and four times for the “realistic worst credible” outcome for each consequence category. An overall risk score is then calculated using an averaging function weighted to the highest risk score for the "realistic most likely" and the highest risk score for the "realistic worst credible". The weighted averaging calculation is an average of:

- Average of all the "realistic most likely" risk scores.
- Average all the "realistic worst credible" risk scores.
- Highest individual score from the "realistic most likely" scores.
- Highest individual score from the "realistic worst credible" scores.

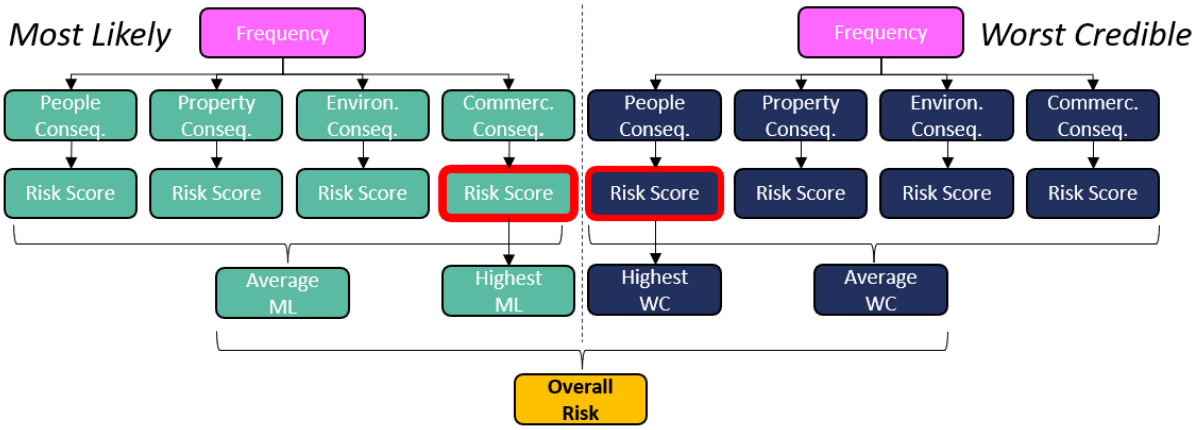


Figure 59: Method to derive overall risk score.

8.3.1.1.3 The tolerability of hazard risk scores with regards to significance and acceptability with or without further action are shown in **Table 37.**

8.3.1.1.4 The assessment criteria, including frequency and consequence bandings, are consistent with previous OWF NRAs submitted and approved by the MCA. Furthermore, reference has been made to Intolerable/ALARP/Negligible bandings defined in IMO FSA studies, such as the FSA for Roll-on/Roll-off Passenger Vessels (MSC 85 INF3).

8.3.1.1.5 For example, a fatality every 10 years, or multiple fatalities every 100 years within the RoPax FSA was defined as the threshold between Unacceptable and ALARP, this translates to a score between 12 and 16, and 10 and 15 respectively on the risk matrix. Similarly, the same study determined that a fatality every 1,000 years, or multiple fatalities every 10,000 years was defined as the threshold between ALARP and Negligible, this translates to a score between four and eight, and five and ten respectively on the risk matrix. The risk matrix presented in **Table 36** is therefore consistent with the FSA for RoPax Vessels (MSC 85 INF3).

8.3.1.1.6 Hazards are then defined as either Broadly Acceptable, with existing (embedded) mitigation, or Unacceptable. MGN654 Annex 1 states that where risks are scored as Medium Risk, *"Further risk control options must be considered to the point where further risk control is grossly disproportionate (i.e. the ALARP principle) and an ALARP justification and declaration made*." Therefore, hazards scored as Medium Risk can only be Tolerable if ALARP is met.

Table 36: Risk matrix.

Risk Matrix							
Severity of consequences	Major	5	5	10	15	20	25
	Serious	4	4	8	12	16	20
	Moderate	3	3	6	9	12	15
	Minor	2	2	4	6	8	10
	Negligible	1	1	2	3	4	5
			1	2	3	4	5
			Remote	Extremely unlikely	Unlikely	Reasonably probable	Frequent
			Likelihood of Occurrence				

Table 37: Tolerability and risk ratings.

Hazard Risk Score	Hazard Risk Rating	Tolerability	Description
0 - 4	Negligible Risk	Broadly Acceptable	Generally regarded as not significant and adequately mitigated. Additional risk reduction should be implemented if reasonably practicable and proportionate
4.1 - 6	Low Risk		
6.1 - 12	Medium Risk	Tolerable (if ALARP)	Generally regarded as within a zone where the risk may be tolerable in consideration of the project. Requirement to properly assess risks, regularly review and implement risk controls to maintain risks to within ALARP where possible.
12.1 - 20	High Risk	Unacceptable	Generally regarded as significant and unacceptable for project to proceed without further review.
20.1 - 25	Extreme Risk		

8.4 HAZARD WORKSHOPS

8.4.1.1.1 Two hazard workshops were held as part of the CRNRA. The first hazard workshop associated with the CRNRA undertaken to inform the PEIR was held in Liverpool on the 10 October 2022. It was attended by representatives from ferry operators, regulators, commercial bodies, oil and gas, ports, the fishing community and recreational users. The hazard workshop process was undertaken as follows:

- Development of a draft or initial hazard log by the NASH project team.
- Identification of shipping and navigation stakeholders, made up of statutory regulators and local users and determination of workshop dates to maximise attendance.
- Provision of detailed pre-read information related to the Projects, baseline vessel traffic and an assessment of likely changes brought about by the Projects as well as the draft hazard log.
- A pre-hazard workshop webinar to review the collated data, CRNRA methodology and the draft hazard log (conducted on 3 October 2022).
- At the workshop:
- The Project team introduced the material and methodology.
- Each hazard was reviewed in turn, with each attendee invited to discuss amongst their tables and score their personalised hazard log. Stakeholders were encouraged to fill out the comments section of each hazard to provide a higher level of description regarding their scores.

- Each hazard score was then reviewed as a group with differences in scoring discussed, before a consensus was sought.
- Once each hazard discussion had come to a close, the summary spreadsheet was 'locked' to capture the concluding scores of the discussion.
- Risk controls were reviewed and appropriate additional risk controls discussed.
- Update of hazard risk scores based on the findings of the hazard workshop for inclusion in the CRNRA.

8.4.1.1.2 At the first hazard workshop undertaken to inform the PEIR, it was concluded that there was insufficient sea room between the Project Array Areas and therefore that unacceptable risks to navigation existed. The findings of this CRNRA are summarised in the respective PEIRs (see Mona Offshore Wind Project, 2023). In particular, the workshop concluded that five hazards were High Risk – Unacceptable, namely Collision – Ferry/Passenger in collision with (ICW). Cargo/Tanker or Ferry Passenger between Mona and Morgan Array Areas and route South of Mona Array Area, and, Collision – Ferry/Passenger or Cargo/Tanker ICW. Small Craft between Mona and Morgan Array Areas, Morgan Array Area and Walney OWF and South Mona Array Area route. Many other hazards were scored towards the high end of the Medium Risk – Tolerable if ALARP category.

8.4.1.1.3 Following the boundary changes made following the PEIR consultation, a second hazard workshop was held in Liverpool on the 28 September 2023 to inform the Environmental Statement. This workshop followed an identical structure and methodology to the first workshop and was attended by many of the same stakeholder groups. A full summary of the workshop is available in **Appendix B**. In total, ten hazards were reviewed as a group.

8.4.1.1.4 During the second hazard workshop to inform the Environmental Statement, consensus was not reached on the specific scoring of several hazards, with a range of scores provided between the Project teams and amongst stakeholders. However, a consensus was reached that due to the changes to the Projects' boundaries all hazards previously identified as High Risk – Unacceptable were now Medium Risk – Tolerable if ALARP. To derive the final scores for the CRNRA, the findings of the workshop were therefore considered with the analysis and wider assessment undertaken by the NASH Project team (see **Appendix A**).

8.5 HAZARD IDENTIFICATION

8.5.1.1.1 An NRA should consider all identified hazards of the Projects on shipping and navigation receptors. In developing the hazard log, consideration was given to project phases, areas, hazard types and vessel types. However, for the purposes of the CRNRA, the objective was to focus on cumulative impacts and therefore the assessment focussed on risks associated with hazards located within the routes between the Projects, rather than hazards associated with individual Project, which are considered in the individual NRA for each Project.

8.5.1.1.2 In total four hazard types were assessed for the CRNRA including:

- **Collision** – Collision between two vessels underway (also includes striking of an anchored or moored vessel).

- **Allision** – Vessel makes contact with Fixed or Floating Object (e.g. WTG/OSP etc.). A separate hazard was included following the first hazard workshop to inform the PEIR to differentiate oil and gas allisions.
- **Grounding** – Vessel makes contact with the seabed/shoreline or underwater assets.
- **Vessel motions** – Vessel experiences a dangerous degree of roll or other motions that cause damage to cargo or injuries.

8.5.1.1.3 For the purposes of the CRNRA, the following vessel types were identified.

Table 38: Vessel types within CRNRA.

Vessel #	Vessel Types/Receptors	Includes
1	Ferry or Passenger Vessel	Passenger Ferry Freight Ferry Cruise Ship
2	Cargo Vessel or Tanker	Cargo (Container, Bulk, Reefer, General etc.) Tanker (Oil, Chemical etc.)
3	Tug and Service Vessels	Tugs Offshore Supply Ships Standby Rescue Vessels Pilot Boats Non-Project CTVs Other Service Vessels
4	Fishing	Trawlers Fishing Boats
5	Recreational	Yachts Pleasure Boats
6	Small Project Vessels	CTVs Survey Vessels Workboats
7	Large Project Vessels	Jackup Barges Cable Layer Heavy Lift Vessels

8.5.1.1.4 Finally, seven areas were identified that largely relate to the routes between OWFs and other obstructions or natural features (**Table 39**).

Table 39: CRNRA areas.

Area #	Areas	Detail
1	Route between Mona and Morgan Array Areas	Route between Mona and Morgan Array Areas and between all three Projects Array Areas
2	Route between Morgan Array Area and Walney OWF	Route between Morgan Array Area and Walney OWF
3	Route between Mona and Morecambe Array Areas	Route between Mona and Morecambe Array Areas
4	Route South of Mona Array Area	Route south of Mona Array Area (incl. TSS)
5	Route East of Morecambe Array Area	Route east of Morecambe Array Area
6	Within OWFs	Navigation within Mona, Morgan or Morecambe Array Areas
7	Operations and Maintenance Base	Route between Projects and an unspecified operations and maintenance base.

8.5.1.1.5 Based on the vessel type, hazard types and hazard area a total of 56 individual hazards were identified. Other hazards and project phases are considered within the respective individual Project NRAs.

8.6 RESULTS

8.6.1 Summary

8.6.1.1.1 The results of the CRNRA are summarised below and a full hazard log is available in **Appendix A**:

- 0 hazards were assessed as High Risk – Unacceptable.
- 45 hazards were assessed as Medium Risk – Tolerable (if ALARP).
- 11 hazards were assessed as Low Risk – Broadly Acceptable.

8.6.2 Top 10 Hazards

8.6.2.1.1 The top 10 hazards and resultant risk scores are shown in **Table 40**.

Table 40: Top 10 hazards.

ID	Rank	Area	Hazard Title	Risk Score	
				Score	Rating
5	1	Morgan-Walney	Allision – Ferry/Passenger	10.0	Medium Risk – Tolerable (if ALARP)
14	1	Mona-Morgan	Allision – Ferry/Passenger	10.0	Medium Risk – Tolerable (if ALARP)
47	3	Within OWFs	Allision – Fishing	9.6	Medium Risk – Tolerable (if ALARP)
10	4	Mona-Morgan	Collision – Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	9.2	Medium Risk – Tolerable (if ALARP)
28	4	South-Mona	Collision – Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	9.2	Medium Risk – Tolerable (if ALARP)
29	6	South-Mona	Collision – Cargo/Tanker ICW. Cargo/Tanker	8.9	Medium Risk – Tolerable (if ALARP)
3	7	Morgan-Walney	Collision – Ferry/Passenger or Cargo/Tanker ICW. Small Craft	8.8	Medium Risk – Tolerable (if ALARP)
12	7	Mona-Morgan	Collision – Ferry/Passenger or Cargo/Tanker ICW. Small Craft	8.8	Medium Risk – Tolerable (if ALARP)
30	7	South-Mona	Collision – Ferry/Passenger or Cargo/Tanker ICW. Small Craft	8.8	Medium Risk – Tolerable (if ALARP)
53	10	Morgan-Walney	Allision (O&G) – Cargo/Tanker or Ferry/Passenger	8.8	Medium Risk – Tolerable (if ALARP)

8.6.2.1.2 The joint highest scoring hazards at 10.0 are an allision involving a ferry/passenger vessel when transiting between Morgan Array Area and Walney OWF, or, Mona and Morgan Array Areas. Both of these routes have a relatively high number of ferry transits, on the former the Ben-my-Chree operates four times a day between Heysham and Douglas and on the latter a combination of the Liverpool-Douglas, Heysham-Warrenpoint, Heysham-Dublin and Liverpool-Belfast routes. Whilst there is greater sea room than previously assessed with the PEIR boundaries, following a ship blackout or mechanical issue the vessel could drift into the Project Array Areas and strike a WTG. It was noted during the navigation simulation exercises undertaken to inform the Environmental Statement that the increased sea room reduces the likelihood of a powered allision and were the vessel disabled that there is a greater opportunity to deploy an anchor were the conditions suitable to do so. Furthermore, ferries have high redundancy and reliability and therefore likelihood of such failure would be low and no such incidents had occurred at other UK OWFs, even where ferry routes are similarly adjacent. Whilst it was agreed that this was unlikely, it carried the potential for a high consequence, with major damage and loss of life, and the consequence scores were increased (from the PEIR values) at the hazard workshop to inform the Environmental Statement for both property and business impacts.

8.6.2.1.3 The third highest hazard was an allision between a fishing vessel and a WTG, with a score of 9.6. Stakeholders noted that allisions involving fishing vessels had occurred historically at other OWFs in UK waters and given the high density of fishing within the Irish Sea, this was a credible scenario. As described in **Section 7.5**, fishing within the three Project Array Areas is anticipated during the operational phase of the Projects. It was suggested by the Project teams that relatively wide spacing between WTGs of the Projects, and notably greater spacing than existing Irish Sea OWFs would mitigate this. Nevertheless, it was agreed that this carried the potential for the loss of the fishing vessel and loss of life in the worst credible occurrence.

8.6.2.1.4 The fourth highest hazards are collisions between Ferry/Passenger vessels and another Cargo/Tanker or Ferry/Passenger vessel in the routes between Mona and Morgan Array Areas and South of Mona Array Area. The route between Mona and Morgan Array Areas would be used by a number of ferry operators and includes commercial routes into Heysham, Liverpool and Douglas (see **Section 7.3** and **7.4**), albeit the numbers for both would equate to less than one an hour (**Section 7.7**), however regular meeting situations were considered a realistic scenario. During the navigation simulations undertaken to inform the Environmental Statement, and as agreed at the workshop undertaken to inform the Environmental Statement, the increase in the sea room between Mona and Morgan Array Areas to 6 nm was sufficient to manage complex traffic scenarios using existing operational practices. Similarly, the route to the south of Mona Array Area although busy with existing traffic into Liverpool, was similarly manageable. A previously identified hazard associated with the proximity of the Mona Array Area to the westbound lane of the Liverpool TSS which caused challenges complying with COLREGs collision avoidance for southeast bound traffic from the IoM had been suitably rectified. It was recognised that more complex traffic situations were likely to develop which necessitated the Master to be called to the bridge. Furthermore, the consequences of collisions involving ferries could result in multiple loss of life, and the "most likely" consequences could involve multiple major injuries. Given that vessels could be travelling in excess of 20 knots, there was the recognised credible potential for catastrophic outcomes were a collision to occur.

8.6.2.1.5 The sixth highest hazard, a collision between two cargo or tanker vessels was similarly scored to the hazards above, but noted that there was a lower potential loss of life but a higher potential for pollution.

8.6.2.1.6 The seventh highest hazards are collision between Ferry/Passenger or a Cargo/Tanker in collision with a small craft such as a fishing vessel, recreational craft or CTV between Morgan Array Area and Walney OWF, Mona and Morgan Array Areas and South Mona Array Area route. By constraining vessel traffic into routes between the Project Array Areas the risk of encountering small craft and colliding with them increases. This is aggravated by the potential for the presence of the Project Array Areas to offset fishing to adjacent waters (see **Section 7.5**). Furthermore, emergence of small craft from the OWFs with possible radar interference or visual obscuration could exacerbate these risks (**Section 7.7.3**), particularly Project CTVs which may be operating at higher speeds. Through additional vessel traffic surveys and navigation simulations undertaken to inform the Environmental Statement, it was demonstrated that even with worst credible traffic situations involving multiple small craft, safe navigation by ferries between the Projects could still be conducted. Some stakeholders asserted that any such collision might involve loss of life, however, comparative historical incidents suggest this is unlikely, with multiple injuries a more credible outcome (**Section 5.3.2.1.8**). The loss of the small craft with multiple loss of life was agreed as a "worst credible" outcome.

8.6.2.1.7 Finally, the tenth highest hazard with a score of 8.8 was an allision between a cargo/tanker vessel or a ferry/passenger vessel and an oil and gas platform. Given the locations of these platforms in relation to the future case routes (see **Section 7.11**), the likelihood of such an incident was considered not only low but relatively unchanged from the existing risk profile. However, given the potential for catastrophic results in both the most likely and worst credible scenarios, a relatively high risk score was derived.

8.6.3 Risk by Route

Route Between Mona and Morgan Array Areas

8.6.3.1.1 Within the CRNRA undertaken to inform the PEIR, the route between Mona and Morgan Array Areas was identified as the most constrained route accounting for two High Risk unacceptable hazards. The 3 nm width between Mona and Morgan Array Areas, with in excess of 4,000 commercial vessel movements per year was not considered of sufficient width for safe navigation and therefore meeting situations between vessels would therefore be reasonably likely to occur. Based on the revised boundaries and the increase to 6 nm separation between Mona and Morgan Array Areas, these risks were significantly reduced as evidenced through the navigation simulations undertaken to inform the Environmental Statement (**Section 2.3.5**), encounter modelling (**Section 7.7/7.7.3**) and hazard workshop to inform the Environmental Statement (**Section 8.4**).

8.6.3.1.2 The highest resulting hazards with the revised boundaries are related to ferry/passenger collisions and allisions whilst passing between Mona and Morgan Array Areas. Other small craft related hazards such as allision were not scored highly given the relatively low density of activity in the centre of the Irish Sea.

Table 41: Route between Mona and Morgan Array Areas risk scores.

ID	Rank	Area	Hazard Title	Risk Score	
				Score	Rating
14	1	Mona-Morgan	Allision – Ferry/Passenger	10.0	Medium Risk – Tolerable (if ALARP)
10	4	Mona-Morgan	Collision – Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	9.2	Medium Risk – Tolerable (if ALARP)
12	7	Mona-Morgan	Collision – Ferry/Passenger or Cargo/Tanker ICW. Small Craft	8.8	Medium Risk – Tolerable (if ALARP)
55	23	Mona-Morgan	Adverse Vessel Motions – Cargo/Tanker or Ferry/Passenger	7.5	Medium Risk – Tolerable (if ALARP)
16	28	Mona-Morgan	Allision – Tug/Service & Small Project Vessels	6.7	Medium Risk – Tolerable (if ALARP)
17	28	Mona-Morgan	Allision – Fishing	6.7	Medium Risk – Tolerable (if ALARP)
13	28	Mona-Morgan	Collision – Small Craft ICW. Small Craft	6.7	Medium Risk – Tolerable (if ALARP)
18	46	Mona-Morgan	Allision – Recreational	5.8	Low Risk – Broadly Acceptable
11	48	Mona-Morgan	Collision – Cargo/Tanker ICW. Cargo/Tanker	5.1	Low Risk – Broadly Acceptable
15	53	Mona-Morgan	Allision – Cargo/Tanker	5.0	Low Risk – Broadly Acceptable

Route between Morgan Array Area and Walney OWF

8.6.3.1.3 The route between Morgan Array Area and Walney OWF would be formed as a result of the Morgan Array Area in isolation, however, the presence of Mona and Morecambe Array Areas may exacerbate risk by altering the routeing decisions taken by vessels. In particular, the passages of the IoMSPC and Stena ferries through a narrow channel with significant fishing activity, oil and gas and some recreational craft increases the risk of small craft collision, which was scored as High Risk in the first hazard workshop to inform the PEIR.

8.6.3.1.4 Following the increase to the sea room between Morgan Array Area and Walney OWF, and tapering of the northwest corner, these High Risk hazards were reduced to Medium Risk. The highest hazard within this route is an allision of a ferry/passenger with a WTG. The relatively long length of the route increases the exposure both to allision and vessel motions (through reduced opportunity to amend heading) aboard ferries transiting it, particularly during adverse weather. Secondly, a collision risk with small craft was noted given the greater density of small craft traffic, particularly fishing and tug/service vessels operating in the area. During the navigation simulations undertaken to inform the Environmental Statement, highly complex traffic situations in adverse weather were tested with the ferry operators of these routes and it was demonstrated that sufficient sea room now existed for collision avoidance.

8.6.3.1.5 Analysis of cargo/tanker vessel traffic showed relatively few movements through this route and as such cargo/tanker related hazards were not scored highly (see **Section 7.4**).

Table 42: Route between Morgan Array Area and Walney OWF risk scores.

ID	Rank	Area	Hazard Title	Risk Score	
				Score	Rating
5	1	Morgan-Walney	Allision - Ferry/Passenger	10.0	Medium Risk - Tolerable (if ALARP)
3	7	Morgan-Walney	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	8.8	Medium Risk - Tolerable (if ALARP)
53	10	Morgan-Walney	Allision (O&G) - Cargo/Tanker or Ferry/Passenger	8.8	Medium Risk - Tolerable (if ALARP)
1	14	Morgan-Walney	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	7.8	Medium Risk - Tolerable (if ALARP)
7	16	Morgan-Walney	Allision - Tug/Service & Small Project Vessels	7.6	Medium Risk - Tolerable (if ALARP)
8	16	Morgan-Walney	Allision - Fishing	7.6	Medium Risk - Tolerable (if ALARP)
54	23	Morgan-Walney	Adverse Vessel Motions - Cargo/Tanker or Ferry/Passenger	7.5	Medium Risk - Tolerable (if ALARP)
9	28	Morgan-Walney	Allision - Recreational	6.7	Medium Risk - Tolerable (if ALARP)
4	28	Morgan-Walney	Collision - Small Craft ICW. Small Craft	6.7	Medium Risk - Tolerable (if ALARP)
2	48	Morgan-Walney	Collision - Cargo/Tanker ICW. Cargo/Tanker	5.1	Low Risk - Broadly Acceptable
6	53	Morgan-Walney	Allision - Cargo/Tanker	5.0	Low Risk - Broadly Acceptable

Route between Mona and Morecambe Array Areas

8.6.3.1.6 At the time of the first CRNRA, the route between the Mona and Morecambe Array Areas was the widest of the cumulative scenarios at 4.9 nm and all hazards were assessed as Medium Risk. The changes to the Project boundaries made following the PEIR consultation (to 5.7 nm with a wine glass type geometry) increases this greatly and therefore further reductions to the likelihood scores has resulted.

8.6.3.1.7 The primary vessel type taking this route would be ferry/passenger vessel services into Liverpool and therefore allision, collision and adverse vessel motion hazards involving this vessel type scored higher than other hazard types. During the hazard workshop to inform the Environmental Statement, there was debate as to the likelihood that cargo and tanker vessels would navigate between Mona and Morecambe Array Areas. At present, a minority of small vessels do not transit through the TSS when navigating west (approximately one per day), and the presence of the Projects could make this more attractive rather than navigating through the TSS. The CRNRA assumes that those vessels would continue to do so, but their relatively low numbers reduce the likelihood that they would be involved in an incident.

8.6.3.1.8 It was agreed at the hazard workshop to inform the Environmental Statement that the potential presence of the Morgan Offshore Wind Project's offshore booster station at the most westerly portion of the search areas would have a minimal impact on navigation safety but might increase the deviation of Stena Lines Liverpool to Belfast route were they to go east of the Isle of Man.

Table 43: Route between Mona and Morecambe Array Areas risk scores.

ID	Rank	Area	Hazard Title	Risk Score	
				Score	Rating
23	12	Mona-Morecambe	Allision – Ferry/Passenger	8.3	Medium Risk – Tolerable (if ALARP)
19	14	Mona-Morecambe	Collision – Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	7.8	Medium Risk – Tolerable (if ALARP)
56	23	Mona-Morecambe	Adverse Vessel Motions – Cargo/Tanker or Ferry/Passenger	7.5	Medium Risk – Tolerable (if ALARP)
21	26	Mona-Morecambe	Collision – Ferry/Passenger or Cargo/Tanker ICW. Small Craft	7.4	Medium Risk – Tolerable (if ALARP)
25	28	Mona-Morecambe	Allision – Tug/Service & Small Project Vessels	6.7	Medium Risk – Tolerable (if ALARP)
22	28	Mona-Morecambe	Collision – Small Craft ICW. Small Craft	6.7	Medium Risk – Tolerable (if ALARP)
26	28	Mona-Morecambe	Allision – Fishing	6.7	Medium Risk – Tolerable (if ALARP)
27	46	Mona-Morecambe	Allision – Recreational	5.8	Low Risk – Broadly Acceptable
20	48	Mona-Morecambe	Collision – Cargo/Tanker ICW. Cargo/Tanker	5.1	Low Risk – Broadly Acceptable
24	53	Mona-Morecambe	Allision – Cargo/Tanker	5.0	Low Risk – Broadly Acceptable

Route South of Mona Array Area

8.6.3.1.9 The South Mona Array Area region, formed due to the presence of Mona Array Area compressing traffic to the southwest in the approaches to Liverpool, achieved two High Risk and several Medium Risk scores at the CRNRA to inform the PEIR. These high risk hazards related to collisions between large commercial ships and small craft and interaction between large vessels to the southwest of Mona Array Area.

8.6.3.1.10 The revised boundaries assessed in the CRNRA to inform the Environmental Statement have increased the separation between the shipping lanes approaching Liverpool and the southern boundary of Mona Array Area. Through the navigation simulations undertaken to inform the Environmental Statement, it was demonstrated that this significantly improved the ability of commercial vessels to avoid one another, particularly those westbound from Liverpool encountering crossing vessels from the northwest inbound to Liverpool. Furthermore, the greater separation improves the ability for small craft and large commercial vessels to separate and avoid interactions. However, the relatively high existing density of traffic results in a relative high baseline risk in comparison to other regions of the Irish Sea, driving some higher scoring hazards.

Table 44: Route South of Mona Array Area risk scores.

ID	Rank	Area	Hazard Title	Risk Score	
				Score	Rating
28	4	South-Mona	Collision – Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	9.2	Medium Risk – Tolerable (if ALARP)
29	6	South-Mona	Collision – Cargo/Tanker ICW. Cargo/Tanker	8.9	Medium Risk – Tolerable (if ALARP)
30	7	South-Mona	Collision – Ferry/Passenger or Cargo/Tanker ICW. Small Craft	8.8	Medium Risk – Tolerable (if ALARP)
33	11	South-Mona	Allision – Cargo/Tanker	8.7	Medium Risk – Tolerable (if ALARP)
32	12	South-Mona	Allision – Ferry/Passenger	8.3	Medium Risk – Tolerable (if ALARP)
34	28	South-Mona	Allision – Tug/Service & Small Project Vessels	6.7	Medium Risk – Tolerable (if ALARP)
35	28	South-Mona	Allision – Fishing	6.7	Medium Risk – Tolerable (if ALARP)
36	28	South-Mona	Allision – Recreational	6.7	Medium Risk – Tolerable (if ALARP)
31	28	South-Mona	Collision – Small Craft ICW. Small Craft	6.7	Medium Risk – Tolerable (if ALARP)

Route East of Morecambe Array Areas

8.6.3.1.11 The route to the east of Morecambe Array Area was identified as having relatively low traffic numbers and therefore the presence of the Morecambe Array Area is not considered to significantly increase the risk profile. Given the greater propensity for small craft traffic, these hazards are scored more highly, but all falling within the Medium Risk/Low Risk categories. It may be the case that the presence of the other Projects, increases the likelihood that small general cargo ships and small craft route further east rather than navigating between the Project Array Areas, although this should not appreciably increase the risk scores. With the exception of minor changes to consequences discussed at the hazard workshop to inform the Environmental Statement in 2023, no changes were made to the likelihood of these hazards than presented in the CRNRA at PEIR.

Table 45: Route East of Morecambe Array Area risk scores.

ID	Rank	Area	Hazard Title	Risk Score	
				Score	Rating
41	16	East Morecambe	Allision - Tug/Service & Small Project Vessels	7.6	Medium Risk - Tolerable (if ALARP)
42	16	East Morecambe	Allision - Fishing	7.6	Medium Risk - Tolerable (if ALARP)
43	16	East Morecambe	Allision - Recreational	7.6	Medium Risk - Tolerable (if ALARP)
39	16	East Morecambe	Collision - Small Craft ICW. Small Craft	7.6	Medium Risk - Tolerable (if ALARP)
44	45	East Morecambe	Grounding - Cargo/Tanker	6.5	Medium Risk - Tolerable (if ALARP)
37	48	East Morecambe	Collision - Cargo/Tanker ICW. Cargo/Tanker	5.1	Low Risk - Broadly Acceptable

ID	Rank	Area	Hazard Title	Risk Score	
				Score	Rating
38	48	East Morecambe	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	5.1	Low Risk - Broadly Acceptable
40	53	East Morecambe	Allision - Cargo/Tanker	5.0	Low Risk - Broadly Acceptable

8.7 POTENTIAL ADDITIONAL RISK CONTROLS OPTIONS

8.7.1.1.1 During the hazard workshop to inform the PEIR in 2022, a number of potential, additional risk control options were identified which could reduce the risk scores further and their utility discussed. Some of these were subsequently adopted by the Projects for inclusion in this CRNRA. These risk controls were then reviewed at the CRNRA workshop to inform the Environmental Statement in September 2023 and two additional risk controls were proposed by participants. The details of these additional risk controls and their status are described in **Table 46**.

Table 46: Potential additional risk control options identified in both hazard workshops and their status.

ID	Title	Description	Status
Proposed at CRNRA to inform the PEIR			
1	Layout Design	To increase manoeuvring space and reduce impact on operators, revision of Project boundaries could include: • Increase in sea room between Morgan and Mona Array Areas. • Realignment of northern corner of the Morgan Array Area to maintain parallel boundaries to route between Morgan Array Area and Walney OWF and improve navigability and line of sight (visual and radar) for vessels entering and departing the route. • Realignment of Morecambe Array Area west boundary extent to minimise course changes (and deviation distance) for vessels navigating north-south through route between Mona and Morecambe Array Areas and then route between Morgan Array Area and Walney OWF. • Realignment of Mona Array Area northeast boundary to enable direct passage between Mona, Morecambe and Morgan Array Areas for traffic passing Liverpool-Douglas. • Realignment south boundary of Mona Array area to increase distance form TSS and passing distance of traffic from OWF.	**Adopted** by Projects for inclusion in Environmental Statement assessment.
2	Ship Routeing	Inclusion of ship routeing schemes to organise vessel traffic, such as: • Extension of Liverpool Bay TSS to the west, enabling direct route for traffic from West of IoM to the TSS, clearing Mona Array Area. • Recommended routeing schemes introduced (starboard side channel navigation) in some of the routes between OWF.	**Not adopted** - this was discussed at the hazard workshops, and it was concluded by the participants that these were not required as they would offer little benefit for organizing traffic and the high complexity of establishing new ship routeing measures would be disproportionate.
3	Site Layout	Two lines of orientation to support internal navigation (and reduce likelihood of small traffic displacement into the routes/areas outside of the OWFs) and SAR.	**Adopted** by Projects (Two Lines of Orientation)

ID	Title	Description	Status
4	CTV Passage Planning	Develop coordinated passage plans for CTVs that minimises impact on other traffic, could include: • Specified crossing points (e.g. between Morgan Array Area and Walney OWF). • Crossing protocols to be established prior to crossing route. • Dissemination of information and liaison with regular runners and ferry services. • Restricted visibility and night time protocols.	**Adopted** by Projects (Through Vessel Traffic Management Plans)
5	Continued Engagement	Maintain the MNEF to facilitate information sharing and management/identification of additional risk controls: • Identify near misses and investigate incidents, disseminating learnings. • Coordinate construction activities.	**Adopted** by Projects (through continuation of MNEF)
6	Reporting Notification	Consider reporting procedures for vessels entering areas between OWFs. VHF Channel 16 broadcasts of vessel details and direction of travels.	**Not adopted** - this was discussed at the hazard workshops, and it was concluded by the participants that these could not be implemented under existing legislation, could not be easily managed and would therefore not be appropriate.
7	Master Training	Provision of enhanced master and bridge team training, such as bridge navigation simulator sessions, for safe navigation within the OWF routes and wider CRNRA study area.	**Not adopted** - this was discussed at the hazard workshops, and it was concluded by the participants that master training was sufficient to appropriately manage navigation safety with the revised boundaries.
8	Construction scheduling	Managing construction activities to deconflict with other marine activities.	**Adopted** by Projects (Through Vessel Traffic Management Plan)
Proposed at CRNRA to inform the Environmental Statement			
9	Exclusion from Array Areas	Exclusion of non-Project vessel traffic from the Project Array Areas, as is the case elsewhere in the world to minimize the risk of allision and collision with Project vessels.	**Not adopted** - this was discussed at the hazard workshops, and it was concluded by the participants that this would adversely impact freedom of navigation, could increase risk by offsetting small craft into adjacent shipping lanes and was inconsistent with the approach taken by the MCA.
10	Emergency Towage Vessel (ETV)	Introduction of an ETV in the Irish Sea to respond to any disabled vessel which was drifting towards the array areas. Existing towage in the Irish Sea would be ill suited to respond to such an emergency and therefore a dedicated ETV, as is more commonly the case in Europe could respond to these situations.	**Not adopted** - this was discussed at the hazard workshops and given that vessel allisions were scored as Medium Risk and relatively unlikely, therefore the very high cost of procuring and operating at ETV was disproportionate.

ID	Title	Description	Status
11	MetOcean Monitoring System	Implementation of real-time wind, wave and visibility monitoring systems on the periphery of the Projects to provide additional information on likely conditions to be encountered by vessels navigating around the Projects, to support passage planning by ferries in adverse weather. This would improve the appreciation on the feasibility of navigating between the Projects during adverse weather and may reduce the precautionary requirement for taking longer adverse weather routes.	The Projects have committed to reviewing how such a system could be implemented and may be adopted.

8.8 RISK STATEMENT AND DETERMINATION OF ALARP

8.8.1.1.1 The CRNRA has brought together significant analysis, consultation, navigation simulations and the findings of the hazard workshops to determine the cumulative risks associated with the Mona Offshore Wind Project, Morgan Generation Assets, Morecambe Generation Assets and Morgan and Morecambe Transmission Assets. The study has concluded that following the changes to the boundaries following the PEIR consultation, all hazards have been reduced to either Medium Risk – Tolerable if ALARP or Broadly Acceptable. Whilst it was recognised that the construction of three Project Array Areas in otherwise navigable waters would increase the risks of collision and allision for navigating vessels, a consensus was reached with stakeholders that these risks were Tolerable or Broadly Acceptable. In particular, the increase in sea room between the OWFs provides sufficient space for vessels to safely manoeuvre in complex realistic traffic situations and adverse weather in full compliance with the COLREGs and the practice of good seamanship.

8.8.1.1.2 Appropriate risk controls were considered to be embedded in the Projects' design and whilst additional risk control options were discussed (such as ship routeing or ETVs), it was agreed that these were disproportionate to the reduction in risk they might achieve. Therefore, the CRNRA has also concluded that where risks are scored as Medium they can be considered ALARP and therefore Tolerable without the need for additional risk control measures.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 CONCLUSIONS

Introduction

1. A regional cumulative assessment has been conducted on a collaborative basis between the Mona Offshore Wind Project, Morgan Offshore Wind Project Generation Assets, Morecambe Offshore Windfarm Generation Assets and Morgan and Morecambe Offshore Wind Farms Transmission Assets.

2. The CRNRA has been conducted in compliance with all relevant legislation, policy and guidance as would be expected of a standalone OWF NRA (**Section 1.4/2**).

3. This CRNRA is an update to the CRNRA undertaken in 2022 which was included within the PEIR submissions of each of the four Projects. The update accounts for changes to the Projects design made following the findings of the PEIR and a review of the Section 42 responses, principally the Project Array Area boundaries, a commitment to two lines of orientation and a reduction in the number of project vessel movements (see **Section 1.2 / Section 1.3**).

4. The four Projects would account for up to 227 additional WTGs and 10 OSPs in the MDS, developed across a sizeable proportion of the Irish Sea (**Section 3**). These might necessitate up to 2,500 additional vessel movements per year during the operational phases of the Projects.

Review of the Baseline

5. The CRNRA study area includes numerous AtoNs, pilot stations, ports and harbours, anchorages and two TSSs (**Section 4.1/4.2**). Furthermore, there are extensive existing activities including oil and gas exploration and extraction, offshore wind and aggregate extraction.

6. The CRNRA study area has predominately southwesterly wind and wave conditions (**Section 4.3**). Annual adverse weather events can exceed 4.2 m significant wave height and 50kns. Reduced visibility might occur up to 24 days/year dependent on location within the CRNRA study area.

7. SAR facilities, including RNLI stations and helicopter stations are located immediately adjacent to the CRNRA study area throughout the Welsh, English and IoM coastlines (**Section 4.4**).

8. Analysis of historical vessel traffic data (**Section 5.2**) identified:

    a. Cargo and tanker shipping predominately passes into the Port of Liverpool from the northwest or west. This includes deep draught vessels over 300 m in length. Some smaller vessels may pass between other ports across the CRNRA study area, but at far fewer transits.

    b. There is significant passenger vessel activity across the CRNRA study area, including ferry services between Liverpool, Heysham, Douglas, Northern Ireland and Ireland. Cruise ship transits also occur, to a lesser extent, between Douglas and Liverpool.

c. Recreational vessel traffic is concentrated inshore, particularly along the Welsh coast and the IoM. Cruising routes exist between Liverpool and Douglas, Heysham and the Welsh coast, and the Welsh Coast and Douglas.

d. There is static and mobile fishing gear deployed across the CRNRA study area, including both local and international based boats.

e. Service vessels associated with existing OWFs and oil and gas infrastructure account for a large proportion of vessel movements within the CRNRA study area.

f. Analysis of adverse weather routeing demonstrates that vessels may deviate from their usual routes frequently throughout the year (**Section 5.2.5**).

g. Anchorages exist to the east of Anglesey and adjacent to the approaches to Liverpool (**Section 5.2.6**). There is evidence of loitering by commercial ships between the Welsh coast and the IoM.

9. Analysis of historical incident data identified that the majority of incidents within the CRNRA study area occurred inshore, and adjacent to the approaches to the key ports (**Section 5.3**). There were few collisions in vicinity of the Project Array Areas and these were largely mechanical failure. Analysis of incidents at other OWFs around the UK show that most accidents involve project vessels contacting WTGs or having incidents in transit between the Project Array Areas and operations and maintenance base.

10. An assessment of the future traffic profile within the CRNRA study area (**Section 6**) determined that an increase in commercial vessel numbers of 15% by 2035 would be a reasonable assumption. There was little evidence of large changes to recreational or fishing vessel numbers. It is anticipated that oil and gas decommissioning would reduce vessel numbers, although there is uncertainty around the timing at which this would occur.

Potential Impacts of Projects

11. An assessment of the potential impacts of the Projects on recognised sea lanes essential to international navigation (**Section 7.2**) determined that access to the TSSs in the CRNRA study area would be maintained.

12. An assessment of the potential impacts of the Projects on ferry vessel routeing (**Section 7.3**) determined that:

a. There would be necessary deviation of Stena, IoMSPC and Seatruck routes around the Project Arrays Areas.

b. This deviation in normal conditions would be less than five minutes in most cases, with the exception of the Stena Line route between Liverpool and Belfast where certain sub routes may experience between 13 and 16 minutes deviation. Existing passages are between three and eight hours (dependent on route), with existing services having significant variation in turnaround times and transit times of greater than 25 minutes. The increase transit duration associated with the Projects is unlikely to have significant schedule impacts but could increase pressures on operators.

c. During adverse weather, the assessment determined that existing adverse weather routes would not be viable and therefore a more circuitous route around the OWFs would be required. This would increase the schedule impacts by between 13 and 70 minutes (dependent on route). This is likely to result in increased delays and cancellations of services. The presence of the Projects may necessitate additional watchkeeping requirements to ensure safe navigation between the Project Array Areas.

13. The potential presence of the Morgan Offshore Wind Project's booster station at the most westerly portion of the search areas would have a minimal impact on navigation safety but might increase the deviation of Stena Lines Liverpool to Belfast route were they to go east of the Isle of Man.

14. An assessment of the potential impacts of the Projects on vessel routeing determined that the principal shipping routes into Liverpool would necessitate a minor deviation to the southwest of the Mona Array Area, but this was not so significant to threaten the viability of Liverpool as a port (**Section 7.4**). Less trafficked routes into Heysham and Douglas would necessitate greater deviations, which are also unlikely to make such services unviable.

15. An assessment of the potential impacts of the Projects on small craft routeing determined that there is sufficient spacing between turbines across all three Project Array Areas to facilitate safe navigation for fishing and recreational craft within the Project Array Areas (**Section 7.5**). Where small craft choose not to navigate within the Project Array Areas, there may be some effect of offsetting these vessels into adjacent routes which could result in increased collision risk with passing vessels.

16. The routes between the Projects were reviewed in context of guidance and UK precedents (**Section 7.6**). The routes between Morgan Array Area and Walney OWF, Mona and Morgan Array Areas, and Mona and Morecambe Array Areas meet both MCA and PIANC guidance, even following sensitivity analysis with greater vessel numbers. Projects elsewhere in the UK have designs which are comparable in geometries to those between the three Project Array Areas and between the four projects and adjacent infrastructure.

17. The frequency at which vessels would encounter one another and the implications for collision avoidance was assessed (**Section 7.7**):

    a. It was concluded that, with the exception of the region to the south of Mona Array Area which is naturally busier, for much of the time there was a low likelihood of multiple commercial vessels navigating between the Projects at any one time (<25%). The likelihood of two or more commercial vessels was less than 3% for the route between Mona and Morgan Array Areas and less than 1% for the routes between Morgan Array Area and Walney OWF, and Mona and Morecambe Array Areas.

b. Modelling of vessel encounters showed that the effect of the Projects would result in a 2% increase in total encounters, and a 15% increase in ferry encounters, which is the equivalent in an additional (typical) ferry service in the study area.

c. Visual identification implications were reviewed and showed that vessels could be easily distinguished within the OWFs both during the day and night and there would be sufficient time for large vessels navigating between or around the Projects to respond to vessels emerging from the OWF.

18. An assessment of the potential impacts of the Projects on collision and allision risk (**Section 7.8**) determined that the Projects would result in a minor to moderate relative increase in collision and allision risk, however, the return periods of such incidents were low at less than once in 88 and 72 years respectively. The individual incident likelihoods for both ferry and cargo/tanker collision and allisions were less than once in one hundred years in all cases.

19. The orientation and width of the routes between the OWFs could have an impact on the ability of vessels to respond to an emergency (**Section 7.9**). However, it was concluded that suitable options remained open to the Master to respond to vessel motions, fires or medical incidents.

20. The layouts of the Projects with relation to SAR was considered (**Section 7.10**). It was concluded that the layout commitments made by the Projects complied with all SAR guidance requirements and are in excess of those currently in place on existing Projects in the Irish Sea.

21. The layout of the Projects, in relation to shipping routes, and accounting for oil and gas decommissioning activities, would not appreciably increase the risk to oil and gas activities beyond the base case (**Section 7.11**).

22. An assessment of the potential impacts of the Projects on vessel communications, radar and positioning systems determined that most impacts are negligible. Impacts to radar are inherent when navigating adjacent to OWFs but there is sufficient sea room to mitigate these impacts (**Section 7.12**).

Navigation Risk Assessment

23. A risk assessment was undertaken, supported through a second hazard workshop to inform the Environmental Statement attended by representatives from ferry operators, regulators, commercial bodies, oil and gas operators, ports and fishing community. The risk assessment, with embedded risk controls concluded that:

    a. The 56 hazards identified, split across different hazard types, vessel types and areas were suitable to characterise the navigation risks for the purpose of this assessment.

    b. A consensus was reached that all of these hazards were either Medium Risk – Tolerable if ALARP or Low Risk – Broadly Acceptable.

c. The highest scoring hazards related to allisions involving Ferry/Passenger vessels on routes between the Morgan Array Area and Walney OWF and between the Mona and Morgan Array Areas, as well as allisions involving fishing boats. The navigation simulations undertaken to inform the Environmental Statement had demonstrated that changes to the boundaries had significantly mitigated the collision risk for vessels transiting between the Projects.

d. Whilst additional risk control measures were identified, some of these (such as ship routeing or ETVs) were not adopted as it was concluded they were disproportionate to the risk reduction and therefore all hazards could be determined to be ALARP without the need for additional mitigation.

9.2 SUMMARY

9.2.1.1.1 The CRNRA has brought together significant analysis, consultation, navigation simulations and the findings of the hazard workshops to determine the cumulative risks associated with the four Projects. The study has concluded that following the changes to the boundaries made following the PEIR consultation, all hazards have been reduced to either Medium Risk – Tolerable if ALARP or Broadly Acceptable. Whilst it was recognised that the construction of four Projects in otherwise navigable waters would increase the risks of collision and allision for navigating vessels, a consensus was reached with stakeholders that these risks were not unacceptable. In particular, the increase in sea room between the OWFs provides sufficient space for vessels to safely manoeuvre in complex realistic traffic situations and adverse weather in full compliance with the COLREGs and the practice of good seamanship.

9.2.1.1.2 Appropriate risk controls were considered to be embedded in the Projects' design and whilst additional risk control options were discussed, it was agreed that these were disproportionate to the reduction in risk they might achieve. Therefore, the CRNRA has also concluded that all Medium Risks can be considered ALARP and that no further risk controls are warranted.

9.2.1.1.3 Due to the release of the scoping report for the Mooir Vannin Offshore Wind Farm in October 2023, after the completion of many of the activities undertaken to inform the CRNRA, an addendum was prepared to consider the additional cumulative impacts that might result. This is reported in **Appendix D**.

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Appendix A CRNRA Hazard Log

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
1	14	Morgan-Walney	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	2	Significant loss of life; Constructive Loss; Serious pollution (Tier 2); International adverse publicity. Ferry out of service.	5	5	4	5	2	7.8	Medium Risk - Tolerable (if ALARP)
2	48	Morgan-Walney	Collision - Cargo/Tanker ICW. Cargo/Tanker	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Vessel requires drydock.	2	3	2	3	2	Single fatalities; Constructive Loss; Major pollution incident (Tier 3); National adverse publicity.	4	5	5	4	1	5.1	Low Risk - Broadly Acceptable
3	7	Morgan-Walney	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	3	Multiple fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
4	28	Morgan-Walney	Collision - Small Craft ICW. Small Craft	Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
5	1	Morgan-Walney	Allision - Ferry/Passenger	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Repairs to WTGs; Short term interruption to ferry services.	3	3	2	4	3	Multiple fatalities; Serious damage to vessel; Serious pollution (Tier 2); International adverse publicity; Loss of WTGs; Ferry out of service.	5	5	3	5	2	10.0	Medium Risk - Tolerable (if ALARP)
6	53	Morgan-Walney	Allision - Cargo/Tanker	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; No pollution; Widespread adverse publicity; Repairs to WTGs.	2	3	1	3	2	Single fatalities; Drydock required; Serious pollution incident (Tier 2); National adverse publicity; Loss of WTGs.	4	5	4	5	1	5.0	Low Risk - Broadly Acceptable

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores: People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	Realistic Worst Credible Scores: People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
7	16	Morgan-Walney	Allision - Tug/Service & Small Project Vessels	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	4	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)
8	16	Morgan-Walney	Allision - Fishing	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; Fishing Liaison Plan; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	4	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)
9	28	Morgan-Walney	Allision - Recreational	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
10	4	Mona-Morgan	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	3	Significant loss of life; Constructive Loss; Serious pollution (Tier 2); International adverse publicity. Ferry out of service.	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)
11	48	Mona-Morgan	Collision - Cargo/Tanker ICW. Cargo/Tanker	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Vessel requires drydock.	2	3	2	3	2	Single fatalities; Constructive Loss; Major pollution incident (Tier 3); National adverse publicity.	4	5	5	4	1	5.1	Low Risk - Broadly Acceptable
12	7	Mona-Morgan	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	3	Multiple fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores: People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	Realistic Worst Credible Scores: People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
13	28	Mona-Morgan	Collision - Small Craft ICW. Small Craft	Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
14	1	Mona-Morgan	Allision - Ferry/Passenger	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Repairs to WTGs; Short term interruption to ferry services.	3	3	2	4	3	Multiple fatalities; Serious damage to vessel; Serious pollution (Tier 2); International adverse publicity; Loss of WTGs; Ferry out of service.	5	5	3	5	2	10.0	Medium Risk - Tolerable (if ALARP)
15	53	Mona-Morgan	Allision - Cargo/Tanker	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; No pollution; Widespread adverse publicity; Repairs to WTGs.	2	3	1	3	2	Single fatalities; Drydock required; Serious pollution incident (Tier 2); National adverse publicity; Loss of WTGs.	4	5	4	5	1	5.0	Low Risk - Broadly Acceptable

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
16	28	Mona-Morgan	Allision - Tug/Service & Small Project Vessels	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
17	28	Mona-Morgan	Allision - Fishing	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; Fishing Liaison Plan; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
18	46	Mona-Morgan	Allision - Recreational	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	2	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	5.8	Low Risk - Broadly Acceptable

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores: People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	Realistic Worst Credible Scores: People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
19	14	Mona-Morecambe	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	2	Significant loss of life; Constructive Loss; Serious pollution (Tier 2); International adverse publicity. Ferry out of service.	5	5	4	5	2	7.8	Medium Risk - Tolerable (if ALARP)
20	48	Mona-Morecambe	Collision - Cargo/Tanker ICW. Cargo/Tanker	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Vessel requires drydock.	2	3	2	3	2	Single fatalities; Constructive Loss; Major pollution incident (Tier 3); National adverse publicity.	4	5	5	4	1	5.1	Low Risk - Broadly Acceptable
21	26	Mona-Morecambe	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	2	Multiple fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
22	28	Mona-Morecambe	Collision - Small Craft ICW. Small Craft	Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
23	12	Mona-Morecambe	Allision - Ferry/Passenger	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Repairs to WTGs; Short term interruption to ferry services.	3	3	2	4	2	Multiple fatalities; Serious damage to vessel; Serious pollution (Tier 2); International adverse publicity; Loss of WTGs; Ferry out of service.	5	5	3	5	2	8.3	Medium Risk - Tolerable (if ALARP)
24	53	Mona-Morecambe	Allision - Cargo/Tanker	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; No pollution; Widespread adverse publicity; Repairs to WTGs.	2	3	1	3	2	Single fatalities; Drydock required; Serious pollution incident (Tier 2); National adverse publicity; Loss of WTGs.	4	5	4	5	1	5.0	Low Risk - Broadly Acceptable

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
25	28	Mona-Morecambe	Allision - Tug/Service & Small Project Vessels	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
26	28	Mona-Morecambe	Allision - Fishing	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; Fishing Liaison Plan; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
27	46	Mona-Morecambe	Allision - Recreational	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	2	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	5.8	Low Risk - Broadly Acceptable

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
28	4	South-Mona	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	3	Significant loss of life; Constructive Loss; Serious pollution (Tier 2); International adverse publicity. Ferry out of service.	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)
29	6	South-Mona	Collision - Cargo/Tanker ICW. Cargo/Tanker	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Vessel requires drydock.	2	3	2	3	3	Single fatalities; Constructive Loss; Major pollution incident (Tier 3); National adverse publicity.	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)
30	7	South-Mona	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	3	Multiple fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
31	28	South-Mona	Collision - Small Craft ICW. Small Craft	Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
32	12	South-Mona	Allision - Ferry/Passenger	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Repairs to WTGs; Short term interruption to ferry services.	3	3	2	4	2	Multiple fatalities; Serious damage to vessel; Serious pollution (Tier 2); International adverse publicity; Loss of WTGs; Ferry out of service.	5	5	3	5	2	8.3	Medium Risk - Tolerable (if ALARP)
33	11	South-Mona	Allision - Cargo/Tanker	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; No pollution; Widespread adverse publicity; Repairs to WTGs.	2	3	1	3	3	Single fatalities; Drydock required; Serious pollution incident (Tier 2); National adverse publicity; Loss of WTGs.	4	5	4	5	2	8.7	Medium Risk - Tolerable (if ALARP)

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
34	28	South-Mona	Allision - Tug/Service & Small Project Vessels	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
35	28	South-Mona	Allision - Fishing	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; Fishing Liaison Plan; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
36	28	South-Mona	Allision - Recreational	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
37	48	East Morecambe	Collision - Cargo/Tanker ICW. Cargo/Tanker	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation.	Multiple minor injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Vessel requires drydock.	2	3	2	3	2	Single fatalities; Constructive Loss; Major pollution incident (Tier 3); National adverse publicity.	4	5	5	4	1	5.1	Low Risk - Broadly Acceptable
38	48	East Morecambe	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	2	Multiple fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	5	4	3	4	1	5.1	Low Risk - Broadly Acceptable
39	16	East Morecambe	Collision - Small Craft ICW. Small Craft	Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	4	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
40	53	East Morecambe	Allision - Cargo/Tanker	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring.	Multiple minor injuries; Moderate damage to vessel; No pollution; Widespread adverse publicity; Repairs to WTGs.	2	3	1	3	2	Single fatalities; Drydock required; Serious pollution incident (Tier 2); National adverse publicity; Loss of WTGs.	4	5	4	5	1	5.0	Low Risk - Broadly Acceptable
41	16	East Morecambe	Allision - Tug/Service & Small Project Vessels	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	4	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)
42	16	East Morecambe	Allision - Fishing	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; Fishing Liaison Plan; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	4	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
43	16	East Morecambe	Allision - Recreational	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	4	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)
44	45	East Morecambe	Grounding - Cargo/Tanker	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation.	Multiple minor injuries; Minor damage to vessel; No pollution; Minor adverse publicity.	2	2	1	1	3	Single fatalities; Serious damage to vessel; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.5	Medium Risk - Tolerable (if ALARP)
45	28	Within OWFs	Collision - Small Craft ICW. Small Craft	Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
46	16	Within OWFs	Allision - Tug/Service & Small Project Vessels	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	4	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)
47	3	Within OWFs	Allision - Fishing	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; Fishing Liaison Plan; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	4	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	3	9.6	Medium Risk - Tolerable (if ALARP)
48	28	Within OWFs	Allision - Recreational	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
49	26	O&M Base	Collision - Small Project Vessels ICW. Cargo/Tanker or Ferry/Passenger	Increased Project Vessel Movements; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; ERCOP; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	2	Multiple fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)
50	28	O&M Base	Collision - Small Project Vessels ICW. Small Craft	Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
51	28	O&M Base	Allision - Small Project Vessel	Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
52	28	O&M Base	Grounding - Small Project Vessel	Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)

Hazard ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
53	10	Morgan-Walney	Allision (O&G) - Cargo/Tanker or Ferry/Passenger	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Moderate pollution (Tier 2); Widespread adverse publicity; Short term interruption to ferry services.	3	4	3	4	2	Significant loss of life; Constructive Loss; Serious pollution (Tier 2); International adverse publicity. Ferry out of service.	5	5	5	5	2	8.8	Medium Risk - Tolerable (if ALARP)
54	23	Morgan-Walney	Adverse Vessel Motions - Cargo/Tanker or Ferry/Passenger	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Adverse Weather; Avoidance of Other Traffic;	Notice to Mariners; Site Marking and Charting; ERCOP; Boundary Changes.	Minor injuries; Minor damage to vessel - some damage to cargo; No pollution; Short term interruption to ferry services.	2	3	1	2	3	Single fatality; Major damage; Minor pollution; National adverse publicity; Ferry out of service.	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)
55	23	Mona-Morgan	Adverse Vessel Motions - Cargo/Tanker or Ferry/Passenger	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Adverse Weather; Avoidance of Other Traffic;	Notice to Mariners; Site Marking and Charting; ERCOP; Boundary Changes.	Minor injuries; Minor damage to vessel - some damage to cargo; No pollution; Short term interruption to ferry services.	2	3	1	2	3	Single fatality; Major damage; Minor pollution; National adverse publicity; Ferry out of service.	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)
56	23	Mona-Morecambe	Adverse Vessel Motions - Cargo/Tanker or Ferry/Passenger	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Adverse Weather; Avoidance of Other Traffic;	Notice to Mariners; Site Marking and Charting; ERCOP; Boundary Changes.	Minor injuries; Minor damage to vessel - some damage to cargo; No pollution; Short term interruption to ferry services.	2	3	1	2	3	Single fatality; Major damage; Minor pollution; National adverse publicity; Ferry out of service.	4	4	2	4	2	7.5	Medium Risk - Tolerable (if ALARP)

Appendix B Hazard Workshop Summary

B.1 HAZARD WORKSHOP PREPARATION:

B.1.1.1.1 The 2023 CRNRA hazard workshop undertaken to inform the Environmental Statement preparation consisted of the following:

1) **9th August 2023:** Save the date email issued to the wider stakeholder group which provided the dates for the hazard workshop, format and location.

2) **29th August 2023**: Issue of letter to all stakeholders introducing the Projects, the commitments made post-PEIR and provided further details of the hazard workshop venue and format.

3) **18th September 2023**: Issue of Project update newsletters outlining boundary changes made to the public.

4) **21st and 22nd September 2023**: Issue of pre-read packs to all stakeholders which contained:

    a. Slide pack containing a summary of the Projects, boundary changes, analysis, methodology and reasoning behind the hazard scoring.

    b. Draft hazard logs developed by the Project Team.

5) **28th September 2023**: CRNRA Hazard Workshop to inform the Environmental Statement.

Hazard workshop:

B.1.1.1.2 A hazard workshop was held in person on 28th September 2023 at the Mercure Atlantic Tower Hotel in Liverpool.

B.1.1.1.3 The agenda was as follows:

- 09:00 - 09:30 Coffee
- 09:30 - 10:15 Introductions / Aims and Objectives
- 10:15 - 11:00 Review of Supporting Studies
- 11:00 - 11:15 Coffee Break
- 11:15 - 11:30 Overview of Methodology
- 11:30 - 13:00 Hazard Scoring Session 1
- 13:00 - 13:45 Lunch
- 13:45 - 15:45 Hazard Scoring Session 2
- 15:45 - 16:00 Coffee Break
- 16:00 - 17:00 Mooir Vannin Scenario
- 17:00 - 17:30 Washup

B.1.1.1.4 The details the organisations and representatives that attended the workshop are shown below.

Organisation	Attendee	Role
Project Team		
NASH Maritime	Andrew Rawson Chris Hutchings Claire Conning Adam Fitzpatrick	Shipping and Navigation Consultants (Mona/Morgan/Morecambe)
HR Wallingford	Ian Simpson	Consultant Master Mariner Supporting NASH Maritime
Brookes Bell	Dominic Bell	Consultant Master Mariner Supporting NASH Maritime
bp / EnBW	Florian Krechting Gero Vella Heather Kwiatkowsk Marta Orcajo Garcia Paul Carter Rosie Howatt Stuart Barnes	Developer of Mona and Morgan Offshore Wind Projects
Flotation Energy	Rachel Watson Hatidzhe Raim	Developer of Morecambe Offshore Windfarm
Royal Haskoning	Sarah Marjoram	EIA Lead for Morecambe Offshore Windfarm
Stakeholders		
Anglo-North Irish Fish Producers Organization (ANIFPO)	Brian Chambers	Impact on Fishing
ENI	Vic Morrell	Impact on Oil and Gas Operations
Harbour Energy	Alex Morton	Impact on Oil and Gas Operations
IoM Government	Emma Rowan David Gooberman	Impact on Ferry Services and IoM Developments
IoMSPC	Brian Thomson	Impact on Navigation Safety and Ferry Services
MCA	Nick Salter Vaughan Jackson	Impact on Navigation Safety
Mooir Vannin Offshore Wind Farm Limited	Hannah Towner-Roethe Samantha Westwood (Anatec)	Impact on Existing and Planned OWFs
Peel Ports	Neil Sumner	Impact on Navigation Safety and Port Operations
Scottish Whitefish Producers Association (SWFPA)	Raymond Hall	Impact on Fishing
Seatruck Group	Matt Henderson	Impact on Navigation Safety and Ferry Services
Spirit Energy	Denis Ustich	Impact on Oil and Gas Operations
Stenaline	Michael Proctor	Impact on Navigation Safety and Ferry Services
Tom Watson	Tom Watson	Impact on Fishing
UK Chamber of Shipping	Robert Merrylees	Impact on Navigation Safety and Commercial Operators

B.2 WORKSHOP

B.2.1.1.1 The Project team introduced the material and methodology.

B.2.1.1.2 Each hazard was reviewed in turn, with each attendee invited to discuss amongst their tables and score their personalised hazard log. Stakeholders were encouraged to fill out the comments section of each hazard post workshop to provide a higher level of description regarding their scores.

B.2.1.1.3 Each hazard score was then reviewed as a group with differences in scoring discussed, before a consensus was sought.

B.2.1.1.4 Once each hazard discussion had come to a close, the summary spreadsheet was 'locked' to capture the concluding scores of the discussion.

B.2.1.1.5 Risk controls were reviewed and appropriate additional risk controls discussed.

B.2.1.1.6 Update of hazard risk scores based on the findings of the hazard workshop for inclusion in the CRNRA to inform the Environmental Statement.

B.3 RESULTS

B.3.1.1.1 During the hazard workshop to inform the Environmental Statement, a total of ten hazards were reviewed as a group. These hazards were selected based on the highest scoring hazards identified during the CRNRA undertaken to inform the PEIR. In particular, all those that were scored as High Risk – Unacceptable during CRNRA Phase 1 were reassessed at the CRNRA workshop to inform the Environmental Statement. Other high scoring hazards across each of the routes between the Projects were also included to capture the discussion on the effects the amendments to the boundaries of the Array Areas had made.

B.3.1.1.2 The scores and discussion points raised by stakeholders for each of these hazards are shown in the following pages.

B.3.1.1.3 During the hazard workshop to inform the Environmental Statement, consensus was not reached on the specific scoring of several hazards, with a range of scores provided between the Project teams and amongst stakeholders. However, a consensus was reached that all hazards previously identified as High Risk – Unacceptable were now Medium Risk – Tolerable if ALARP. To derive the final scores for the CRNRA, the findings of the workshop were therefore considered with the analysis and wider assessment undertaken by the NASH Project team (see **Appendix A**).

NASH MARITIME

Hazard ID:	10												
Hazard Title:	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger												
Area:	Mona-Morgan												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Risk	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency	Baseline Score		
Draft Scores	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
ANIFPO	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
CoS	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
ENI	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
IoM Gov	3	3	2	3	3	5	5	4	5	3	11.6	Medium Risk - Tolerable (if ALARP)	Query over the time periods associated with the Realistic Worst Credible Scores - Most *unlikely* within 1:10-1:100 years - support IOMSPC comments and scoring.
IoMSPC	3	3	2	3	3	5	5	4	5	3	11.6	Medium Risk - Tolerable (if ALARP)	IOMSPC feel the realistic worst credible score frequency should be a 3 based on the Methodology as explained.
MCA	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Peel Ports	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Seatruck	3	3	2	3	3	5	5	4	5	3	11.6	Medium Risk - Tolerable (if ALARP)	considering the time periods used for the frequency of occurrence and life time of the windfarm is potentially to wide. the likely hood considered wouldn't be so significantly reduced. Likely to be increased traffic at the corners of the wind farms, thus the potential for collision exists.
Spirit Energy	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Stenaline	3	3	2	3	3	5	5	4	5	3	11.6	Medium Risk - Tolerable (if ALARP)	Our contention is that there is likely to be increased vessel interaction at the corners of the windfarms and this will be with increased funnelled traffic.
SWPAL	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
WCSP	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Updated Scores post-workshop	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	No change made to draft scores.

Hazard ID:	12												
Hazard Title:	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft												
Area:	Mona-Morgan												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
ANIFPO	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
CoS	3	3	2	3	3	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)	
ENI	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
IoM Gov	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	IOMSPC satisfied with these frequency scores in this instance.
IoMSPC	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
MCA	3	3	2	3	3	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)	
Peel Ports	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Seatruck	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	Still disagree with the scaling for the frequency, but on discussions held will defer to what is here.
Spirit Energy	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Stenaline	3	3	2	3	3	5	3	3	4	3	10.9	Medium Risk - Tolerable (if ALARP)	With the expected displacement of fishing vessels from the current footprint of the windfarms there is likely to be increased concentrations in the channels between the windfarms. Visibility of fishing vessels in the backscatter of the wind farms may also cause an additional risk.
SWPAL	3	3	2	3	3	5	3	3	4	3	10.9	Medium Risk - Tolerable (if ALARP)	Radar interference, displacement of fishing activity to navigational routes for commercial shipping.
WCSP	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Updated Scores post-workshop	3	3	2	3	3	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)	Worst credible property consequence score increased from 3 to 4 to account for higher value of lost vessel.

Hazard ID:	14													
Hazard Title:	Allision – Ferry/Passenger													
Area:	Mona-Morgan													
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Env.	Business	Frequency	People	Property	Env.	Business	Frequency			
Draft Scores	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
ANIFPO	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
CoS	3	3	2	4	3	5	5	3	5	2	10.0	Medium Risk - Tolerable (if ALARP)	(Realistic) severe negative publicity from ferry alliding with turbine so increase to 4. (Worse case) property damage in excess of £10m so increase to 5.
ENI	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	2	3	2	5	4	3	5	2	7.5	Medium Risk - Tolerable (if ALARP)	Based on current data showing Calder 3.4e-6 as quantitative risk
IoM Gov	3	3	2	5	3	5	4	3	5	2	10.8	Medium Risk - Tolerable (if ALARP)	Dependent on IOM situation and context - In an instance of such an Allison, the reporting in the news would be National and Island-Wide, this will result in increase to 5 - in line with IOMSPC scoring and comments. Also needs to be mindful that if an IOMSPC vessels is out of service as a result, that would also be newsworthy given it is a lifeline service to the IOM.
IoMSPC	3	3	2	5	3	5	4	3	5	2	10.8	Medium Risk - Tolerable (if ALARP)	
MCA	3	3	2	3	3	5	5	3	5	2	9.1	Medium Risk - Tolerable (if ALARP)	
Peel Ports	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
Seatruck	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
Spirit Energy	3	3	2	3	2	5	4	3	5	2	7.5	Medium Risk - Tolerable (if ALARP)	Reduction of frequency based on the Annual Passing Powered Collision Freq. for the Morecambe Hub Installations study with 3.4E-6
Stenaline	3	3	2	4	3	5	4	3	5	2	9.9	Medium Risk - Tolerable (if ALARP)	
SWPAL	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
WCSP	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
Updated Scores post-workshop	3	3	2	4	3	5	5	3	5	2	10.0	Medium Risk - Tolerable (if ALARP)	Most likely business consequence increased from 3 to 4 to account for greater adverse publicity and impact to services. Worst credible property consequence score increased from 4 to 5 to account for higher potential damage to both vessel and wind turbine.

Hazard ID:	3												
Hazard Title:	Collision – Ferry/Passenger or Cargo/Tanker ICW. Small Craft												
Area:	Morgan-Walney												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
ANIFPO	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	Fishing effort displaced from the array will increase the probability of a collision giving that fishing boats will be very restricted in manoeuvrability.
CoS	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	Property and business consequence scores increased for worst case
ENI	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	2	3	3	5	3	3	4	3	10.9	Medium Risk - Tolerable (if ALARP)	change not substantial enough to drive lower score
IoM Gov	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
IoMSPC	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
MCA	3	3	2	3	3	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)	
Peel Ports	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	Peel Ports have reviewed the hazard log and have stated that they are content with the draft scoring
Seatruck	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	Not regularly sailing in this area
Spirit Energy	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Stenaline	3	3	2	3	3	5	3	3	4	3	10.9	Medium Risk - Tolerable (if ALARP)	Fishing vessels are likely to be displaced from within the footprint of the windfarms increasing the concentration in the channels.
SWPAL	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Tom Watson	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	Scored with CoS
WCSP	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Updated Scores post-workshop	3	3	2	3	3	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)	Worst credible property consequence score increased from 3 to 4 to account for higher value of lost vessel.

Hazard ID:	5												
Hazard Title:	Allision – Ferry/Passenger												
Area:	Morgan-Walney												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
ANIFPO	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	If encountering a dense cluster of fishing boats, ability to manoeuvre and avoid each other and the fishing boats is reduced ,which increases the risk, peak scallop season is November to May when daylight is limited and the boats fish day and night.
CoS	3	3	2	4	3	5	4	3	5	2	9.9	Medium Risk - Tolerable (if ALARP)	Business increased to 4 for realistic most likely
ENI	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	2	3	4	5	4	3	5	2	10.4	Medium Risk - Tolerable (if ALARP)	due to general frequency of allision and grounding incidents
IoM Gov	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
IoMSPC	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
MCA	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
Peel Ports	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	Peel Ports have reviewed the hazard log and have stated that they are content with the draft scoring
Seatruck	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	Not regularly sailing in this area, Would agree with the findings of Stena and IoMSPC
Spirit Energy	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
Stenaline	3	3	2	4	3	5	4	3	5	2	9.9	Medium Risk - Tolerable (if ALARP)	
SWPAL	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
Tom Watson	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	Scored with CoS
WCSP	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	
Updated Scores post-workshop	3	3	2	4	3	5	5	3	5	2	10.0	Medium Risk - Tolerable (if ALARP)	Most likely business consequence increased from 3 to 4 to account for greater adverse publicity and impact to services. Worst credible property consequence score increased from 4 to 5 to account for higher potential damage to both vessel and wind turbine.

Hazard ID:	28												
Hazard Title:	Collision – Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger												
Area:	South-Mona												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
ANIFPO	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
CoS	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
ENI	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	No comment from Harbour Energy
IoM Gov	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
IoMSPC	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
MCA	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Peel Ports	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	Peel Ports have reviewed the hazard log and have stated that they are content with the draft scoring
Seatruck	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Spirit Energy	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Stenaline	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
SWPAL	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Tom Watson	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	Scored with CoS
WCSP	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	
Updated Scores post-workshop	3	3	2	3	3	5	5	4	5	2	9.2	Medium Risk - Tolerable (if ALARP)	No change.

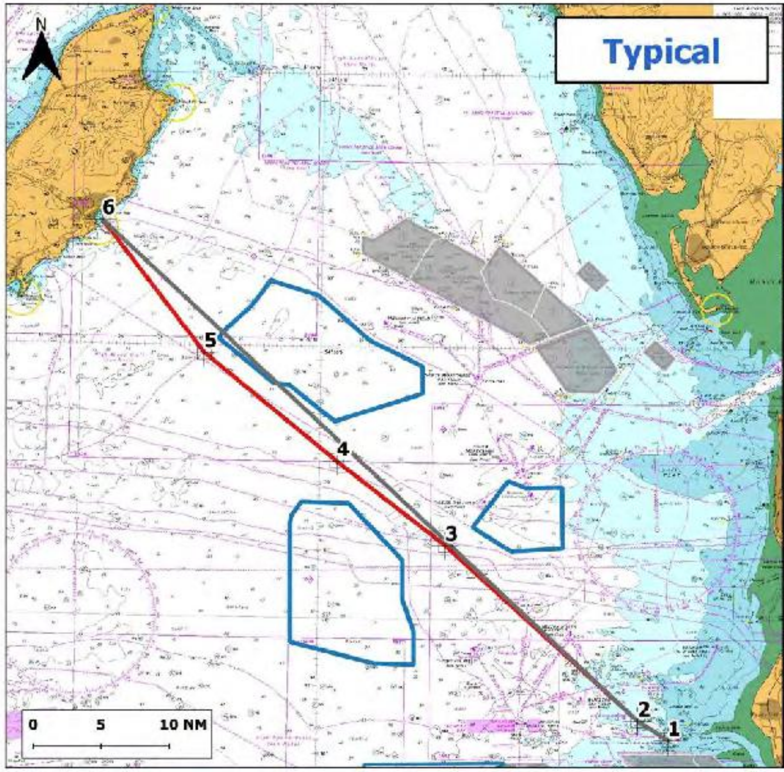
Hazard ID:	30												
Hazard Title:	Collision – Ferry/Passenger or Cargo/Tanker ICW. Small Craft												
Area:	South-Mona												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
ANIFPO	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
CoS	3	3	2	3	3	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)	
ENI	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
IoM Gov	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
IoMSPC	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
MCA	3	3	2	3	3	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)	
Peel Ports	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	Peel Ports have reviewed the hazard log and have stated that they are content with the draft scoring
Seatruck	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Spirit Energy	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Stenaline	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
SWPAL	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Tom Watson	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	Scored with CoS
WCSP	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Updated Scores post-workshop	3	3	2	3	3	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)	Worst credible property consequence score increased from 3 to 4 to account for higher value of lost vessel.

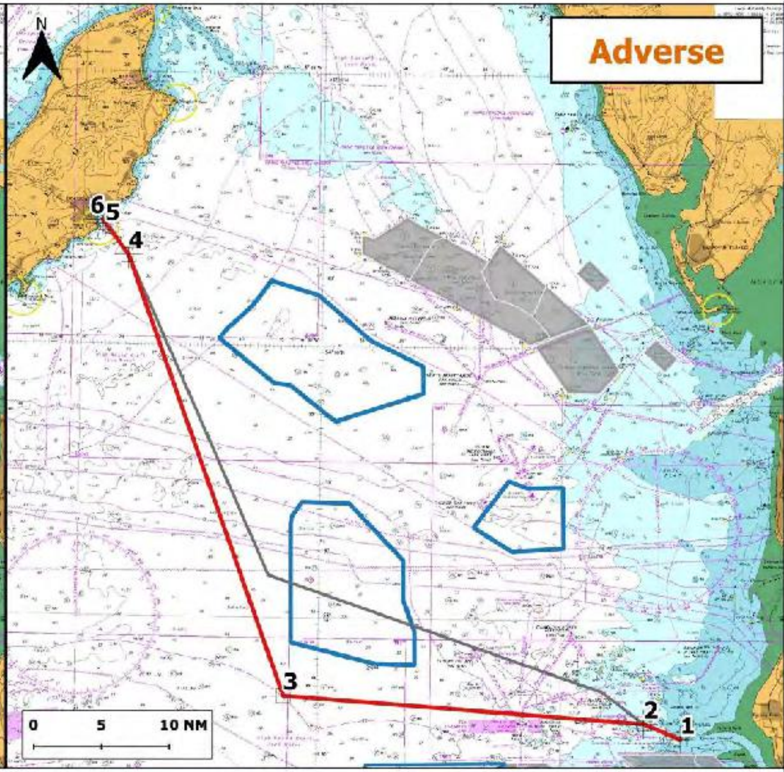
Hazard ID:	29												
Hazard Title:	Collision – Cargo/Tanker ICW. Cargo/Tanker												
Area:	South-Mona												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	2	3	2	3	3	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)	
ANIFPO	2	3	2	3	3	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)	
CoS	2	3	2	3	3	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)	
ENI	2	3	2	3	3	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	2	3	2	3	3	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)	
IoM Gov	2	3	2	4	3	4	5	5	4	2	9.8	Medium Risk - Tolerable (if ALARP)	
IoMSPC	2	3	2	4	3	4	5	5	4	2	9.8	Medium Risk - Tolerable (if ALARP)	
MCA	2	3	2	3	3	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)	
Peel Ports	2	3	2	3	3	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)	Peel Ports have reviewed the hazard log and have stated that they are content with the draft scoring
Seatruck	2	4	2	3	3	4	5	5	4	2	9.8	Medium Risk - Tolerable (if ALARP)	Damage between vessels will be very costly not likely to be less the £1million
Spirit Energy	2	3	2	3	3	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)	
Stenaline	2	3	2	4	3	4	5	5	4	2	9.8	Medium Risk - Tolerable (if ALARP)	
SWPAL	2	3	2	3	3	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)	
Tom Watson	2	3	2	3	3	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)	Scored with CoS
WCSP	2	3	2	3	3	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)	
Updated Scores post-workshop	2	3	2	3	3	4	5	5	4	2	8.9	Medium Risk - Tolerable (if ALARP)	No change.

Hazard ID:	21												
Hazard Title:	Collision – Ferry/Passenger or Cargo/Tanker ICW. Small Craft												
Area:	Mona-Morecambe												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	3	3	2	3	2	5	3	3	4	2	7.3	Medium Risk - Tolerable (if ALARP)	
ANIFPO	3	3	2	3	2	5	3	3	4	2	7.3	Medium Risk - Tolerable (if ALARP)	
CoS	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	Property consequence increased to 4 for worse case
ENI	3	3	2	3	2	5	3	3	4	2	7.3	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	2	3	2	5	3	3	4	2	7.3	Medium Risk - Tolerable (if ALARP)	
IoM Gov	3	3	2	3	2	5	3	3	4	2	7.3	Medium Risk - Tolerable (if ALARP)	
IoMSPC	3	3	2	3	2	5	3	3	4	2	7.3	Medium Risk - Tolerable (if ALARP)	
MCA	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	
Peel Ports	3	3	2	3	2	5	3	3	4	2	7.3	Medium Risk - Tolerable (if ALARP)	Peel Ports have reviewed the hazard log and have stated that they are content with the draft scoring
Seatruck	3	3	2	3	2	5	3	3	4	2	7.3	Medium Risk - Tolerable (if ALARP)	
Spirit Energy	3	3	2	3	2	5	3	3	4	2	7.3	Medium Risk - Tolerable (if ALARP)	
Stenaline	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	Fishing vessels are likely to be displaced from within the footprint of the adjacent windfarms increasing the concentration in the channels. Identifying small craft visually at night is likely to be affected by backscatter.
SWPAL	3	3	2	3	2	5	3	3	4	2	7.3	Medium Risk - Tolerable (if ALARP)	
Tom Watson	3	3	2	3	2	5	3	3	4	2	7.3	Medium Risk - Tolerable (if ALARP)	
WCSP	3	3	2	3	2	5	3	3	4	2	7.3	Medium Risk - Tolerable (if ALARP)	
Updated Scores post-workshop	3	3	2	3	2	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)	Worst credible property consequence score increased from 3 to 4 to account for higher value of lost vessel.

Hazard ID:	23												
Hazard Title:	Allision – Ferry/Passenger												
Area:	Mona-Morecambe												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Env.	Business	Frequency	People	Property	Env.	Business	Frequency			
Draft Scores	3	3	2	3	2	5	4	3	5	2	7.5	Medium Risk - Tolerable (if ALARP)	
ANIFPO	3	3	2	3	2	5	4	3	5	2	7.5	Medium Risk - Tolerable (if ALARP)	
CoS	3	3	2	4	2	5	4	3	5	2	8.1	Medium Risk - Tolerable (if ALARP)	
ENI	3	3	2	3	2	5	4	3	5	2	7.5	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	2	3	3	5	4	3	5	3	11.3	Medium Risk - Tolerable (if ALARP)	removal of Morecambe full area exposes Calder, and recent event frequency in UK supports frequency of 3
IoM Gov	3	4	2	4	2	5	4	3	5	2	8.3	Medium Risk - Tolerable (if ALARP)	Realistic ML Scores - Reflection that an Allision in this instance could result in a level 4 property because the vessel may be out of service for some time to allow for any required repairs. In addition, Business should also be level 4 as, owing to any damage as a result of the Allision, there will be a financial loss to the business.
IoMSPC	3	4	2	4	2	5	4	3	5	2	8.3	Medium Risk - Tolerable (if ALARP)	
MCA	3	3	2	3	2	5	4	3	5	2	7.5	Medium Risk - Tolerable (if ALARP)	
Peel Ports	3	3	2	3	2	5	4	3	5	2	7.5	Medium Risk - Tolerable (if ALARP)	Peel Ports have reviewed the hazard log and have stated that they are content with the draft scoring
Seatruck	3	4	2	3	2	5	4	3	5	2	8.1	Medium Risk - Tolerable (if ALARP)	property damage would be more than £1 million in long term repair - Ferry operators (PAX) may suffer a greater loss in business and reputation.
Spirit Energy	3	3	2	3	3	5	4	3	5	2	8.9	Medium Risk - Tolerable (if ALARP)	Increased frequency based on the recent events in NS with collisions with offshore infrastructure
Stenaline	3	3	2	4	2	3	4	3	5	3	10.1	Medium Risk - Tolerable (if ALARP)	
SWPAL	3	3	2	3	2	5	4	3	5	2	7.5	Medium Risk - Tolerable (if ALARP)	
Tom Watson	3	3	2	3	2	5	4	3	5	2	7.5	Medium Risk - Tolerable (if ALARP)	
WCSP	3	3	2	3	2	5	4	3	5	2	7.5	Medium Risk - Tolerable (if ALARP)	
Updated Scores post-workshop	3	3	2	4	2	5	5	3	5	2	8.3	Medium Risk - Tolerable (if ALARP)	Most likely business consequence increased from 3 to 4 to account for greater adverse publicity and impact to services. Worst credible property consequence score increased from 4 to 5 to account for higher potential damage to both vessel and wind turbine.

Appendix C Passage Plans for Ferry Operators





Morgan, Mona and Morecambe OWFs

Liverpool - Douglas IoM Passage Plans

Legend

- Cumulative Project (2023)
- Base Case
- Future Case
- Waypoint

Date	Vessel	From	Scenario
05.06.2023	IoMSPC Manannan / Ben-my-Chree	Liverpool	CRNRA

TYPICAL

WP No.	Waypoint Name	Latitude	Longitude	Course	Distance to next Waypoint	Cumulative Distance	Planned Speed	Max Speed	Notes
001	Liverpool	53°31'10.8	3°16'33.60	303°	2.6 nm	0.0 nm	30.0 kts	33.0 kts	Departing Liverpool
002	Racon	53°32'36.0	3°20'17.40	312°	19.2 nm	2.6 nm	30.0 kts	33.0 kts	Passing Racon
003	Morecambe-Mona	53°45'24.8	3°44'16.95	307°	10.1 nm	21.8 nm	30.0 kts	33.0 kts	2.4nm CPA to OWFs
004	Morgan-Mona	53°51'31.5	3°57'52.21	309°	12.6 nm	31.9 nm	30.0 kts	33.0 kts	3nm CPA to OWFs
005	West Morgan	53°59'23.4	4°14'35.10	322°	12.4 nm	44.6 nm	30.0 kts	33.0 kts	1.6nm CPA to Morgan OWF
006	Douglas	54°09'03.0	4°27'38.40	N/A	N/A	56.9 nm	30.0 kts	33.0 kts	Arriving in Douglas

ADVERSE

WP No.	Waypoint Name	Latitude	Longitude	Course	Distance to next Waypoint	Cumulative Distance	Planned Speed	Max Speed	Notes
001	Liverpool	53°31?17.0	3°15'07.89	293°	2.9 nm	0.0 nm	30.0 kts	33.0 kts	Departing Liverpool
002	Racon	53°32?24.4	3°19'40.61	274°	26.6 nm	2.9 nm	30.0 kts	33.0 kts	Passing Racon
003	Soutwest Mona	53°34?15.4	4°04'12.11	340°	34.4 nm	29.5 nm	30.0 kts	33.0 kts	4nm CPA to Mona OWF
004	Approach to Douglas	54°06?30.6	4°24'21.07	323°	2.9 nm	64.0 nm	30.0 kts	33.0 kts	Approaching Douglas
005	Douglas Head	54°08?47.9	4°27'20.37	325°	0.3 nm	66.9 nm	30.0 kts	33.0 kts	Arriving in Douglas
006	Douglas	54°09?03.0	4°27'38.40	N/A	N/A	67.2 nm	30.0 kts	33.0 kts	Arriving in Douglas

Notes

1. Admiralty Charts 1826 under license.
2. Boundaries provided by Projects.
3. Crown Estate existing OWF boundaries.
4. Vessel traffic data 2022 MarineTraffic.

Client

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Issue Details

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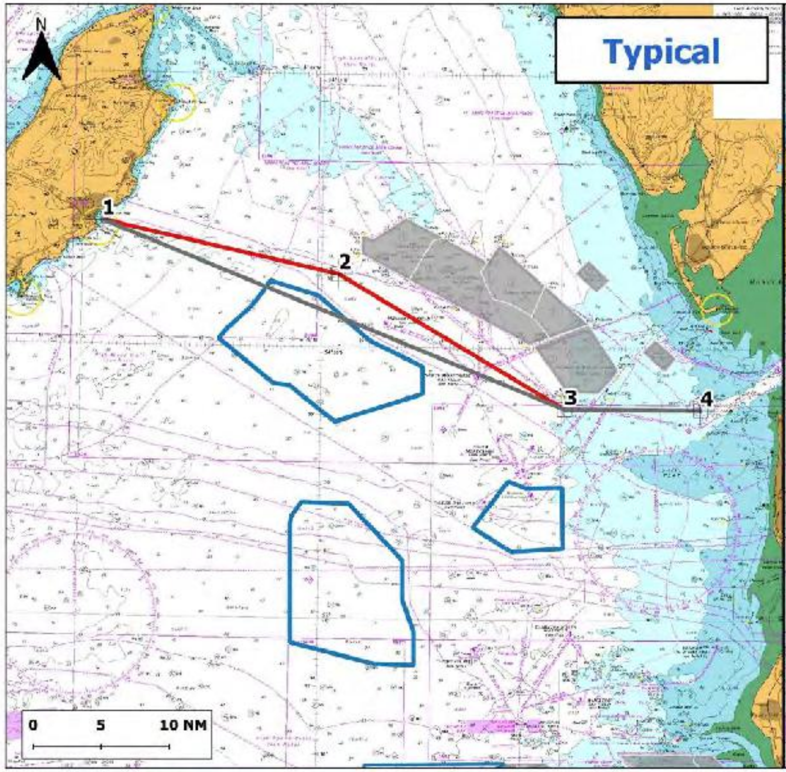
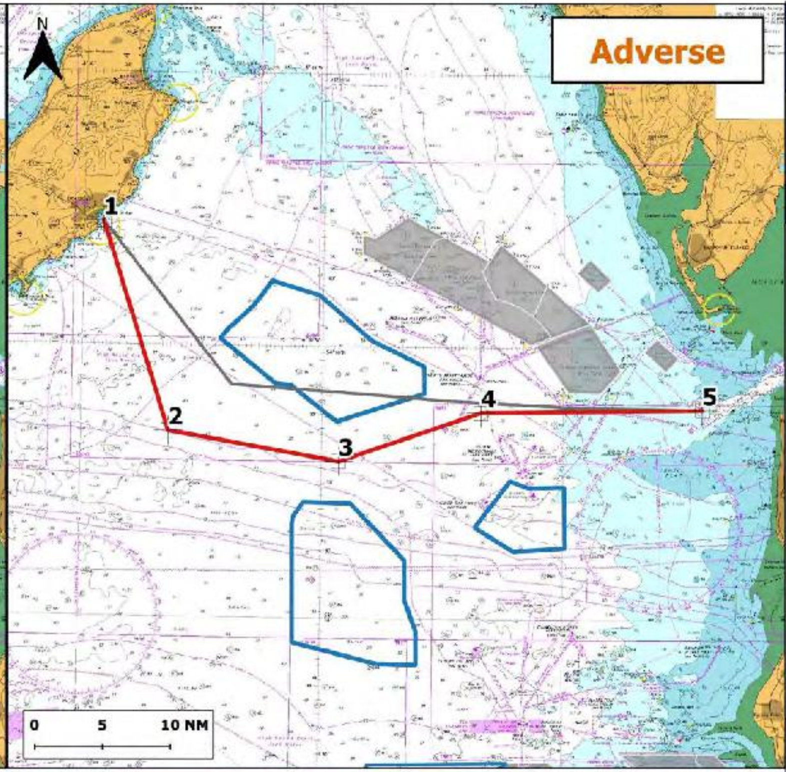
Figure Ref: 0306_PassagePlans_Liv-Doug





Morgan, Mona and Morecambe OWFs

Douglas IoM - Heysham Passage Plans

Legend

- Cumulative Project (2023)
- Base Case
- Future Case
- Waypoint

Date	Vessel	From	Scenario
05.06.2023	IoMSPC Ben-my-Chree	Douglas	CRNRA

TYPICAL

WP No.	Waypoint Name	Latitude	Longitude	Course	Distance to next Waypoint	Cumulative Distance	Planned Speed	Max Speed	Notes
001	Douglas	54°09'03.0	4°27'38.40	102°	17.8 nm	0.0 nm	18.0 kts	20.0 kts	Departing Douglas
002	Walney-Morgan	54°05'19.3	3°57'58.33	120°	19.4 nm	17.8 nm	18.0 kts	20.0 kts	2.2nm CPA to OWFs
003	West of Dudden Sands	53°55'29.9	3°29'34.90	090°	10.0 nm	37.3 nm	18.0 kts	20.0 kts	1.2nm CPA to West of Dudden Sands
004	Lune Deep	53°55'27.1	3°12'39.55	N/A	N/A	47.3 nm	18.0 kts	20.0 kts	Passing Lune Deep

ADVERSE

WP No.	Waypoint Name	Latitude	Longitude	Course	Distance to next Waypoint	Cumulative Distance	Planned Speed	Max Speed	Notes
001	Douglas	54°08'59.0	4°27'37.62	162°	16.2 nm	0.0 nm	18.0 kts	20.0 kts	Departing Douglas
002	Southwest Morgan	53°53'38.0	4°19'07.56	099°	12.8 nm	16.2 nm	18.0 kts	20.0 kts	7.8nm southwest of Morgan
003	Morgan-Mona	53°51'31.5	3°57'52.21	070°	11.1 nm	29.0 nm	18.0 kts	20.0 kts	3nm CPA to OWFs
004	Morecambe Gas Fields	53°55'11.7	3°40'13.01	089°	16.3 nm	40.1 nm	18.0 kts	20.0 kts	2.3nm CPA to Gas Fields
005	Lune Deep	53°55'27.1	3°12'39.55	N/A	N/A	56.3 nm	18.0 kts	20.0 kts	Passing Lune Deep

Notes

1. Admiralty Charts 1826 under license.
2. Boundaries provided by Projects.
3. Crown Estate existing OWF boundaries.
4. Vessel traffic data 2022 MarineTraffic.

Client

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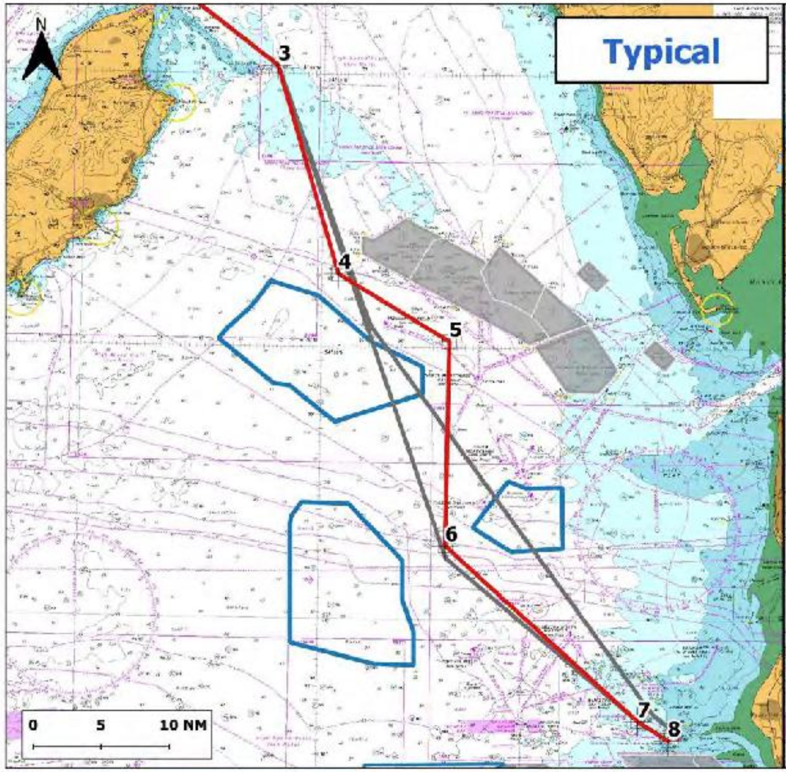
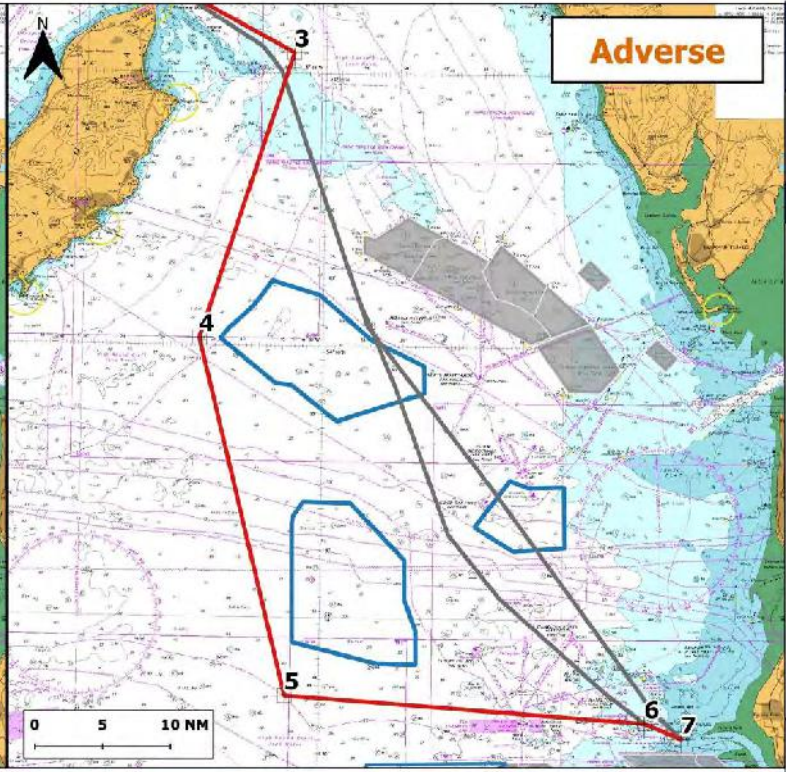
Figure Ref: 0306_PassagePlans_Hey-Doug





Morgan, Mona and Morecambe OWFs

Belfast - Liverpool (East of IoM) Passage Plans

Legend

- Cumulative Project (2023)
- Base Case
- Future Case
- Waypoint

Date	Vessel	From	Scenario
05.06.2023	Stena Edda / Embla / Mersey / Horizon / Lagan / Forecaster / Forerunner	Liverpool	CRNRA

TYPICAL

WP No.	Waypoint Name	Latitude	Longitude	Course	Distance to next Waypoint	Cumulative Distance	Planned Speed	Max Speed	Notes
002	North IoM	54°27'54.0	4°22'31.80	127°	12.2 nm	43.2 nm	19.0 kts	21.0 kts	2.8nm north of IoM
003	Bahama	54°20'36.0	4°05'54.00	163°	16.0 nm	55.4 nm	19.0 kts	21.0 kts	Passing Bahama
004	Walney-Morgan	54°05'19.3	3°57'58.33	121°	9.6 nm	71.4 nm	19.0 kts	21.0 kts	2.2nm CPA to OWFs
005	Millom Gas Field	54°00'25.8	3°44'01.36	181°	15.0 nm	81.0 nm	19.0 kts	21.0 kts	2.6 nm CPA to OWFs / Gas Fields
006	Morecambe-Mona	53°45'24.8	3°44'16.95	132°	19.2 nm	96.0 nm	19.0 kts	21.0 kts	2.4nm CPA to OWFs
007	Racon	53°32'35.4	3°20'17.40	122°	2.6 nm	115.2 nm	19.0 kts	21.0 kts	Passing Racon
008	Liverpool	53°31'10.8	3°16'33.60	N/A	N/A	117.8 nm	19.0 kts	21.0 kts	Arriving in Liverpool

ADVERSE

WP No.	Waypoint Name	Latitude	Longitude	Course	Distance to next Waypoint	Cumulative Distance	Planned Speed	Max Speed	Notes
002	North IoM	54°26'55.9	4°21'40.57	118°	11.6 nm	43.0 nm	19.0 kts	21.0 kts	2.8nm north of IoM
003	Bahama	54°21'31.9	4°04'04.64	198°	22.1 nm	54.6 nm	19.0 kts	21.0 kts	Passing Bahama
004	West Morgan	54°00'29.8	4°15'27.28	166°	27.1 nm	76.7 nm	19.0 kts	21.0 kts	1.6nm CPA to Morgan OWF
005	Southwest Mona	53°34'15.4	4°04'12.11	094°	26.6 nm	103.8 nm	19.0 kts	21.0 kts	4nm CPA to Mona OWF
006	Racon	53°32'24.4	3°19'40.61	113°	2.9 nm	130.5 nm	19.0 kts	21.0 kts	Passing Racon
007	Liverpool	53°31'17.0	3°15'07.89	N/A	N/A	133.4 nm	19.0 kts	21.0 kts	Arriving in Liverpool

Notes

1. Admiralty Charts 1826 under license.
2. Boundaries provided by Projects.
3. Crown Estate existing OWF boundaries.
4. Vessel traffic data 2022 MarineTraffic.

Client

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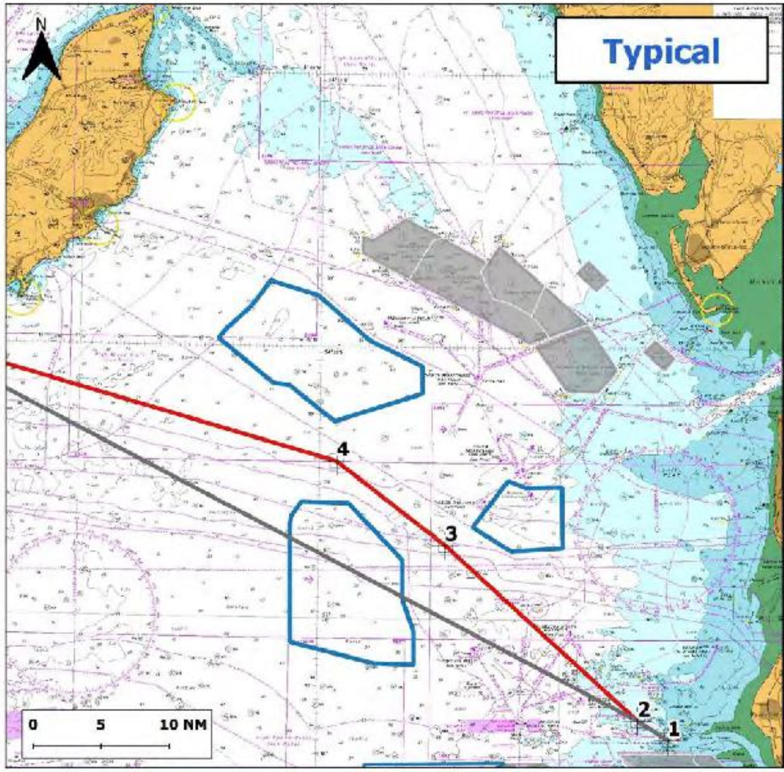
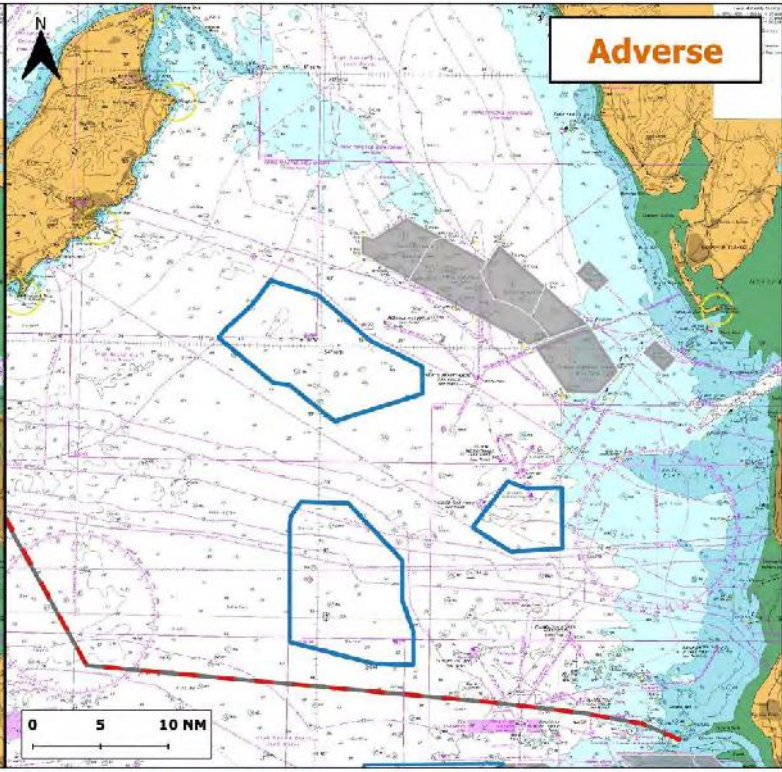
Figure Ref: 0306_PassagePlans_Liv-Bel_E





Morgan, Mona and Morecambe OWFs

Liverpool - Belfast (West of IoM) Passage Plans

Legend

- Cumulative Project (2023)
- Base Case
- Future Case
- Waypoint

Date	Vessel	From	Scenario
05.06.2023	Stena Edda / Embla / Mersey / Horizon / Lagan / Forecaster / Forerunner	Liverpool	CRNRA

TYPICAL

WP No.	Waypoint Name	Latitude	Longitude	Course	Distance to next Waypoint	Cumulative Distance	Planned Speed	Max Speed	Notes
001	Liverpool	53°31'10.8	3°16'33.60	303°	2.6 nm	0.0 nm	19.0 kts	23.0 kts	Departing Liverpool
002	Racon	53°32'36.0	3°20'17.40	312°	19.2 nm	2.6 nm	19.0 kts	23.0 kts	Passing Racon
003	Morecambe-Mona	53°45'24.8	3°44'16.95	307°	10.1 nm	21.8 nm	19.0 kts	23.0 kts	2.4nm CPA to OWFs
004	Morgan-Mona	53°51'31.5	3°57'52.21	286°	33.5 nm	31.9 nm	19.0 kts	23.0 kts	3nm CPA to OWFs
005	Calf of Man	54°00'24.0	4°52'36.00	335°	46.5 nm	65.5 nm	19.0 kts	23.0 kts	Passing Calf of Man

Notes

1. Admiralty Charts 1826 under license.
2. Boundaries provided by Projects.
3. Crown Estate existing OWF boundaries.
4. Vessel traffic data 2022 MarineTraffic.

Client

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Issue Details

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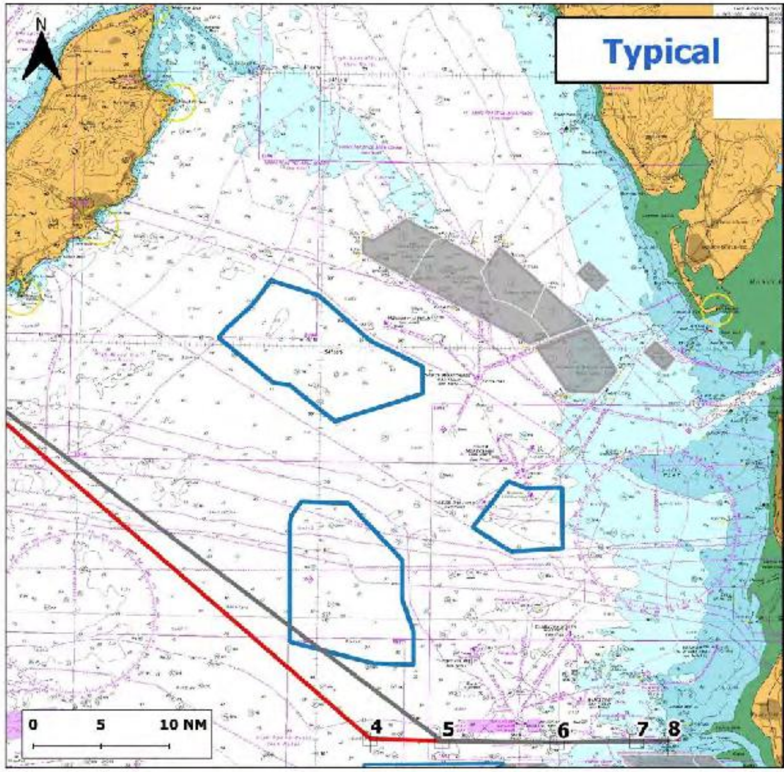

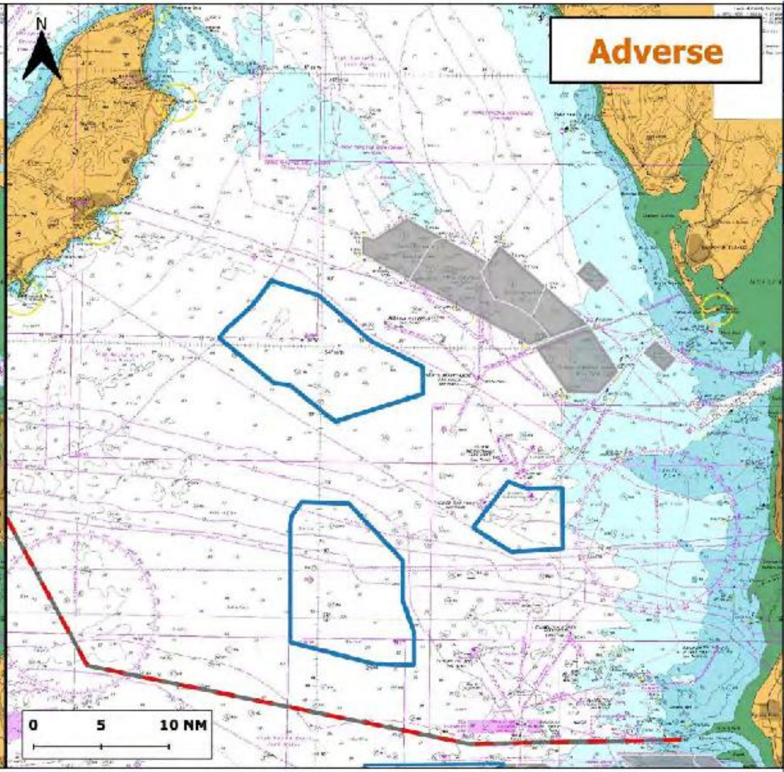

Morgan, Mona and Morecambe OWFs

Belfast - Liverpool (West of IoM) via TSS Passage Plans

Legend

- Cumulative Project (2023)
- Base Case
- Future Case
- Waypoint

Date	Vessel	From	Scenario
05.06.2023	Stena Edda / Embla / Mersey / Horizon / Lagan / Forecaster / Forerunner	Belfast	CRNRA

Belfast

WP No.	Waypoint Name	Latitude	Longitude	Course	Distance to next Waypoint	Cumulative Distance	Planned Speed	Max Speed	Notes
003	Calf of Man	54°00'24.0	4°52'36.00	129°	45.8 nm	49.6 nm	19 kts	22.0 kts	Passing Calf of Man
004	Awel y Mor	53°31'08.9	3°53'17.73	091°	5.3 nm	95.3 nm	19 kts	22.0 kts	1.9nm CFA to Awel y Mor OWF boundary
005	East TSS	53°31'01.6	3°44'24.72	090°	8.5 nm	100.7 nm	19 kts	22.0 kts	Traversing east through TSS
006	Douglas Oil Field	53°30'59.6	3°30'12.53	089°	5.8 nm	109.1 nm	19 kts	22.0 kts	Passing Douglas Oil Field
007	South Racon	53°31'07.9	3°20'24.54	089°	2.3 nm	115.0 nm	19 kts	22.0 kts	Passing south of Racon
008	Liverpool	53°31'10.8	3°16'33.60	N/A	N/A	117.3 nm	19 kts	22.0 kts	Arriving in Liverpool

Notes

1. Admiralty Charts 1826 under license.
2. Boundaries provided by Projects.
3. Crown Estate existing OWF boundaries.
4. Vessel traffic data 2022 MarineTraffic.

Client EnBW bp MORECAMBE

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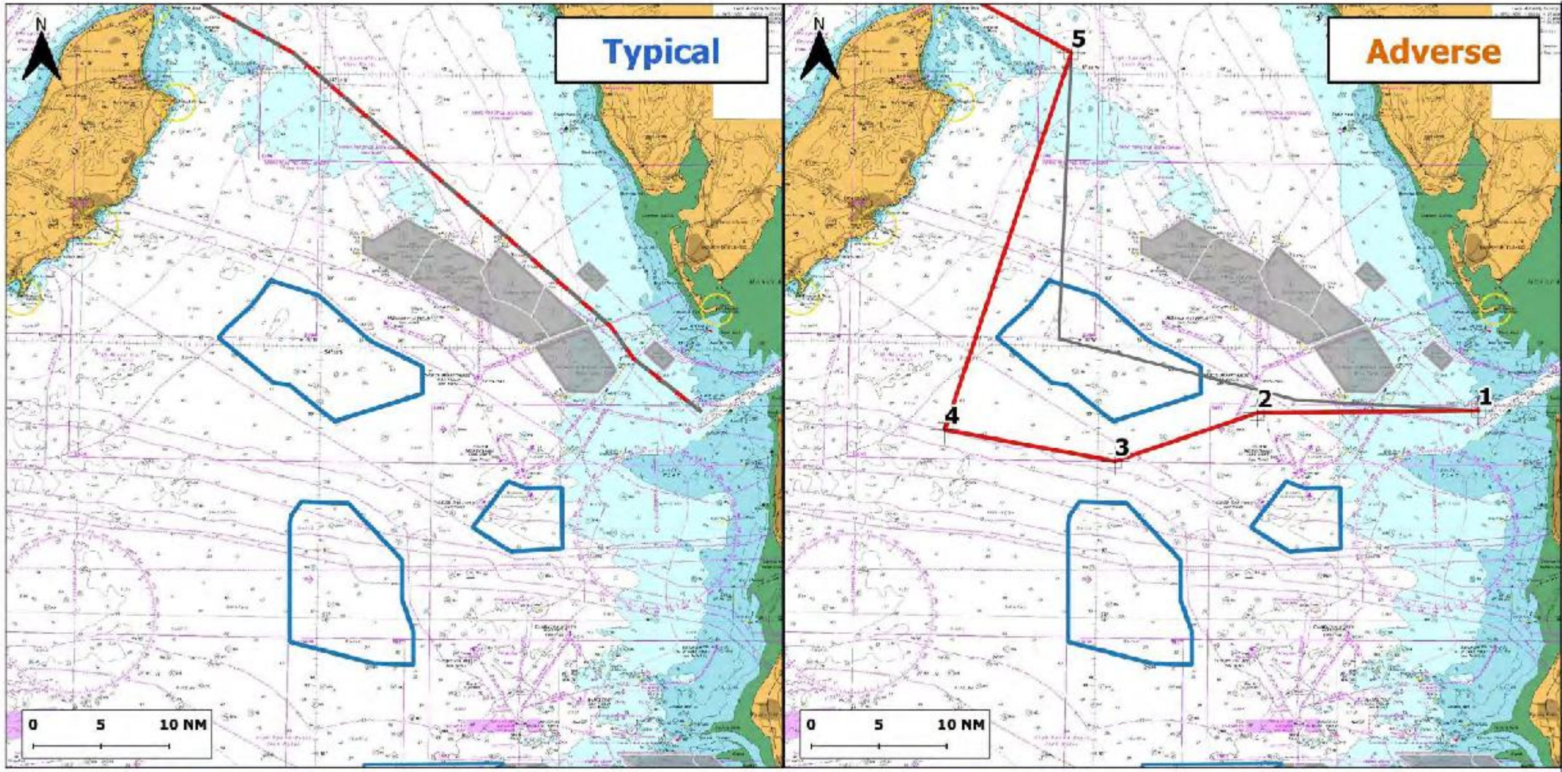
Figure Ref: 0306_PassagePlans_Liv-Bel_WestIoM_TSSEast



Morgan, Mona and Morecambe OWFs

Heysham - Belfast (East IoM) Passage Plans

Legend

- Cumulative Project (2023)
- Base Case
- Future Case
- Waypoint

Date	Vessel	From	Scenario
05.06.2023	Stena Edda / Embla / Mersey / Horizon / Lagan / Forecaster / Forerunner	Heysham	CRNRA

ADVERSE

WP No.	Waypoint Name	Latitude	Longitude	Course	Distance to next Waypoint	Cumulative Distance	Planned Speed	Max Speed	Notes
001	Lune Deep	53°55'27.1	3°12'39.55	269°	16.3 nm	0.0 nm	17.0 kts	19.0 kts	Passing Lune Deep
002	Morecambe Gas Fields	53°55'11.7	3°40'13.01	251°	11.1 nm	16.3 nm	17.0 kts	19.0 kts	2.3nm CPA to Gas Fields
003	Morgan-Mona	53°51'31.5	3°57'52.21	280°	12.8 nm	27.4 nm	17.0 kts	19.0 kts	3nm CPA to OWFs
004	Southwest Morgan	53°53'38.0	4°19'07.56	017°	29.3 nm	40.1 nm	17.0 kts	19.0 kts	7.8nm southwest of Morgan
005	East IoM	54°21'32.2	4°04'03.45	298°	11.6 nm	69.4 nm	17.0 kts	19.0 kts	Passing to the east of IoM
006	North IoM	54°26'55.9	4°21'40.57	293°	43.0 nm	81.0 nm	17.0 kts	19.0 kts	2.8nm north of IoM

Notes

1. Admiralty Charts 1826 under license.
2. Boundaries provided by Projects.
3. Crown Estate existing OWF boundaries.
4. Vessel traffic data 2022 MarineTraffic.

Client

NOT FOR NAVIGATION

Issue Details

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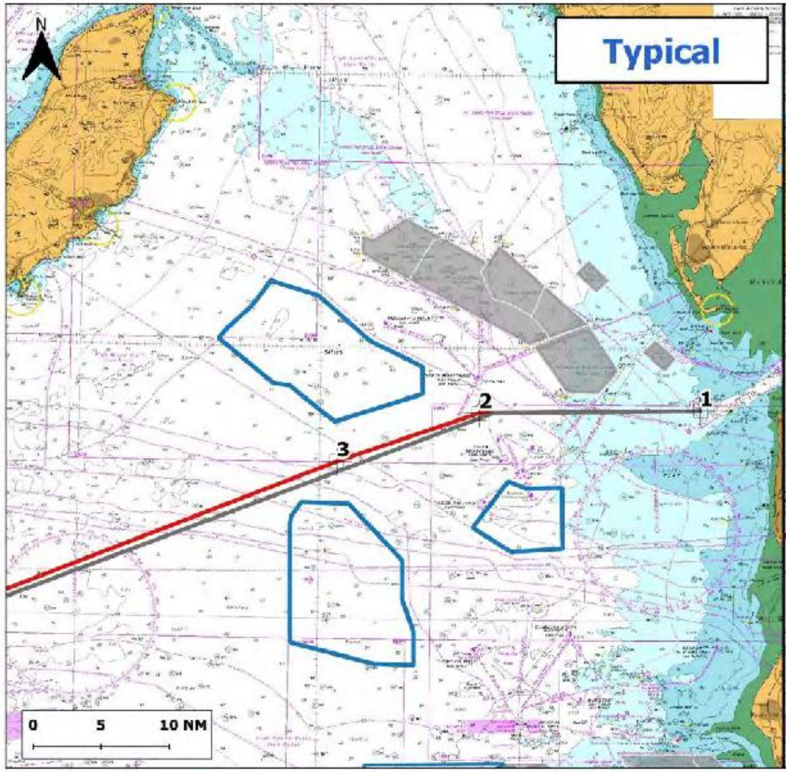
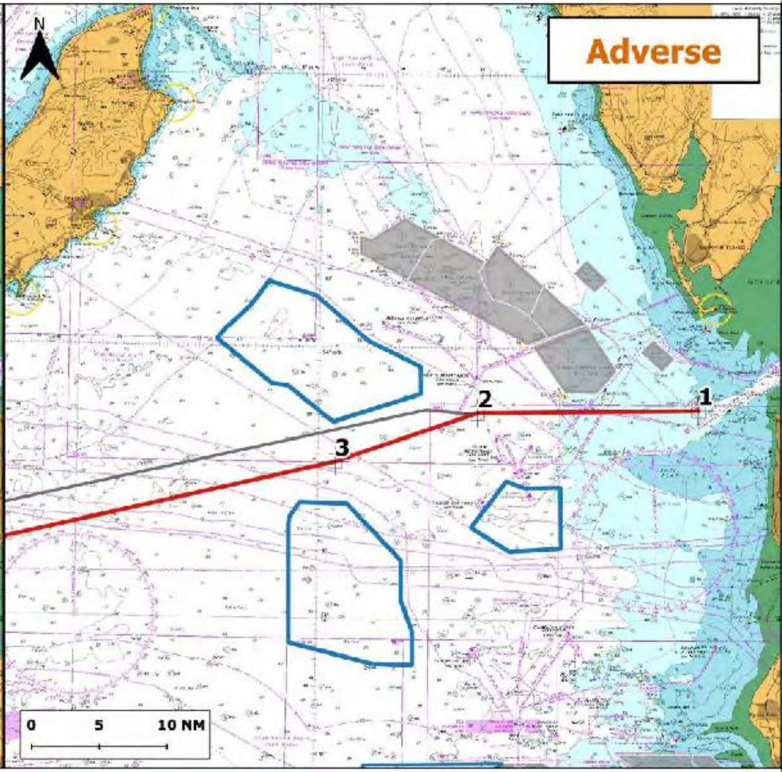
Figure Ref: 0306_PassagePlans_Hey-Bel_EastIoM

NASH MARITIME





Morgan, Mona and Morecambe OWFs

Heysham - Dublin Passage Plans

Legend

- Cumulative Project (2023)
- Base Case
- Future Case
- Waypoint

Date	Vessel	From	Scenario
05.06.2023	Seatruck Pace / Panorama	Heysham	CRNRA

TYPICAL

WP No.	Waypoint Name	Latitude	Longitude	Course	Distance to next Waypoint	Cumulative Distance	Planned Speed	Max Speed	Notes
001	Lune Deep	53°55'27.1	3°12'9.55	269°	16.3 nm	0.0 nm	14.0 kts	20.0 kts	Passing Lune Deep
002	Morecambe Gas Fields	53°55'11.7	3°40'13.01	251°	11.1 nm	16.3 nm	14.0 kts	20.0 kts	2.3nm CPA to Gas Fields
003	Morgan-Mona	53°51'31.5	3°57'52.21	248°	81.8 nm	27.4 nm	14.0 kts	20.0 kts	3nm CPA to OWFs
004	Dublin	53°20'00.2	6°04'35.70	N/A	N/A	109.2 nm	14.0 kts	20.0 kts	Arriving in Dublin

ADVERSE

WP No.	Waypoint Name	Latitude	Longitude	Course	Distance to next Waypoint	Cumulative Distance	Planned Speed	Max Speed	Notes
001	Lune Deep	53°55'27.1	3°12'39.55	269°	16.3 nm	0.0 nm	14.0 kts	20.0 kts	Passing Lune Deep
002	Morecambe Gas Fields	53°55'11.7	3°40'13.01	251°	11.1 nm	16.3 nm	14.0 kts	20.0 kts	2.3nm CPA to Gas Fields
003	Morgan-Mona	53°51'31.5	3°57'52.21	257°	51.5 nm	27.4 nm	14.0 kts	20.0 kts	3nm CPA to OWFs
004	Northeast Dublin	53°39'07.1	5°22'05.22	233°	31.8 nm	78.9 nm	14.0 kts	20.0 kts	Approaching Dublin

Notes

1. Admiralty Charts 1826 under license.
2. Boundaries provided by Projects.
3. Crown Estate existing OWF boundaries.
4. Vessel traffic data 2022 MarineTraffic.

Client EnBW bp MORECAMBE

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Issue Details

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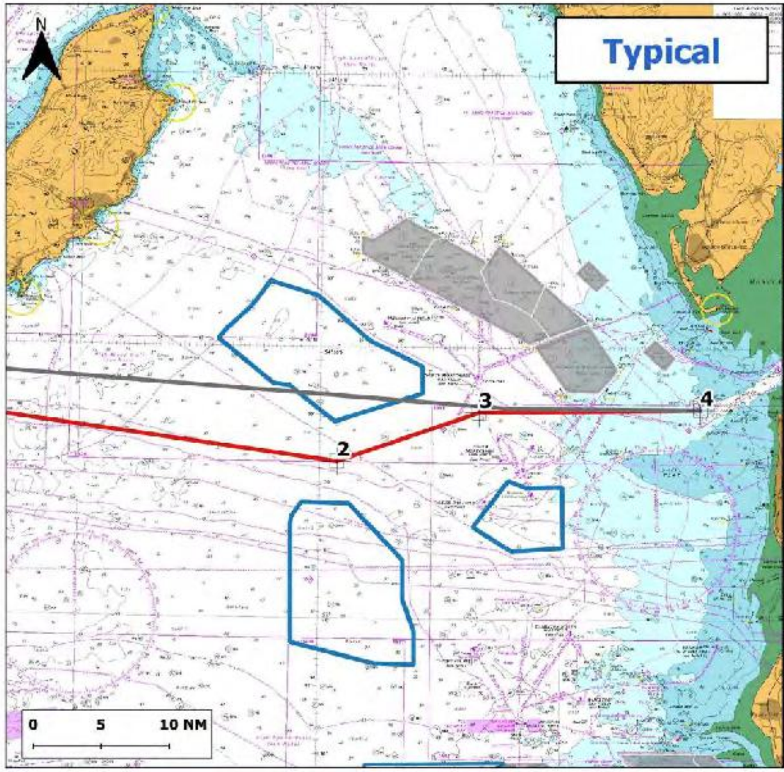
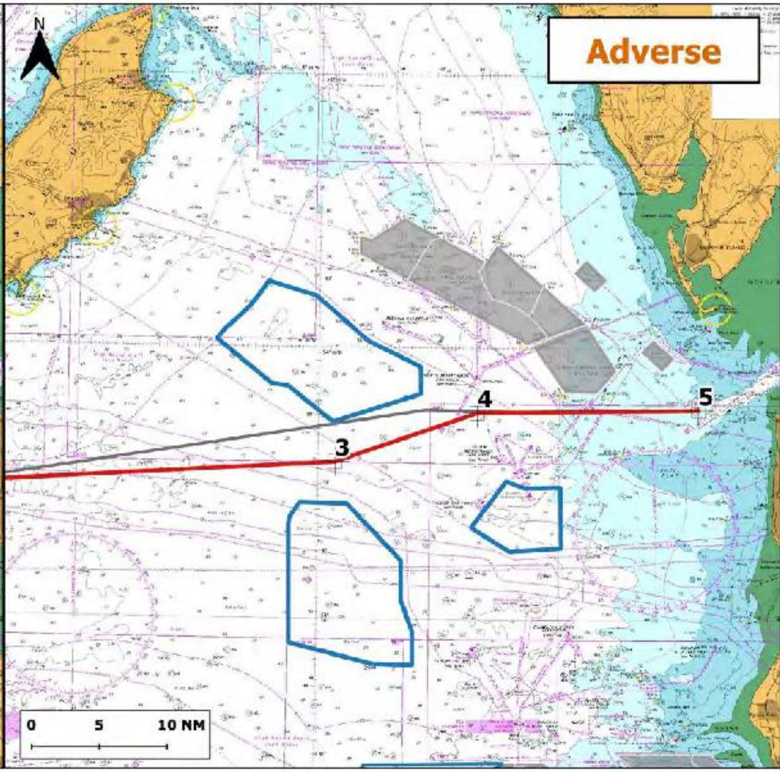
Figure Ref: 0306_PassagePlans_Hey-Dub





Morgan, Mona and Morecambe OWFs

Carlingford Lough - Heysham Passage Plans

Legend

- Cumulative Project (2023)
- Base Case
- Future Case
- Waypoint

Date	Vessel	From	Scenario
05.06.2023	Seatruck Precision / Performance	Carlingford Lough	CRNRA

TYPICAL

WP No.	Waypoint Name	Latitude	Longitude	Course	Distance to next Waypoint	Cumulative Distance	Planned Speed	Max Speed	Notes
001	Carlingford Lough	54°00'11.2	6°02'13.02	096°	74.0 nm	0.0 nm	17.0 kts	20.0 kts	Departing Carlingford Lough
002	Morgan-Mona	53°51'31.5	3°57'52.21	070°	11.1 nm	74.0 nm	17.0 kts	20.0 kts	3nm CPA to OWFs
003	Morecambe Gas Fields	53°55'11.7	3°40'13.01	089°	16.3 nm	85.1 nm	17.0 kts	20.0 kts	2.3nm CPA to Gas Fields
004	Lune Deep	53°55'27.1	3°12'39.55	N/A	N/A	101.4 nm	17.0 kts	20.0 kts	Passing Lune Deep

ADVERSE

WP No.	Waypoint Name	Latitude	Longitude	Course	Distance to next Waypoint	Cumulative Distance	Planned Speed	Max Speed	Notes
002	South IoM	53°49'34.0	4°45'58.69	086°	28.6 nm	46.3 nm	17.0 kts	20.0 kts	Passing south of IoM
003	Morgan-Mona	53°51'31.5	3°57'52.21	070°	11.1 nm	74.9 nm	17.0 kts	20.0 kts	3nm CPA to OWFs
004	Morecambe Gas Fields	53°55'11.7	3°40'13.01	089°	16.3 nm	85.9 nm	17.0 kts	20.0 kts	2.3nm CPA to Gas Fields
005	Lune Deep	53°55'27.1	3°12'39.55	N/A	N/A	102.2 nm	17.0 kts	20.0 kts	Passing Lune Deep

Notes

1. Admiralty Charts 1826 under license.
2. Boundaries provided by Projects.
3. Crown Estate existing OWF boundaries.
4. Vessel traffic data 2022 MarineTraffic.

Client

NOT FOR NAVIGATION

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Figure Ref: 0306_PassagePlans_Hey-CarL

Appendix D Mooir Vannin OWF Addendum

D.1 INTRODUCTION

D.1.1.1.1 Due to their proximity and expected development timeline, there was a recognised potential for cumulative impacts between the four Round 4 Irish Sea Offshore Wind Farm Projects; Mona Offshore Wind Project, Morgan Offshore Wind Project Generation Assets, Morecambe Offshore Windfarm Generation Assets and Morgan and Morecambe Offshore Wind Farms Transmission Assets (the "Projects").

D.1.1.1.2 In light of this, the developers (EnBW, bp, Cobra Instalaciones y Servicios, S.A. (Cobra) and Flotation Energy Ltd) commissioned a joint CRNRA in 2022. The objective of the joint CRNRA was to enable stakeholders to engage with and understand the potential cumulative effects of the Projects. Adopting a regional (co-ordinated) approach to assessment enabled the individual Projects to identify appropriate design mitigation for the cumulative impacts in a coordinated, consistent and efficient manner. This was undertaken at an early stage to ensure that the potential impacts of the four Projects were understood as early in the EIA and design process as possible.

D.1.1.1.3 At the time of drafting the CRNRA to inform the PEIR for the Projects, it was noted that an agreement for lease had been awarded to Orsted (subsequently Mooir Vannin Offshore Wind Farm Limited) in 2015 for an area of seabed in Isle of Man territorial waters, approximately 6 nm to the east of the Isle of Man. Whilst some stakeholders had raised concerns during the NRA on the additional cumulative impact with this project, since 2015 no further information was made publicly available nor had a Scoping Report been issued publicly for the proposed development of the wind farm lease area and therefore its status was uncertain. Following the Planning Inspectorate's Advice Note Seventeen (Planning Inspectorate, 2019), the Mooir Vannin Offshore Wind Farm (OWF) project was incorporated into the shipping and navigation assessments undertaken to inform the PEIR as a Tier 3 Project and therefore not incorporated into the drafting of the CRNRA undertaken to inform the PEIR as there was insufficient information available.

D.1.1.1.4 The PEIR response provided by Orsted (Mooir Vannin Offshore Wind Limited) in June 2023 to Morgan Generation Assets (also referred to within Mona Offshore Wind Project and Morecambe Generation Assets PEIR responses) stated that a Scoping Report for the Mooir Vannin OWF would be published in September or October 2023 and that Orsted would supply pre-scoping project details to allow its inclusion in the CRNRA undertaken to inform the Project's Environmental Statements. This information was provided on 01 September 2023. On 18 October 2023, Mooir Vannin Offshore Wind Farm Limited issued a Scoping Report with details of the proposed development of the Mooir Vannin OWF (Mooir Vannin Offshore Wind Farm Limited, 2023) within the agreement for lease area.

D.1.1.1.5 The project information provided by Orsted on 01 September 2023 has been incorporated into the CRNRA undertaken to inform the Projects' Environmental Statements. This included undertaking some navigation simulations with the IoMSPC which included the Projects' Array Areas and the Mooir Vannin OWF agreement for lease area, subsequently presented as the scoping boundary within the Scoping Report (Mooir Vannin Offshore Wind Limited, 2023). Furthermore, the Mooir Vannin OWF agreement for lease area was included within the September

2023 hazard workshop undertaken to inform the Projects' Environmental Statements.

D.1.1.1.6 Following publication of its Scoping Report the Mooir Vannin OWF is now categorised as a Tier 2 Project using the Planning Inspectorate's Advice Note Seventeen (Planning Inspectorate, 2019). A Tier 2 Project is where a Scoping Report has been submitted for a project in the development pipeline. The information in the Mooir Vannin OWF Scoping Report informed the cumulative effects assessment of each of the Projects' shipping and navigation Environmental Statement chapters.

D.1.1.1.7 Given the timing of the provision of project information from Orsted and the release of the Mooir Vannin OWF Scoping Report, the Projects have included the assessment of the Mooir Vannin OWF project within this addendum to the CRNRA undertaken to inform the Projects' Environmental Statements. This was to ensure that the Mooir Vannin OWF was included within the cumulative assessment in a logical manner prior to submission of an application for Development Consent for Mona Offshore Wind Project.

D.1.1.1.8 The CRNRA addendum assesses how the development of the Mooir Vannin OWF might impact upon the cumulative risk to vessel traffic identified within the CRNRA undertaken to inform the Projects' Environmental Statements.

D.1.1.1.9 As the Mooir Vannin OWF Scoping Report was issued after the navigation simulations, risk modelling and both hazard workshops informing the CRNRA, this assessment within the addendum is primarily desk based, applying the information contained within the Mooir Vannin OWF Scoping Report to identify any changes to the earlier findings of the CRNRA.

D.1.1.1.10 A discussion was held with stakeholders during the CRNRA hazard workshop on the 28 September 2023 on the potential impact on navigational safety if Mooir Vannin OWF was included. As the Mooir Vannin OWF Scoping Report had not yet been published this was done on the basis of the agreement for lease area.

D.1.1.1.11 As described in the Mooir Vannin OWF Scoping Report, it is expected that a CEA (which will include shipping and navigation) will be prepared by Mooir Vannin Offshore Wind Limited on the basis of their proposed development parameters which will accompany their development application to the IoM Government.

D.2 BASIS OF ASSESSMENT

D.2.1.1.1 The basis of the CRNRA Addendum is information included within the Scoping Report of the Mooir Vannin OWF, published in October 2023 (Mooir Vannin Offshore Wind Limited, 2023).

D.2.1.1.2 The Scoping Boundary of Mooir Vannin OWF comprises up to 100 turbines within an offshore array area of approximately 253 km^2 in water depths of approximately 10 m to 37 m below LAT. The Scoping Boundary consists of an offshore array and offshore electrical connection search area. The offshore array would contain the WTGs, offshore substations platforms and array cables. The offshore electrical connection search area would contain the export cable corridor for connecting the electrical cables to the IoM (**Figure 60**). A route to market transmission asset funnel identified in the Scoping Report for assets that potentially terminate in either the UK or Eire that are subject to additional UK and/or Eire consents and therefore not part of the infrastructure to which a Scoping Opinion is being sought and is therefore not shown in **Figure 60** or considered within this addendum.

D.2.1.1.3 Construction is stated to commence from 2030 with the wind farm expected to be fully operational by 2032, subject to the relevant consents being in place. This would therefore follow the completion of the planned construction programme for the Projects.

D.2.1.1.4 The Mooir Vannin OWF Scoping Boundary (namely the offshore array area) is situated approximately 2.6 nm from the proposed Morgan Array Area and approximately 4.7 nm from Walney Extension OWF array area, as shown in **Figure 61**. However, when maintaining a parallel course east-west, the effective navigable width of the route between the Mooir Vannin OWF Scoping Boundary and the Morgan Array Area was measured at 2.5 nm.

D.2.1.1.5 Given the proximity of these OWFs, it is recognised that there is a potential additional cumulative impact on shipping and navigation. Based on the available information within the Mooir Vannin OWF Scoping Report, a desktop assessment of the following key impacts to navigation was undertaken:

- Impact on vessel routeing in typical and adverse weather conditions.
- Impact on navigational safety.

D.2.1.1.6 To support this assessment, some of the navigation simulations undertaken to inform the Environmental Statement (see **Section 2.3.5**) conducted with and without representatives of the ferry companies included the Mooir Vannin OWF Scoping Boundary. The implications of the Mooir Vannin OWF Scoping Boundary on the results of the CRNRA were also discussed with stakeholders at the hazard workshop undertaken to inform the Environmental Statement (see **Appendix B**).

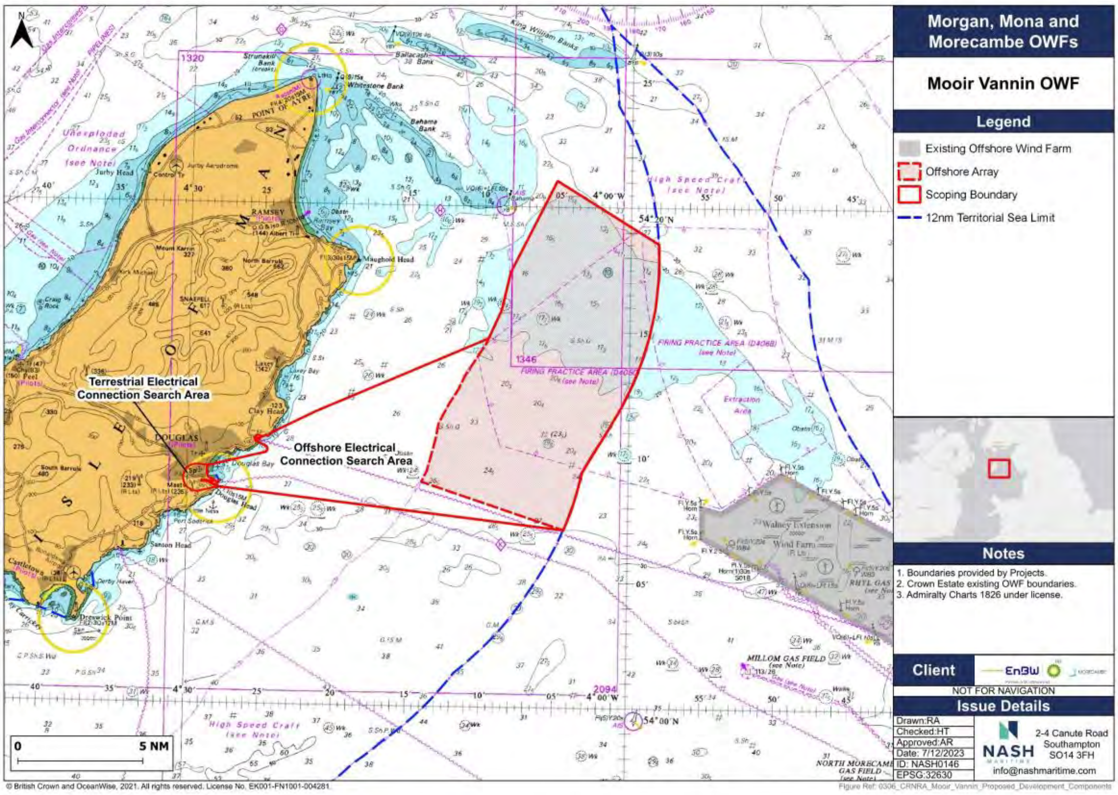

Figure 60: Mooir Vannin OWF Scoping Boundary and Proposed Development Components (Source: Mooir Vannin Offshore Wind Limited, 2023).

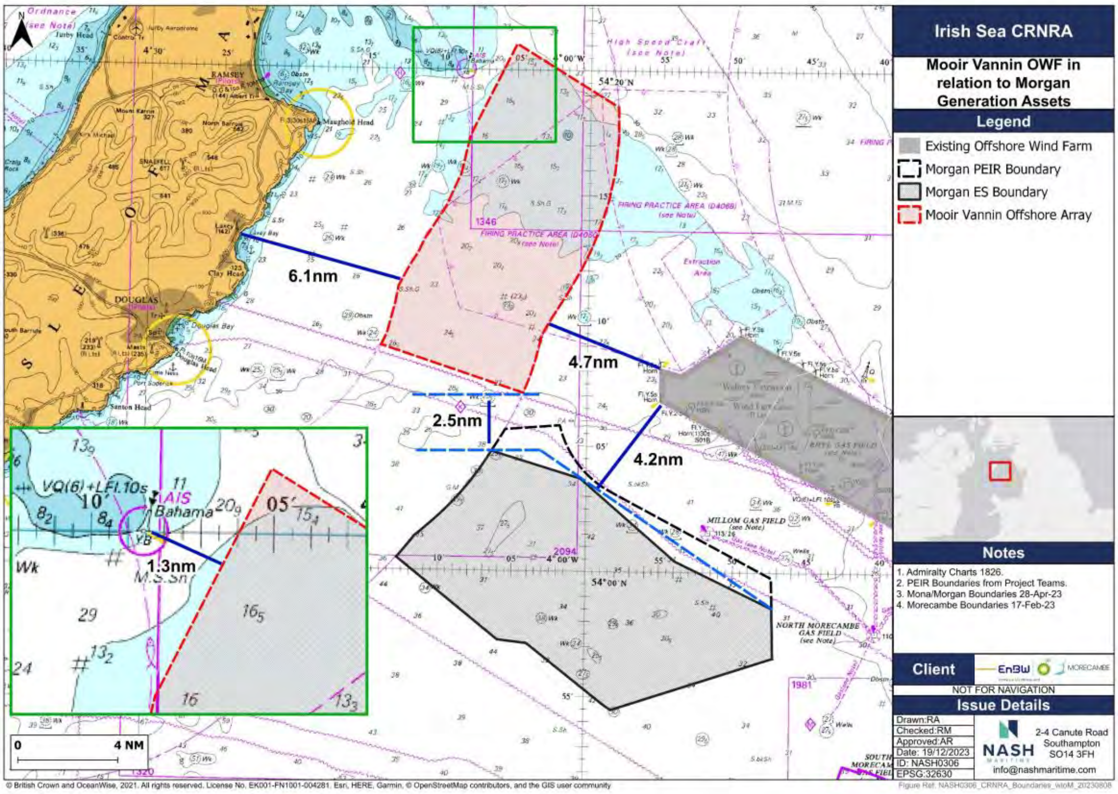

Figure 61: Mooir Vannin OWF in relation to Morgan Generation Assets.

D.3 IMPACT ON VESSEL ROUTEING IN TYPICAL AND ADVERSE CONDITIONS

D.3.1.1.1 As described in **Section 7** of the CRNRA undertaken to inform the Environmental Statement, OWFs can have impacts on vessel routeing in typical and adverse weather conditions.

D.3.1.1.2 The existing cargo, tanker and passenger vessel traffic in proximity to the Mooir Vannin OWF Scoping Boundary is presented in **Figure 62**.

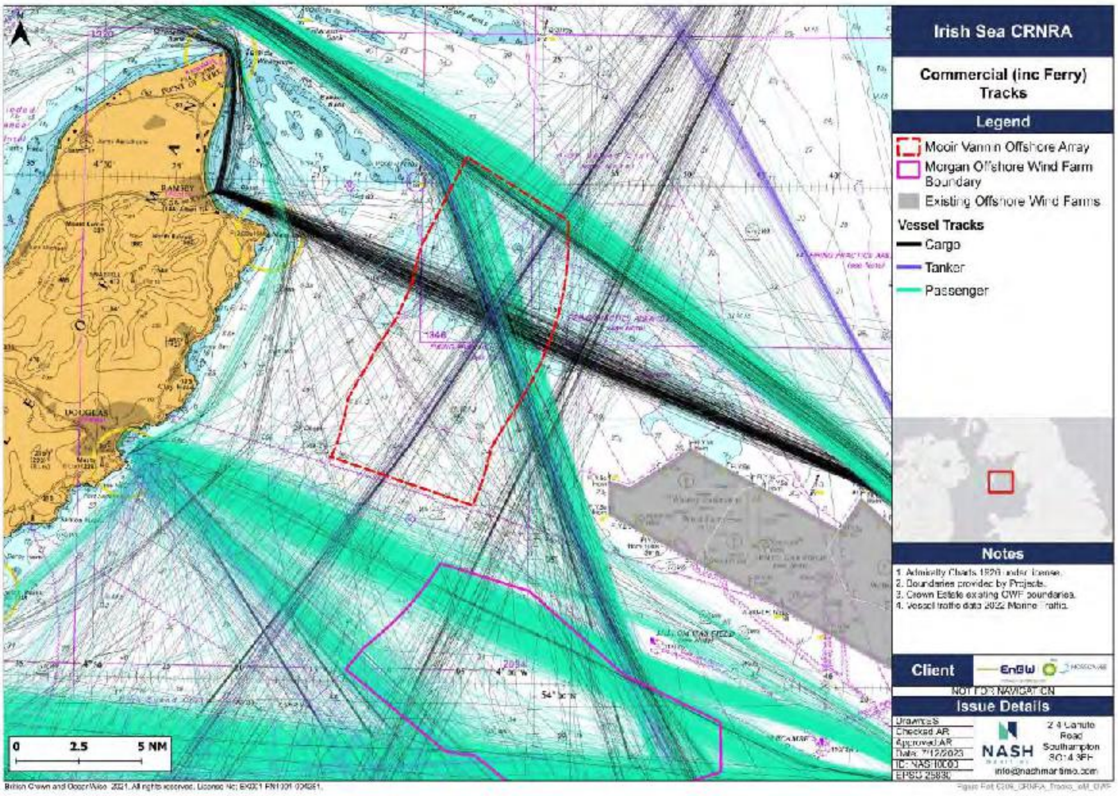

Figure 62: Cargo, tanker and passenger vessel tracks in proximity to Mooir Vannin.

D.3.1.1.3 Five routes were identified transiting across the Mooir Vannin OWF Scoping Boundary, which will be required to deviate and pass through one or more of the sea areas between the Mooir Vannin OWF Scoping Boundary, Morgan Array Area and Walney Extension OWF (see **Section 5.2.2** and **Section 5.2.4** for further details):

- Silver River cargo vessel route between Ramsey and Glasson.
- The Stena Line route between Liverpool and Belfast, passing east of the Isle of Man.
- An adverse weather route operated by Stena Line between Heysham and Belfast.
- A cargo/tanker route between Liverpool and Belfast, passing east of the Isle of Man.
- A cargo/tanker route between southern Irish Sea and Solway Firth.

D.3.1.1.4 Revised passage plans were developed by the NASH project team, including master mariners, and account for existing decision-making principles (such as passing at least 1.5 nm from a wind turbine) that were obtained during consultation with operators and the navigation simulation sessions.

D.3.1.1.5 The route deviations for the three routes currently passing within the Mooir Vannin OWF Scoping Boundary are most likely to avoid the shallow waters of Bahama and Whitestone Banks to the northwest of the proposed Mooir Vannin OWF Scoping Boundary which has water depths as shallow as 2 m (as shown in **Figure 61**). There is an inshore route to the east of the Isle of Man infrequently used by ferries and small craft.

D.3.1.1.6 The cargo vessel route that runs between Ramsey and Glasson is predominantly used by the 41 m Silver River cargo vessel. The cargo vessel is most likely to deviate south of the Mooir Vannin Scoping Boundary, passing between the Mooir Vannin OWF Scoping Boundary and Morgan Array Area, and between Mooir Vannin OWF and Walney Extension OWF, which measure 2.6 nm and 4.7 nm in width, respectively. The Silver River makes approximately 182 transits annually on this route, equivalent to one transit every two days. Precise values for the additional time required for the Silver River to deviate safely around the Mooir Vannin OWF Scoping Boundary are not known, though it is possible that the additional transit times, additional fuel and effects on vessel timetabling could render the service unviable.

D.3.1.1.7 The Stena Line route that runs east of the Isle of Man between Liverpool and Belfast is most likely to deviate east of the Mooir Vannin OWF Scoping Boundary, passing between the Mooir Vannin offshore array area and Walney Extension OWF and then between Morgan Array Area and Walney Extension OWF, which measure 4.7 nm and 4.2nm, respectively. Stena Line vessels using this route will necessitate longer transit times following the addition of Mooir Vannin OWF. Compared to the existing route to the east of the Isle of Man, the inclusion of the Mooir Vannin OWF Scoping Boundary would necessitate an additional 10.8 nm (35 minutes of transit) on the present day base case. This would be a further 6.2 nm (20 minutes) compared to the CRNRA future case without Mooir Vannin OWF (see **Section 7.3**).

D.3.1.1.8 Based on this preliminary assessment of this Stena Line route, a 31 minute increase in transit duration compared to the westabout route (see **Section 5.2.4.3**) is considered likely to make the eastabout route significantly less attractive. Furthermore, the multiple and significant course changes would make this route challenging in adverse weather conditions.

D.3.1.1.9 A second Stena Line route, between Heysham and Belfast, passes to the northeast of the Mooir Vannin OWF Scoping Boundary in typical conditions. During adverse weather conditions these vessels pass west of West of Duddon Sands OWF and the Walney OWF, before proceeding east of the Isle of Man (see **Section 7.3**). The CRNRA assessment undertaken to inform the Environmental Statement recognised that in adverse weather these vessels may choose to navigate to the south of the Morgan Array Area rather than pass between the Walney OWFs and the Morgan Array Area. With the inclusion of the Mooir Vannin OWF Scoping Boundary, there would be little opportunity for these transits to then proceed east of the Isle of Man, due to little sea room, and they would be required to pass through more exposed waters to the west of the Isle of Man.

D.3.1.1.10 The cargo/tanker route between the southern Irish Sea and the Solway Firth will most likely deviate east of the Mooir Vannin OWF Scoping Boundary, passing between the Mooir Vannin OWF Scoping Boundary and Walney Extension OWF and between the Mooir Vannin Scoping Boundary and Morgan Array Area, which measure 4.7 nm and 2.6 nm, respectively. Whilst relatively few vessels transit this route, the deviation would have an impact on their operations through increased transit time and fuel cost.

D.3.1.1.11 As described in **Section 7.3.3**, during adverse weather, it may not be prudent for IoMSPC ferries to transit between the Morgan Array Area and Walney Extension OWF. The Ben-my-Chree which runs on the Douglas/Heysham route is constrained in heavy seas on the beam, which can cause large roll motions. The CRNRA undertaken to inform the Environmental Statement concluded that when significant wave heights are in excess of 2.6 m the vessel would choose to pass south of Morgan. This would necessitate a further increase in current adverse weather transit times by 24 minutes, a total delay of at least 34 minutes to the current normal weather route. Given the further reduction in sea room between the Morgan Array Area and the Mooir Vannin OWF Scoping Boundary, the vessel master may choose to use alternative weather routeing more often to ensure vessel and passenger safety.

D.3.1.1.12 As described in **Section 7.3.3**, the Stena Line ferries travelling between the east of Isle of Man and Liverpool are susceptible to excessive roll motions with seas in excess of 3 m Hs on the beam (occurring approximately monthly on average during winter months), posing a risk to passengers and crew. Routes to the east of the Isle of Man are used in adverse weather. However, given the multiple and large course alterations, and the increased transit distance, it is unlikely that Stena Line would choose to take this route in adverse weather.

D.3.1.1.13 During consultation for the Projects assessed within the CRNRA, ferry operators raised several existing operational constraints which should be considered where revised passage plans include increased distance to clear an OWF, such as to schedules, hours of rest, increased fuel use and berth constraints (see **Section 7.3**). These may be exacerbated beyond that described in **Section 7.3** due to the inclusion of the Mooir Vannin OWF Scoping Boundary.

D.4 IMPACT ON NAVIGATIONAL SAFETY

D.4.1 Risk Assessment

D.4.1.1.1 Following a review of the Mooir Vannin OWF Scoping Report, several potential additional cumulative impacts on navigational safety were identified compared to those presented within the CRNRA undertaken to inform the Environmental Statement. These include the potential for vessel traffic being concentrated into the navigation routes between the Mooir Vannin OWF Scoping Boundary, Morgan Array Area and Walney Extension OWF leading to an increase in vessel to vessel collision risk, an increase in the risk of allision and greater potential for interactions between large commercial vessels and fishing activity.

D.4.1.1.2 The hazard log of the CRNRA undertaken to inform the Environmental Statement presented in **Section 8** and **Appendix A** was reviewed and the relevant hazards considered to be impacted by the inclusion of Mooir Vannin OWF were identified.

These primarily relate to the route between Morgan Array Area and Walney Extension OWF (Hazard IDs 1-9).

D.4.1.1.3 The risk assessment was reviewed and the likelihood of such hazards occurring was updated. It was not considered that the inclusion of Mooir Vannin OWF would change the consequence scores previously agreed with stakeholders during the hazard workshops.

D.4.1.1.4 A draft risk assessment was presented to stakeholders during the CRNRA hazard workshop undertaken to inform the Environmental Statement (see **Appendix B**). Stakeholders were invited to comment on the findings and there was a consensus that the findings were broadly consistent with their perspective.

D.4.1.1.5 **Table 47** compares the CRNRA hazard scores undertaken to inform the Environmental Statement (described in **Section 8**) and the scores with the inclusion of the Mooir Vannin OWF Scoping Boundary.

Table 47: CRNRA hazard scores including Mooir Vannin OWF.

ID	Rank	Area	Hazard Title	CRNRA Scores		CRNRA Scores (including Mooir Vannin)	
				Score	Rating	Score	Rating
1	3	Morgan-Walney	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	7.8	Medium Risk - Tolerable (if ALARP)	10.6	Medium Risk - Tolerable (if ALARP)
2	8	Morgan-Walney	Collision - Cargo/Tanker ICW. Cargo/Tanker	5.1	Low Risk - Broadly Acceptable	5.1	Low Risk - Broadly Acceptable
3	2	Morgan-Walney	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	8.8	Medium Risk - Tolerable (if ALARP)	12.5	High Risk - Unacceptable
4	6	Morgan-Walney	Collision - Small Craft ICW. Small Craft	6.7	Medium Risk - Tolerable (if ALARP)	9.6	Medium Risk - Tolerable (if ALARP)
5	1	Morgan-Walney	Allision - Ferry/Passenger	10.0	Medium Risk - Tolerable (if ALARP)	14.1	High Risk - Unacceptable
6	9	Morgan-Walney	Allision - Cargo/Tanker	5.0	Low Risk - Broadly Acceptable	7.4	Medium Risk - Tolerable (if ALARP)
7	4	Morgan-Walney	Allision - Tug/Service & Small Project Vessels	7.6	Medium Risk - Tolerable (if ALARP)	10.5	Medium Risk - Tolerable (if ALARP)
8	4	Morgan-Walney	Allision - Fishing	7.6	Medium Risk - Tolerable (if ALARP)	9.6	Medium Risk - Tolerable (if ALARP)
9	6	Morgan-Walney	Allision - Recreational	6.7	Medium Risk - Tolerable (if ALARP)	9.6	Medium Risk - Tolerable (if ALARP)

D.4.2 Vessel to Vessel Collision Risk

D.4.2.1.1 Collision avoidance and vessel collision risk were assessed within **Section 7.7** and **Section 7.8** of the CRNRA undertaken to inform the Environmental Statement. Whilst a number of factors associated with OWFs might impact the risk of collision, the primary factors were traffic density and available sea room.

D.4.2.1.2 Vessel numbers passing between Morgan Array Area and the Mooir Vannin Scoping Boundary annually are likely to consist of:

- 1,451 IoMSPC Ferries travelling between Douglas and Heysham.
- 182 Silver River general cargo vessels.
- Some small commercial vessels (under 100 m in length).

D.4.2.1.3 Vessel numbers passing between Walney Extension OWF and the Mooir Vannin Scoping Boundary annually are likely to consist of:

- 400 Stena Line ferries travelling between Liverpool and Belfast.
- 82 cargo vessels (most frequently the CEG Galaxy).
- 38 tankers (most frequently the Keewhit).

D.4.2.1.4 The frequency of meeting situations on these routes within the CRNRA undertaken to inform the Environmental Statement was assessed without Mooir Vannin OWF (see **Section 7.7**). Between the Morgan Array Area and Walney OWF, it was predicted that there would be no large commercial vessels for 80% of the year and for 19% of the time there would a single large commercial vessel navigating this route. For 0.6% of the year there would be two or more vessels navigating this route which suggests a low likelihood of meeting another large commercial vessel. These results may be higher with Mooir Vannin OWF given the greater deviations of commercial routes.

D.4.2.1.5 Moreover, the sea area between the Mooir Vannin OWF Scoping Boundary and Morgan Array Area has a much narrower width, measuring 2.6 nm. This means that two vessels meeting at this point would not have the ability to maintain a 1 nm CPA from other vessels and the turbines. Hence, the frequency of a collision event occurring has been raised within the hazard log in this addendum. Furthermore, the 2.6nm route width would not meet the guidance set out in **Section 7.6**.

D.4.2.1.6 Fishing activity currently taking place around the Mooir Vannin OWF Scoping Boundary is reasonably high, as was observed within the 2020 VMS data obtained from the MMO (see **Section 5.2.2.6**). The presence of Mooir Vannin Scoping Boundary would mean that fishing activity could be further displaced above that considered for the Project Array Areas, potentially into areas where deviated commercial routes are regularly transiting. This poses a greater risk of interaction between fishing vessels and large commercial vessels. As shown in the hazard log, a collision between a small craft and ferry/passenger vessel has the potential to be severe, resulting in multiple fatalities in the realistic worst credible scenario.

D.4.2.1.7 During the navigation simulations to inform the Project's Environmental Statements (**Appendix E**) a run was added which considered the navigation with the Mooir Vannin OWF Scoping Boundary in place with the Ben-My-Chree operating between Heysham and Douglas. The run failed on two counts, one of which was that there was not a sufficient clearance from other ships. During the simulation, three trawlers as well as a product tanker were modelled. Both the ferry and the tanker were required to take collision avoidance action during the simulation and were not able to maintain an adequate CPA due to the limited sea room available when passing between the Mooir Vannin OWF Scoping Boundary and Morgan Array Area.

D.4.2.1.8 Of the amended hazard scores for collision hazards taking into account Mooir Vannin OWF Scoping Boundary, the greatest increase was a scenario of a collision between a ferry/passenger/cargo/tanker vessel and a small craft. This is largely due to the higher chance of encounters with fishing vessels, given the significant reduction in sea room, particularly where activity is dense in IoM waters. The increase resulted in the hazard going up to a High Risk – Unacceptable rating.

D.4.2.1.9 The hazards with the second highest increase in score were a collision between two small craft and the scenario of a collision between a ferry/passenger vessel and a cargo/tanker/ferry/passenger vessel. In the first case, this is due to the potential displacement of fishing and recreational cruising associated with Mooir Vannin OWF. In the latter case, the scoring can be attributed to the higher possibility for vessel to vessel encounters given the reduction in available sea room between the Mooir Vannin OWF Scoping Boundary, Morgan Array Area and Walney Extension OWF. However, the impact on the viability of these ferry routes may result in a reduction in the density of ferry traffic which may in turn reduce this likelihood.

D.4.2.1.10 There was no change in the score for a collision between cargo/tanker vessels given the low frequency of transits of this route.

D.4.3 Allision Risk

D.4.3.1.1 The introduction of further infrastructure (such as WTGs or OSPs) adjacent to navigation routes would increase the risk of vessels striking these structures. This was assessed within the CRNRA undertaken to inform the Environmental Statement (see **Section 7.8** and **Section 8.6**), however, the addition of Mooir Vannin OWF could increase this risk further.

D.4.3.1.2 As with the risk of collision, the density of vessel traffic and available sea room are key factors in determining the risk of allision. The concentration of traffic in narrower routes of 2.6 nm would result in vessels navigating closer to the Morgan Array Area, Mooir Vannin offshore array area and Walney OWFs and there is little contingency should there be a mechanical failure or collision avoidance action is required.

D.4.3.1.3 During the navigation simulations to inform the Projects' Environmental Statements (**Appendix E**) a run was added which considered the navigation with the Mooir Vannin OWF Scoping Boundary in place with the Ben-My-Chree operating between Heysham and Douglas. The run failed on two counts, one of which was that there was not a sufficient distance between the vessel and fixed infrastructure (i.e. the proposed turbines). During the simulation, collision avoidance action was required due to an encounter with a products tanker. Given the reduced sea room, the Ben-My-Chree was unable to maintain an adequate CPA from the wind turbines of the Mooir Vannin OWF Scoping Boundary.

D.4.3.1.4 The frequency of an allision occurring within the CRNRA undertaken to inform the Environmental Statement reported above was increased to reflect the additional risks posed by the Mooir Vannin OWF Scoping Boundary in combination with other cumulative projects. Of the five allision hazards considered for the Mooir Vannin OWF Addendum, the greatest increase was for an allision involving a ferry or passenger vessel, largely because the Stena Line and IoMSPC ferries would not be able to maintain a safe CPA should another vessel be encountered when passing between the Morgan Array Area and Mooir Vannin OWF Scoping Boundary. This resulted in a High Risk – Unacceptable rating. This is largely due to the potential for multiple fatalities in the realistic worst credible scenario.

D.4.3.1.5 Allision hazard scores for a recreational vessel, tug/service vessel or a small project vessel were also increased but remained within the Medium Risk – Tolerable (if ALARP) region.

D.4.3.1.6 The hazard scoring for a cargo/tanker vessel allision increased from Low Risk – Broadly Acceptable to Medium Risk – Tolerable (if ALARP), due to the need for the deviated cargo/tanker routes to transit closer to turbines when passing through the sea areas between the proposed and existing offshore wind farms.

D.5 SUMMARY

D.5.1.1.1 This addendum has considered the results of the CRNRA undertaken to inform the Environmental Statement reported above with the addition of the Mooir Vannin OWF Scoping Boundary based on information presented in its Scoping Report published on 18 October 2023 (Mooir Vannin Offshore Wind Limited, 2023).

D.5.1.1.2 At its closest point, the Mooir Vannin OWF Scoping Boundary is 2.6 nm from the Morgan Array Area and this will create a much narrower passage than was assessed within the CRNRA undertaken to inform the Environmental Statements. The distance between the Mooir Vannin OWF Scoping Boundary and the Walney Extension OWF is 4.7 nm, and whilst considered navigable in most conditions with realistic traffic numbers, would necessarily increase the risk of collision and allision in this sea area when considered with the Morgan Array Area.

D.5.1.1.3 The Mooir Vannin OWF Scoping Boundary, in combination with the Projects and existing operational OWFs, will require deviations to regular commercial vessel routes in typical and adverse conditions.

D.5.1.1.4 This includes the IoMSPC route between Heysham and Douglas and the Stena Line route between Liverpool and Belfast east of the Isle of Man. The shallow water to the northwest of the Mooir Vannin Scoping Boundary would likely result in a greater number of vessels routeing between the Mooir Vannin Scoping Boundary, Walney Extension OWFs and the Morgan Array Area.

D.5.1.1.5 The assessment within this addendum found that the cumulative impact on vessel routeing when including the Mooir Vannin OWF Scoping Boundary would be to significantly affect the viability of the IoMSPC and Stena Line routes in both typical and adverse weather conditions. Primarily, the Stena Line route between Liverpool and Belfast, east of the Isle of Man, would require such significant deviations that this route may no longer be viable, and therefore all traffic would pass west of the Isle of Man. The Stena Line service between Heysham and Belfast in adverse weather may require passages to the west of the Isle of Man rather than the east as is currently the case. Furthermore, the impact on the IoMSPC route between Heysham and Douglas would require greater frequency of adverse weather routeing to the south of the Morgan Array Area to avoid the constrained 2.6 nm waters between the Morgan Array Area and the Mooir Vannin Scoping Boundary. Furthermore, it was unclear how the Silver River regular service between Ramsey and Glasson would continue to operate.

D.5.1.1.6 The assessment within this addendum concluded that the sea room between the Mooir Vannin OWF Scoping Boundary and Morgan Array Area was inadequate for safe navigation given the expected traffic density and prevailing meteorological conditions. Vessels would be unable to maintain the desired 1.0 nm CPA from other vessels and structures.

D.5.1.1.7 A desktop review of two of the hazards for which consensus was reached at the CRNRA hazard workshop to inform the Environmental Statements to be Medium Risk and ALARP without Mooir Vannin OWF, would be High Risk – Unacceptable with the addition of the Mooir Vannin OWF. These are both for transits between the Morgan Array Area, Walney OWFs and Mooir Vannin OWF Scoping Boundary; firstly, the risk of a ferry or passenger vessel in an allision with an offshore wind turbine or OSP, and secondly, a collision between a ferry, cargo or tanker in collision with a small craft. Both of these hazards have the potential to result in multiple fatalities in the realistic worst credible scenario.

D.5.1.1.8 In summary, it was concluded that with the addition of Mooir Vannin OWF, there were likely to be further impacts on ferry routes in typical and adverse conditions and unacceptable risk to navigation safety.

D.6 CUMULATIVE HAZARD LOG INCLUDING MOOIR VANNIN

ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	CRNRA Scores														CRNRA Scores (including Mooir Vannin)			
						Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating	ML	WC	Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency			Frequency	Frequency		
1	3	Morgan-Walney	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	2	Significant loss of life; Constructive Loss; Serious pollution (Tier 2); International adverse publicity. Ferry out of service.	5	5	4	5	2	7.8	Medium Risk - Tolerable (if ALARP)	4	2	10.6	Medium Risk - Tolerable (if ALARP)
2	8	Morgan-Walney	Collision - Cargo/Tanker ICW. Cargo/Tanker	Reduced Searoom Between OWFs; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Layout Plan and Lines of Orientation.	Multiple minor injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Vessel requires drydock.	2	3	2	3	2	Single fatalities; Constructive Loss; Major pollution incident (Tier 3); National adverse publicity.	4	5	5	4	1	5.1	Low Risk - Broadly Acceptable	2	1	5.1	Low Risk - Broadly Acceptable

ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	CRNRA Scores: Realistic Most Likely Scenario	Realistic Most Likely Scores: People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	Realistic Worst Credible Scores: People	Property	Environment	Business	Frequency	Risk Score	Risk Rating	CRNRA Scores (including Mooir Vannin): ML Frequency	WC Frequency	Risk Score	Risk Rating
3	2	Morgan-Walney	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	3	Multiple fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)	4	3	12.5	High Risk - Unacceptable
4	6	Morgan-Walney	Collision - Small Craft ICW. Small Craft	Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)	4	3	9.6	Medium Risk - Tolerable (if ALARP)

ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	CRNRA Scores															CRNRA Scores (including Mooir Vannin)			
						Realistic Most Likely Scenario	Realistic Most Likely Scores					Realistic Worst Credible Scenario	Realistic Worst Credible Scores					Risk Score	Risk Rating	ML	WC	Risk Score	Risk Rating
							People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency			Frequency	Frequency		
5	1	Morgan-Walney	Allision - Ferry/Passenger	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Repairs to WTGs; Short term interruption to ferry services.	3	3	2	4	3	Multiple fatalities; Serious damage to vessel; Serious pollution (Tier 2); International adverse publicity; Loss of WTGs; Ferry out of service.	5	5	3	5	2	10.0	Medium Risk - Tolerable (if ALARP)	4	3	14.1	High Risk - Unacceptable
6	9	Morgan-Walney	Allision - Cargo/Tanker	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring.	Multiple minor injuries; Moderate damage to vessel; No pollution; Widespread adverse publicity; Repairs to WTGs.	2	3	1	3	2	Single fatalities; Drydock required; Serious pollution incident (Tier 2); National adverse publicity; Loss of WTGs.	4	5	4	5	1	5.0	Low Risk - Broadly Acceptable	2	2	7.4	Medium Risk - Tolerable (if ALARP)

ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	CRNRA Scores: Realistic Most Likely Scenario	Realistic Most Likely Scores: People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	Realistic Worst Credible Scores: People	Property	Environment	Business	Frequency	Risk Score	Risk Rating	CRNRA Scores (including Mooir Vannin): ML Frequency	WC Frequency	Risk Score	Risk Rating
7	4	Morgan-Walney	Allision - Tug/Service & Small Project Vessels	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	4	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)	5	3	10.5	Medium Risk - Tolerable (if ALARP)
8	4	Morgan-Walney	Allision - Fishing	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; Fishing Liaison Plan; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	4	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)	4	3	9.6	Medium Risk - Tolerable (if ALARP)

ID	Haz. Rank	Area	Hazard Title	Possible Causes	Embedded Risk Controls	Realistic Most Likely Scenario	CRNRA Scores – Realistic Most Likely Scores – People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	Realistic Worst Credible Scores – People	Property	Environment	Business	Frequency	Risk Score	Risk Rating	CRNRA Scores (including Mooir Vannin) – ML – Frequency	WC – Frequency	Risk Score	Risk Rating
9	6	Morgan-Walney	Allision - Recreational	Presence of WTGs; Reduced Searoom Between OWFs; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from WTGs; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility;	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCOP; Periodic Exercises; Incident Investigation and Reporting; Aids to Navigation; Air Draught Clearance; Layout Plan and Lines of Orientation.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to WTGs.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to WTGs.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)	4	3	9.6	Medium Risk - Tolerable (if ALARP)

Appendix E Navigation Simulations

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Morgan, Mona and Morecambe Offshore Wind Farms

Navigation Simulation Study - 2023

DJR6687-RT005 R03-00
30 November 2023

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Summary

There are three Offshore Wind Farms (OWFs), collectively referred to as 'the Projects', being proposed in the Irish Sea, by the following developers:

- bp/EnBW Morgan Offshore Wind Project Generation Assets;
- bp/EnBW Mona Offshore Wind Project;
- Flotation Energy/Cobra OWF.

To help in understanding the potential navigation impacts of the OWFs on existing commercial ferries in the region, the Projects are carrying out extensive shipping and navigation studies. This includes a Cumulative Regional Navigation Risk Assessment (CRNRA) which considers the impacts brought about by all Projects and individual Navigation Risk Assessments (NRAs), which consider impacts brought about by each Project in isolation.

HR Wallingford have previously been commissioned by bp/EnBW through RPS and NASH Maritime to undertake a navigation simulation study with the involvement of the ferry companies. This provided an early and detailed understanding of the potential impact to the passage plans for ferries navigating between and around the Morgan, Mona and Morecambe OWFs. This work is presented in Reference 1. Following the findings of the navigation simulations and the hazard workshop, several high risk, unacceptable hazards were identified and therefore commitments to boundary changes were made in December 2022 to increase the sea room between the Projects.

HR Wallingford are undertaking an update of the real time navigation simulation study on behalf of NASH Maritime (the shipping and navigation lead for the projects), to an agreed specification (see Reference 1) to provide an indication of the effectiveness of the boundary changes.

The update to the navigation simulation for the revised boundaries includes external simulation session conducted with attendance by the following ferry companies:

- Isle of Man Steam Packet Company (IOMSPC);
- Stena Line Ferries (Stena Line);
- Seatruck Ferries (Seatruck).

The navigation simulations demonstrated that the Stena Line ferries can safely navigate with the OWFs in place using standard operational procedures. In particular, the amendments made to the Project boundaries have greatly improved sea room with ferries having multiple actions available to avoid collisions in compliance with the COLREGs.

The navigation simulations also demonstrated that the IoMSPC ferries can safely navigate with the OWFs in place using standard operational procedures. In particular, the amendments made to the Project boundaries have greatly improved sea room with ferries having multiple actions available to avoid collisions in compliance with the COLREGs.

In addition, the navigation simulations demonstrated that the Seatruck ferries can safely navigate with the OWFs in place using standard operational procedures. In particular, Seatruck noted that the alterations of the OWF boundaries, particularly between Morgan and Mona, resulted in a significant improvement to the efficiency and safety of operations compared to the original boundaries.

Contents

Appendices

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1 Introduction

There are three Offshore Wind Farms (OWFs), collectively referred to as 'the Projects', being proposed in the Irish Sea, by the following developers:

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- Isle of Man Steam Packet Company (IOMSPC);
- Stena Line Ferries (Stena Line);
- Seatruck Ferries (Seatruck).

2 Navigation simulation configuration

2.1 Layouts

The navigation simulation configuration was modified from that created previously for the 2022 real time navigation simulation study, which is described in Reference 2. The layout used for that study is illustrated in Figure 2.1.

Revised OWF boundaries were provided by NASH Maritime in digital shape file format, which were converted to AutoCAD and incorporated into the simulation configuration. The extent of the new proposed boundaries and OWF layouts that were simulated in this study were as shown in Figure 2.2.

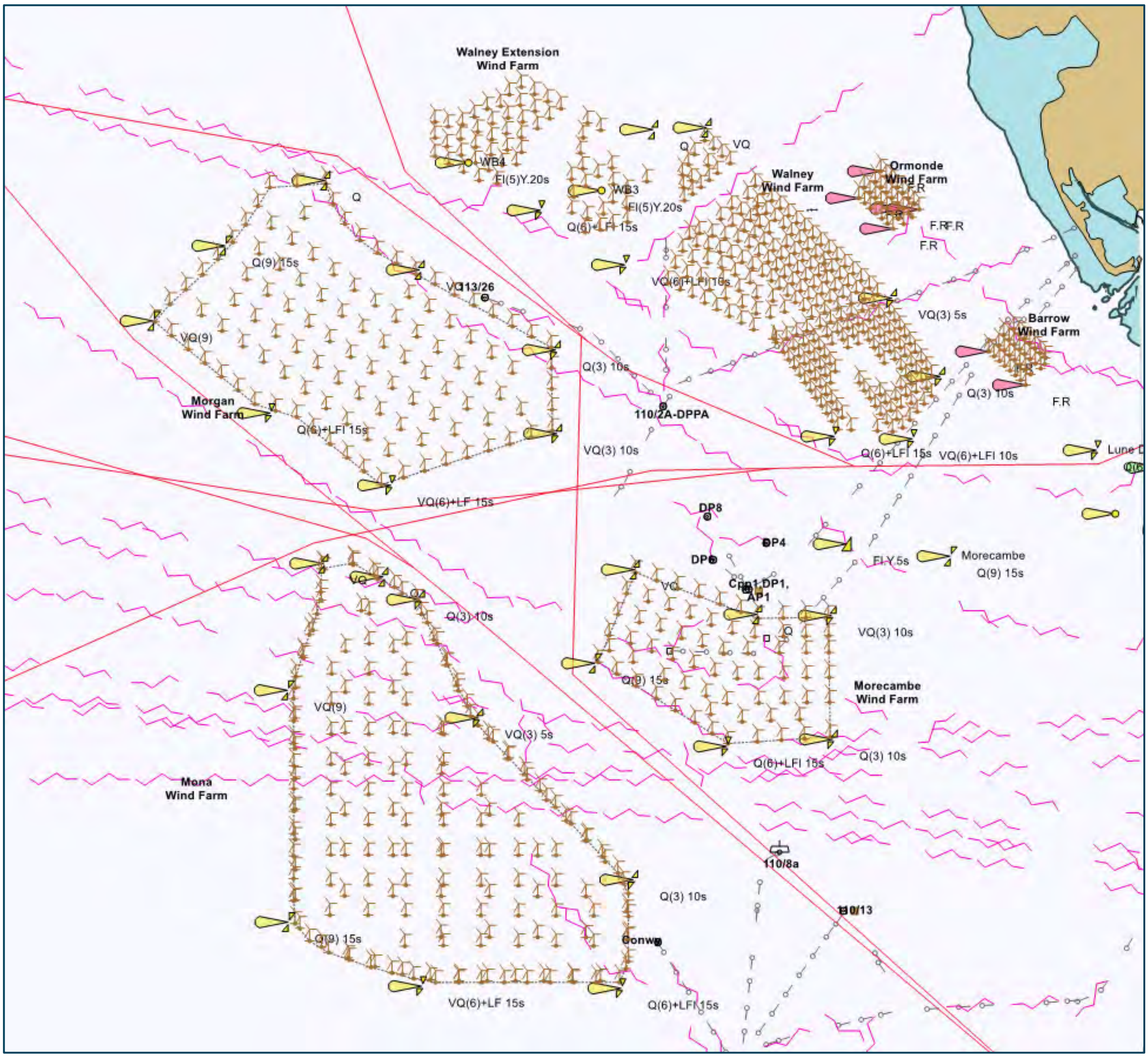


Figure 2.1: Layout for Morgan, Mona, Morecambe and existing OWFs as used for the 2022 navigation simulation study

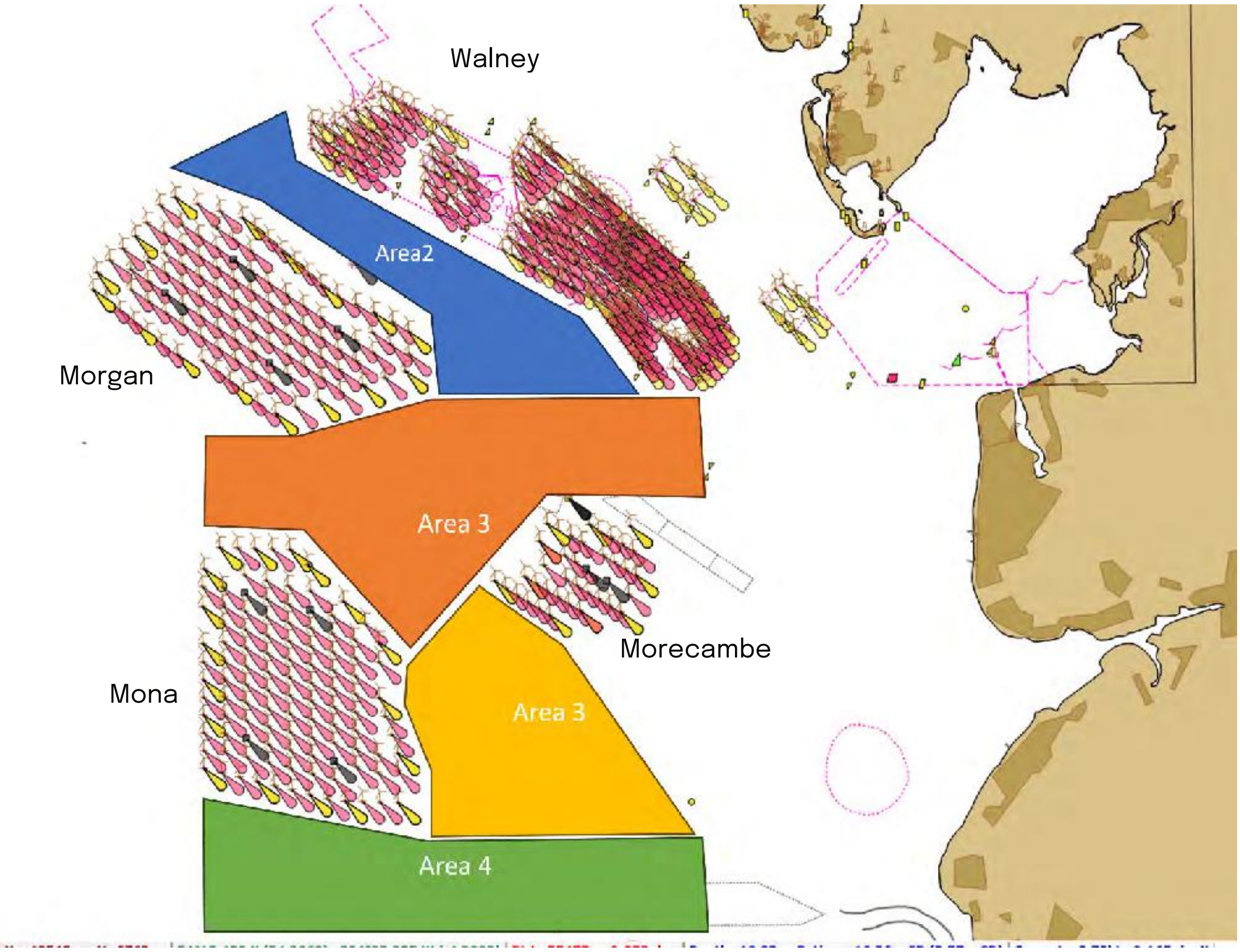


Figure 2.2: General description of changes applied

The key aspects of the new boundaries from a navigational perspective were:

- Increased space in Area 1 to enable safer navigation between the Morgan, Mona and Morecambe OWFs;
- Increased space in Area 2 to enable safer navigation between the Morgan and Walney OWFs;
- Increased space in Area 3 to enable safer navigation between the Mona and Morecambe OWFs;
- Increased space in Area 4 to enable safer navigation south of the Mona OWF, in the vicinity of the Liverpool approach traffic separation scheme (TSS).

A series of search areas were determined by the Project to assist in selecting the best option for the location of a booster station. As its precise location is still to be determined, the search areas were included as navigational features and the stakeholders invited to comment. The extent of the search areas relative to the OWFs, as represented in the simulation, is shown in Figure 2.3.

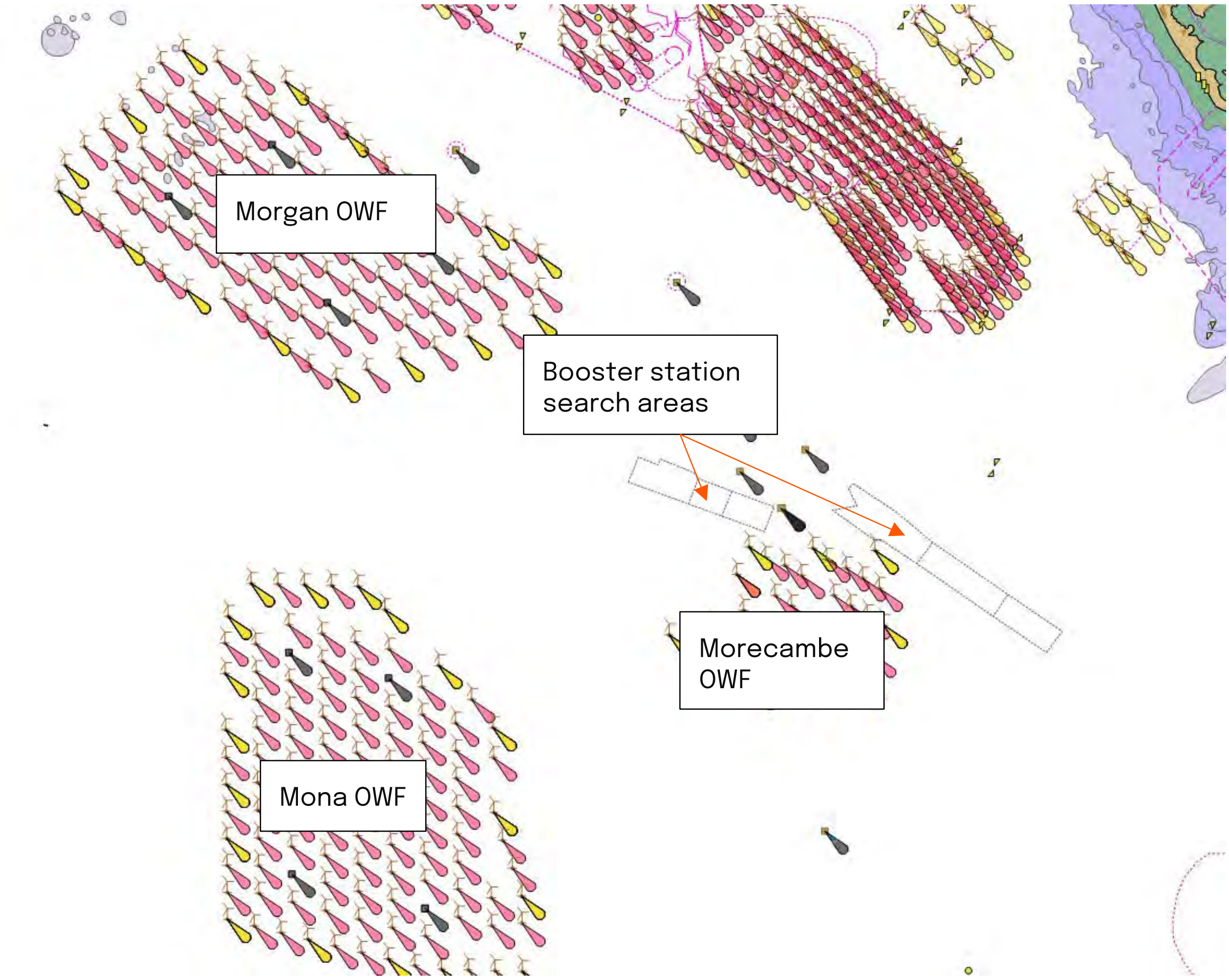


Figure 2.3: Layout as simulated in the 2023 series of simulations including location of booster station search areas

2.2 Environmental conditions

2.2.1 General

Various data on the environmental conditions in the area of interest were analysed in detail during the previous study. This analysis was presented and verified during the simulation sessions conducted in 2022, as summarised in Reference 2.

The analysis included data for wave conditions at 8 points in the Irish Sea, as shown in Figure 2.4.

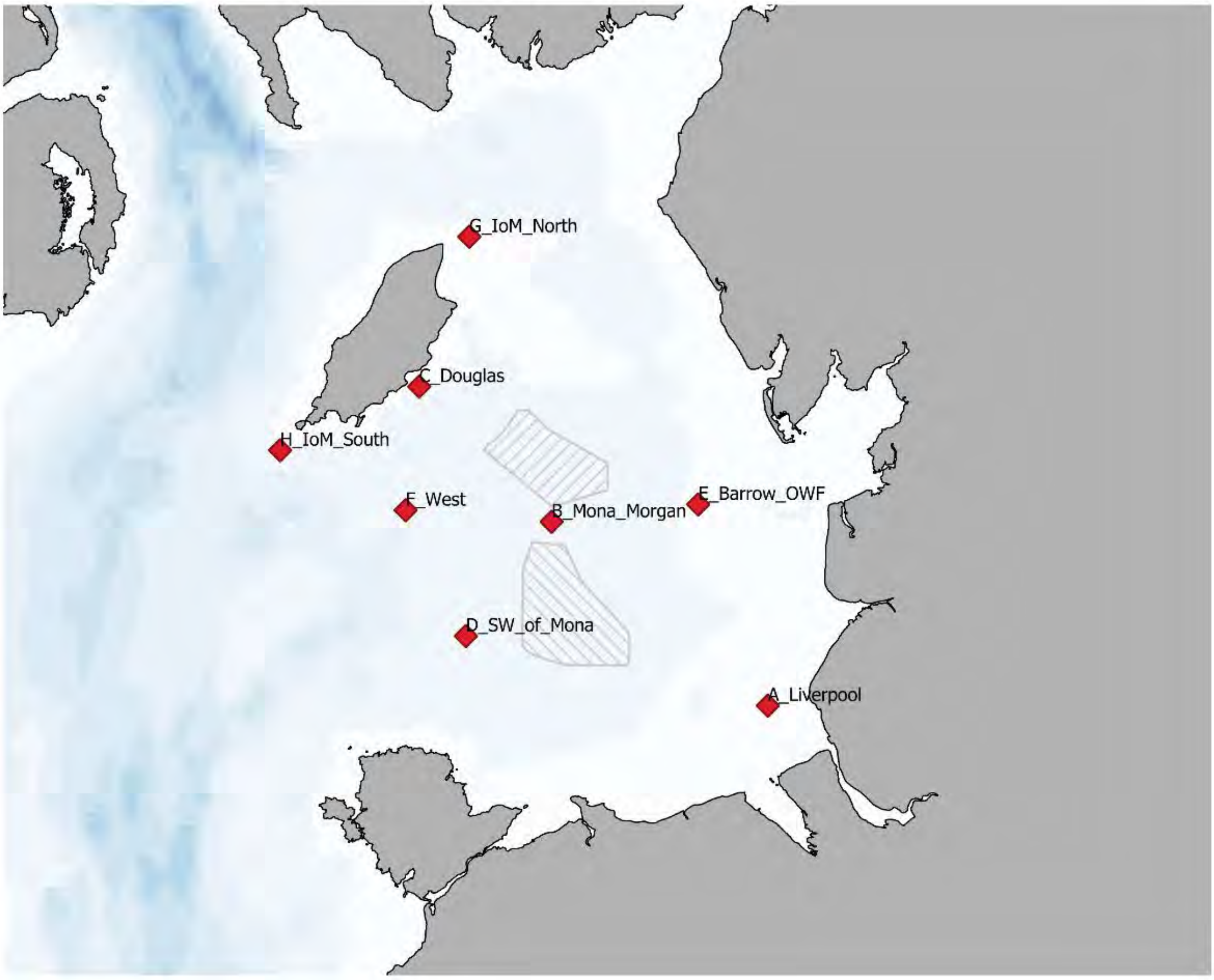


Figure 2.4: Wave model output locations

The annual wave roses for points B, D, E, and F are shown in Figure 2.5 to Figure 2.8. The roses show the difference between the points in terms of the general wave climate (wave height and direction).

The corresponding omni-directional operational and extreme wave conditions were determined and are summarised in Table 2.1.

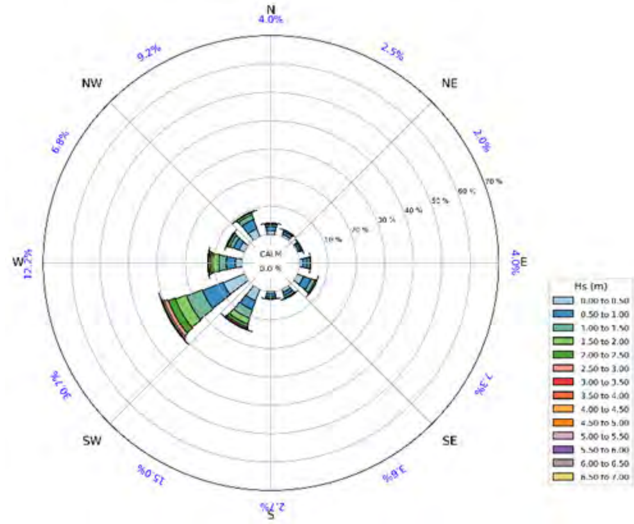


Figure 2.5: Annual wave rose: Location B - Mona/Morgan

Source: NWS 1980-2021

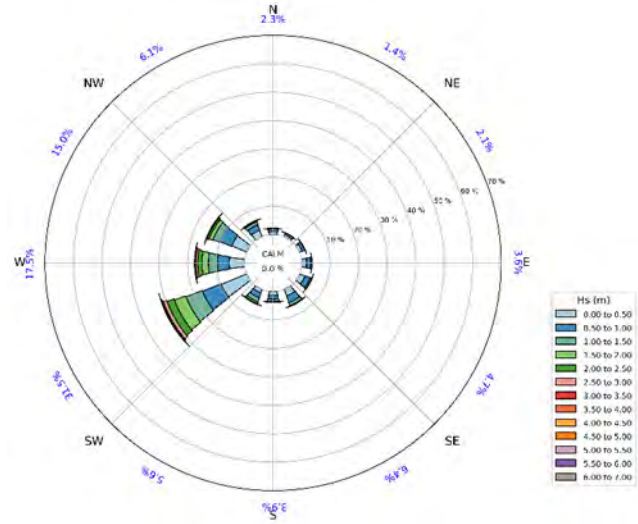


Figure 2.6: Annual wave rose: Location E - Barrow OWF

Source: NWS 1980-2021

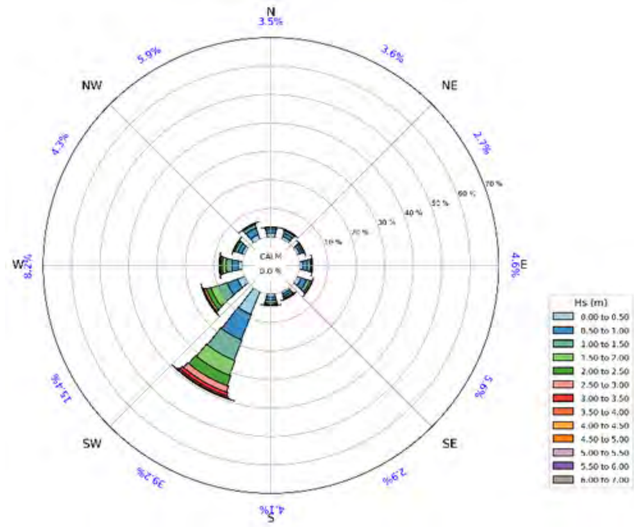


Figure 2.7: Annual wave rose: Location F - West

Source: NWS 1980-2021

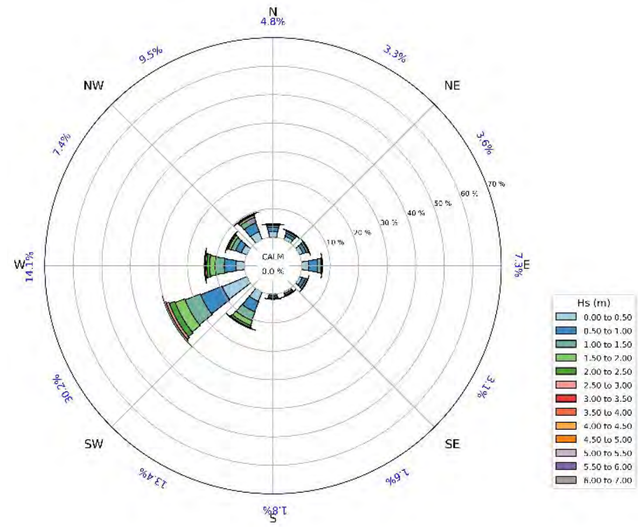


Figure 2.8: Annual wave rose: Location D - SW of Mona

Source: NWS 1980-2021

For the areas of interest for this study the worst waves, from a navigation and ship handling perspective, were predominately from a south westerly direction. This was due to the direction of prevailing weather in the region and because the OWFs are exposed to the maximum fetch when the sea and swell are associated with south westerly winds.

Table 2.1: Summary of omni-directional wave conditions

Point	Return periods		Significant wave height, H_s (m)	Spectral peak wave period, T_p (s)
A	0.02	Weekly (50 in 1 year)	1.2	5.1
	0.1	Monthly (10 in 1 year)	2.0	6.8
	1	Yearly (1 in 1 year)	2.8	8.3
B	0.02	Weekly (50 in 1 year)	1.6	5.2
	0.1	Monthly (10 in 1 year)	2.9	7.5
	1	Yearly (1 in 1 year)	4.4	8.5
C	0.02	Weekly (50 in 1 year)	1.5	5.8
	0.1	Monthly (10 in 1 year)	2.9	8.3
	1	Yearly (1 in 1 year)	4.3	9.6
D	0.02	Weekly (50 in 1 year)	1.6	6.6
	0.1	Monthly (10 in 1 year)	2.7	7.9
	1	Yearly (1 in 1 year)	4.0	8.2
E	0.02	Weekly (50 in 1 year)	1.5	4.8
	0.1	Monthly (10 in 1 year)	2.8	7.1
	1	Yearly (1 in 1 year)	4.0	8.4
F	0.02	Weekly (50 in 1 year)	1.6	6.6
	0.1	Monthly (10 in 1 year)	2.7	7.9
	1	Yearly (1 in 1 year)	4.0	8.2
G	0.02	Weekly (50 in 1 year)	1.5	6
	0.1	Monthly (10 in 1 year)	2.4	6.4
	1	Yearly (1 in 1 year)	3.3	8.3
H	0.02	Weekly (50 in 1 year)	1.6	5.2
	0.1	Monthly (10 in 1 year)	3.2	8.2
	1	Yearly (1 in 1 year)	4.8	9.4

Source: Met Office NWS model

Based on further consideration of these data during the present study, the simplified environmental data presented in Table 2.2 were used as the basis for setting the environmental conditions for the simulation runs.

There was only minor spatial variation in the general conditions across the area of interest and the simplified data better represented the level of precision considered during the simulation (i.e. to the nearest 0.5 m of significant wave height).

The particular situation where a vessel transiting from Liverpool past the Morecambe OWF and passes clear from the lee of the Island of Anglesey was taken into account by agreeing a point at which the effect would be experienced and changing the environmental conditions accordingly.

It should be noted that the monthly summer and winter conditions shown in Table 2.2 could occur in any season, as the descriptor is only indicative, although, in general, the worst conditions will be experienced during the winter.

Table 2.2: Simplified environmental data

Description	Significant wave height, Hs (m)	Spectral peak wave period, Tp (s)	Corresponding approximate wind speed (knots)
Weekly	1.5	5.5	SW 15 (F 4)
Fortnightly	2	6	SW 20 (F5)
Monthly (summer)	2.5	6.5	SW 25-30 (F6-7)
Monthly (winter)	3	7	SW 31-40 (F7-F8 Gale)
Annually	4.0	10	SW 40 -50(F9- F10 Storm)

2.2.2 Bathymetry, water levels and current flows

The simulation model for the Irish Sea used in the present study was the same as that used for the 2022 work, as detailed in Reference 2.

The effects of the current and changes in water level are important in the Irish Sea and needed to be considered for passage planning. However, for the purposes of this work their effects were not considered to be critical so were not specifically evaluated.

2.2.3 Visibility

The visibility can be reduced in the simulation visual scene to represent the effect of fog or heavy rain. This was used in one run.

2.3 Ship manoeuvring models

For the previous study in 2022, specific ship manoeuvring models were created, which were verified by representatives from the stakeholder ferry companies. This was to ensure that the response to any helm, engine or tug control, along with the effects of the local wind, wave and current conditions were realistic.

The same ship manoeuvring models were used in this study, details of which are contained in Table 2.3.

Details of the verification process for the ship manoeuvring models is contained in Reference 2.

Table 2.3: Ship manoeuvring models

Characteristic	Units	96 m x 26 m CAT Manannan	125 m x 23 m RoRo Ben-My-Chree	133 m x 26 m RoRo Manxman	142 m x 25 m RoRo Seatruck Progress	215 m x 28 m RoRo Stena Estrid
Length overall	m	95.5	125.2	133	142.0	214.5
Length between perpendiculars	m	86.0	115.1	122	133.5	202.5
Beam	m	26.0	23.4	25.7	25.0	27.8
Loading condition						
Mean draught	m	3.4	5	5.2	5.2	6.4
Displacement	tonnes	1,300	7,700	11,400	10,700	23,700
Propulsion						
Main engine type		4xCAT 3618 Diesel	2 x MaK 9M32	2 x Diesel Electric	2xMAN7L48/60BCR	2xMaK 12M43C
Engine power (total)	kW	28,800	8,640	15,700	16,000	25,200
No. of propellers and type		2 x water jet	2 x CPP	2 x CPP	2 x CPP	2 x CPP
Bow thruster	tonnes	None	28	45	27.5	72
Rudder type	-	n/a	Flapped	Bulb	Spade	Flapped
Rudder angle	°	30	45	45	55	45
Manoeuvring engine order						
Full Ahead	knots	34	19	20	21.9	22
STOP	knots	0	0	0	0	0
Full Astern	knots	-17	-13.3	-14	-17.5	-15.4
Windage area						
Windage lateral	m^2	1,015	2,422	3,230	2,999	5,316
Windage frontal	m^2	363	654	719	712	825
Wind speed		**Beam wind force (t)**				
15 knots		3	7	10	9	16
20 knots		5	13	18	16	29
25 knots		8	21	27	25	45
30 knots		11	30	39	37	65
35 knots		16	40	54	50	88

3 Navigation simulation

3.1 Simulation session

There were 3 navigation simulation sessions conducted at HR Wallingford's UK Ship Simulation Centre (UKSSC), focussing on each of the ferry companies, as follows:

- Stena Ferries – 23 to 25 May 2023 – The Simulation Team for this session is shown in Table 3.1;
- Seatruck – 22 to 23 June 2023 – The Simulation Team for this session is shown in Table 3.2;
- IoMSPC – 13 to 14 September 2023 – The Simulation Team for this session is shown in Table 3.3.

Table 3.1: Simulation Team for Stena Line session – In person attendance

Name	Company	Role	23 May	24 May	25 May
Mike Parr	HR Wallingford	Project Manager	x	x	x
Morgan Robinson	HR Wallingford	Simulator Operator	x	x	x
Captain Ian Simpson	HR Wallingford	Staff Master Mariner	x	x	x
Captain Dominic Bell	NASH Maritime	Consultant Mariner	x	x	x
Ed Rogers	NASH Maritime	Director	x		x
Chris Hutchings	NASH Maritime	Project Manager	x	x	
Dr Andrew Rawson	NASH Maritime	Principal Consultant	x	x	x
Brocque Preece	NASH Maritime	Principal Consultant	x	x	x
Captain Nigel Basset	NASH Maritime	Consultant Master Mariner	x	x	x
Michael Proctor	Stena	Superintendent	x	x	x
Sean Fitzgerald	Stena	Master Mariner	x	x	x
Vinu John	MCA	Marine specialist	x	x	x
Vaughan Jackson	MCA	Marine specialist	x	x	x
Sarah Marjoram	RHDHV	Consultant	x	x	
Miriam Knollys	RPS	EIA Lead			x
Gero Vella	BP	Developer		x	x
Paul Carter	BP	Consultant			x
Miriam Parish	BP	Consultant			x

Table 3.2: Simulation Team for Seatruck session – In person attendance

Name	Company	Role	22 Jun	23 Jun
Mike Parr	HR Wallingford	Project Manager	x	x
Liam Monahan Smith	HR Wallingford	Simulator Operator	x	x
Captain Ian Simpson	HR Wallingford	Staff Master Mariner	x	x
Captain Dominic Bell	NASH Maritime	Consultant Mariner	x	x
Ed Rogers	NASH Maritime	Director	x	
Chris Hutchings	NASH Maritime	Project Manager	x	x
Dr Andrew Rawson	NASH Maritime	Principal Consultant	x	x
Captain Nigel Basset	NASH Maritime	Consultant Master Mariner	x	x
Matthew Henderson	Seatruck	Superintendent	x	x
Jaan Kalijola	Seatruck	Master Mariner	x	x
James Kitney	Seatruck	Master Mariner	x	x
Artur Kwinta	Seatruck	Master Mariner	x	x
Rob Mereylees	Chamber of Shipping	Policy Advisor	x	x
Gero Vella	BP	Developer	x	
Rosie Howatt	BP	Developer	x	

Table 3.3: Simulation Team for IOMSPC session

Name	Company	Role	13 Sep	14 Sep
John Pirrie	IoMSPC	Senior Master	X	X
John Lambert	IoMSPC	Second Mate	X	X
Ed Rogers	NASH Maritime	Director	X	
Jamie Holmes	NASH Maritime	Director	X	R
Chris Hutchings	NASH Maritime	Project Manager	X	X
Dr Andrew Rawson	NASH Maritime	Principal Consultant	X	X
Adam Fitzpatrick	NASH Maritime	Project Engineer		X
Captain Nigel Bassett	NASH Maritime	Consultant Master Mariner	X	X
Captain Dominic Bell	NASH Maritime	Consultant Mariner	X	X
Dr Mark McBride	HR Wallingford	Project Director	X	X
Jon Woodhams	HR Wallingford	Project Manager	X	X
Liam Monahan-Smith	HR Wallingford	Simulator Operator	X	X
Captain Ian Simpson	HR Wallingford	Staff Master Mariner	X	X
Gero Vella	BP – Mona OWF	Developer	X	R
Rosie Howatt	BP – Morgan OWF	Developer	X	
Hati Raim	Morecambe OWF	Developer	X	
Florian Ketching	EnBW	Developer	R	R
Miriam Knollys	RPS	EIA Lead		R

Note: "X" indicates attendance in person and "R" indicates remote attendance

3.2 Scope

The scope of the simulation session was laid out in NASH Maritime's scoping document (Reference 1).

The aim of the studies was to assess the mitigation measures (revised array area boundaries) identified in the previous navigation simulations and subsequent navigation risk assessment workshops and provide an early and detailed understanding of any remaining potential safety of navigation impacts on individual ferry operators.

The work set out to:

- Provide detailed engagement with the ferry companies at the earliest opportunity and throughout the work.
- Assess whether shipping and navigation safety can be maintained with the projects in place.
- Understand changes required to ferry to passage plans to achieve safe navigation.

The conditions for the simulation runs were informed by the results of the previous simulation sessions that were completed with the stakeholder ferry companies during 2022, with special reference to considering runs in which failure or marginal assessments had been made.

3.3 Assessment criteria

The assessment criteria in used in the simulation sessions are outlined in Table 3.4, which was the same as that used previously.

Table 3.4: Assessment criteria

No.	Criteria	Description	Assessment
1	Ship Control	Was full control of the vessel maintained throughout the run, given the prevailing conditions and ship characteristics?	**Success**: Ship remains under full control for duration of simulation.
			Marginal: Whilst ship remained under control, it was considered at the limits of acceptable seamanship.
			Fail: Ship lost control and could not be manoeuvred acceptably.
2	Clearances from Fixed Infrastructure	Was sufficient sea room maintained from fixed objects to reduce the risk of allision/contact, given the prevailing conditions and ship characteristics?	**Success**: Passing distances from fixed objects met requirements in the passage plans.
			Marginal: Ship navigated closer to fixed hazards than defined in the passage plans but maintained sufficient control to continue to navigate safely.
			Fail: Ship came within unacceptably close proximity to a fixed hazard or entered the wind farm boundary.
3	Clearances from Other Vessels	Was sufficient maintained from other vessels to reduce the risk of collision, given the prevailing conditions and ship characteristics?	**Success**: Passing distances from other vessels met requirements in the passage plans.
			Marginal: Ship navigated closer to other vessels than defined in the passage plans but maintained sufficient control to continue to navigate safely.
			Fail: Ship came within unacceptably close proximity to another vessel and there was a risk of collision.
4	Under Keel Clearance	Was suitable under keel clearance to avoid grounding maintained, given the prevailing conditions and ship characteristics?	**Success:** Ship retained substantial under keel clearance throughout the passage (>5 m).
			Marginal: Under keel clearance thresholds were breached but safe navigation could be maintained.
			Fail: Ship either grounded or had unacceptable under keel clearance.
5	Capacity and Space to Respond to Emergencies	Was there sufficient control and sea room to respond to possible emergency situations, given the prevailing conditions and ship characteristics?	**Success**: It was deemed the vessel was capable to respond to an emergency if require.
			Marginal: It was deemed the vessel's capability to respond to an emergency situation is compromised but any incident would be unlikely to occur.
			Fail: It was deemed the vessel does not have the capability to respond to an emergency without an incident occurring.
6	Avoidance of Excessive Roll	Did the Vessels route expose it to conditions likely to	**Success**: All vessel effects considered to be within normal limits.

No.	Criteria	Description	Assessment
	Induced Cargo Shift	result in cargo shift or damage?	**Marginal:** Potentially Hazardous Sea Conditions encountered (slamming, surfing or broaching etc) but vessel could take action to reduce the risk and prevent incident.
			Fail: Conditions experienced likely to result in hazardous incidents (slamming, surfing, or broaching etc).
7	Avoiding Dangerous Sea Conditions	Did the vessel's route expose it to potentially dangerous Metocean phenomenon?	**Success**: All vessel effects considered to be within normal limits.
			Marginal: Potentially Hazardous Sea conditions encountered (slamming, surfing, or broaching etc) but vessel could take action to reduce the risk and prevent incident.
			Fail: Conditions experienced likely to result in hazardous incidents (slamming, surfing, or broaching etc).
8	Maintaining Passenger Comfort	Did the vessel's route result in conditions likely to induce motion sickness for passengers?	**Success:** Conditions considered benign for passenger travel.
			Marginal: Conditions considered likely to result in motion sickness amongst some passengers.
			Fail: Conditions not considered viable for passenger ferry services.
9	Impact on Vessel Schedule	Did the vessel's route result in delays to vessel's schedule through re-routing or reduction in speed?	**Success:** No or negligible impact on schedule.
			Marginal: Delays experienced, however, comparable to current operating performance.
			Fail: Route likely to result in significant delays for vessel.

Additionally, based on guidance provided by the stakeholder ferry companies in previous studies, the criteria in Table 3.5 were considered.

Table 3.5: CPA thresholds provided by ferry operators

Operator	From other vessels	From fixed infrastructure
IoMPSC	>1 or 2 nm	>1 or 2 nm
Stena Line	>1 nm	>1 nm
Seatruck	>1 nm	> 1.25 nm (west of Duddon Sands OWF)
Seatruck	>1.5 nm (bow crossing distance)	> 2 nm from wind farms

3.4 Presentation of results

All aspects of each simulation run were recorded such that it could be replayed and documented.

The data and results from each real time simulation run are presented in a range of formats, as described in the following sections.

3.4.1 Simulation run summary

After each run a simulation run summary table entry was completed to provide a high level record of each runs and the assessment. These are presented in Appendix A.

3.4.2 Simulation run synopsis and plots

Appendix B contains the synopsis, vessel track plots and associated information for each run, which describe:

- The location of the run;
- The objectives of the run;
- The initial conditions;
- A description of the scenario;
- A plot of the vessel tracks;
- A timeline of events and a corresponding plot;
- Simulation run commentary;
- Assessment based on the criteria in Table 3.4.

4 Stena Line navigation simulation session

The main conclusion from the test simulation session was that for the Stena Line vessels and routes, the proposed changes to the boundaries of the Morgan, Mona and Morecambe OWFs significantly improve sea room, compared to the previous boundaries. Consequently, the changes were found to alleviate the navigation issues previously identify during the previous simulation sessions and those which were expressed by the stakeholder ferry operators.

This is because the changes substantially increase the navigational areas available to transiting vessels between the Projects enabling Stena Line:

- Safe continuation of routine and non-routine (e.g. for adverse weather) ferry passages;
- Increased sea room for avoiding other vessels;
- Increased sea room from structures.

4.1 Safe navigation with other traffic and structures

It was demonstrated that the revised boundaries enable the bridge teams on the Stena Line ferries, following a route planned approximately midway between the OWFs or the normal routes associated with the Liverpool traffic separation scheme (TSS) south of the Mona OWF, to:

- Take appropriate action as required by the Collision Regulations (COLREGS) for at least 2 compounded traffic situations in which the simulated ferry was the 'give way' vessel, whilst maintaining a Stena closest point of approach (CPA) of greater than 1 nautical mile (NM) from the 'stand on' vessel(s) and other static hazards (OWFs, platforms, etc);
- Where there is additional complexity, for example, 3 relatively fast moving OWF support craft crossing from starboard in convoy, the simulated ferry can take appropriate action as required by the COLREGS, but would not maintain the specified CPA. For these situations it was considered likely that the Master would be required to be on the bridge, in line with good industry practice in complex shipping situations.

4.2 Safe navigation in adverse meteorological conditions

The orientation of the route between the Morgan and Walney OWFs and between the Morecambe and Mona OWFs means that vessels transiting those routes will be beam onto any significant conditions which prevail from the south west.

The transit of these routes in heavy seas was considered for both the Stena Scotia and Stena Estrid design vessels, with south westerly conditions including seas ranging from 3 m to 4 m significant wave height (Hs).

Runs with both vessels showed that the increase in sea conditions from 3 m to 3.5 m Hs on the beam resulted in motions which could place passengers at risk due to the rate of roll, and between 3.5 m to 4 m Hs the situation was becoming unsafe for cargo.

The existing practice in south westerly seas above 3 m Hs, would be for masters to attempt a direct route, with the sea on the beam and alter it, to take a longer more comfortable route, if required. However the effect of the Morgan and Mona OWFs will preclude the master from turning into the sea onto a safer heading if the situation deteriorates or is worse than originally anticipated.

Consequently Stena Line are clear that with the OWFs in place, the operational guidance will be for ferries to take a longer, more southerly route in SW seas of 3 m Hs and above. This sea condition is likely to occur in a high force 7 or low force 8 and is expected to occur approximately monthly during the winter.

The potential for ferries to zig-zag between the OWFs, whilst trying to maintain an overall comfortable course, exists and was considered, but should be discouraged because:

- The tactic requires the ferry to make multiple changes of heading across seas which will induce additional roll motions causing potential hazards during the course alterations;
- The subsequent route is longer and more inefficient than the alternative 'adverse' weather route.

4.3 Consideration of proposed Morgan/Morecambe transmission booster station

The search areas, within which the Morgan/Morecombe transmission booster station will be located, were included as restricted navigational areas during the simulations. The areas had no effect on any of the scenarios.

It was noted that the most north westerly search area protrudes beyond the westerly extremity of the Morecombe OWF. Locating the booster station in this area would negate some benefit associated with the adjustment to the western boundary of the Morecombe OWF already proposed by the Projects.

4.4 Emergency scenarios

As with the previous simulation sessions, emergency scenarios were considered as follows:

- Manoeuvring to facilitate a casualty transfer by helicopter, during which the master has discretion to manoeuvre to provide sufficient sea room for the transfer before the helicopter arrives. It was noted that the launch and transit time for the helicopter would be longer than a vessel would be navigating between the Projects.
- Manoeuvring due to a fire onboard, requiring the master to adjust the aspect of the vessel to the wind to assist with firefighting and to keep smoke away from the accommodation areas.

Stena Line concluded that the procedures applied during existing transits between the Walney OWF and the mainland could be adapted for use in the less constrained Morgan-Walney and Morgan-Mona corridors.

It was noted that the increased space due to the boundary changes increases the available sea room. It is expected that the emergency manoeuvres would involve reducing the vessel speed over the ground into wind to 1 knot or slower, providing up to 1 hour of slow travel in, say, a situation where a fire started and the vessel was 1 NM upwind of a OWF.

4.5 Consideration of night time situation

HR Wallingford produced a night time simulation indicating the likely effect of the prescribed aids to navigation and aircraft warning lights associated with the OWFs. This was examined with a simulated night time view showing likely traffic expected in the Irish Sea with normal navigation lights as follows:

- 24 m yacht;
- Trawler;
- Products tanker;
- Ferry.

The vessels were located in front of the OWFs and observations made from the relevant ferry's bridge at 2 to 5 NM distance.

It was clear that the proposed aids to navigation and other lights associated with the OWFs did not interfere with the normal ability to safely determine the nature and aspect of other traffic at night.

Figure 4.1: View from ferry bridge showing the vessel situated ahead of the wind farm

4.6 Summary

The navigation simulations demonstrated that the Stena Line ferries can safely navigate with the OWFs in place using standard operational procedures. In particular, the amendments made to the Project boundaries have greatly improved sea room with ferries having multiple actions available to avoid collisions in compliance with the COLREGs.

5 IoMSPC navigation simulation session

5.1 Outline

The following section provides the conclusions based on the navigation simulation session that was held considering the runs previously conducted with IoMSPC. This was completed over a 3 day period from 13 to 14 September 2023 (see Appendix A, Table A.2 and Appendix B.2).

The IoMSPC were not able to attend this session. In lieu of IoMSPC Masters, two Master Mariners with Irish Sea ferry experience were used to provide local area knowledge. Furthermore. comments from previous sessions that were attended by IoMSPC and responses to the Morgan and Mona Preliminary Environmental Information Report (PEIR) submissions were used to inform this assessment.

The main conclusion from the simulation session was that for the IoMSPC vessels and routes, the proposed changes to the boundaries of the Morgan, Mona and Morecambe OWFs significantly improve sea room, compared to the previous boundaries. Consequently, the changes were found to alleviate the key navigation safety issues identified during the previous simulation sessions and those which were expressed by the IoMSPC.

This is because the changes substantially increase the navigational areas available to transiting vessels between the Projects enabling:

- Safe continuation of routine and non-routine (e.g. adverse weather) ferry passages;
- Increased sea room for avoiding other vessels;
- Increased sea room from structures.

5.2 Safe navigation with other traffic and structures

It was demonstrated that the revised boundaries enable the bridge teams on the IoMSPC ferries, following a route planned approximately midway between the OWFs, or the normal routes associated with the Liverpool traffic separation scheme (TSS) south of the Mona OWF, to:

- Take appropriate action as required by the Collision Regulations (COLREGS) for at least 2 compounded traffic situations in which the simulated ferry was the ‘give way’ vessel, whilst maintaining an IoMSPC closest point of approach (CPA) of greater than 1 nautical mile (NM) from the ‘stand on’ vessel(s) and other static hazards (OWFs, platforms, etc);
- Where there is additional complexity, for example, from 3 relatively fast moving OWF support craft crossing from starboard in convoy, the simulated ferry can take appropriate action as required by the COLREGS and maintain the specified CPA.

The ability of the Ben-My-Chree (BMC) to transit the corridors based on the new boundaries with high concentrations of traffic was demonstrated. The traffic density based on analysis of vessel traffic data, was assessed as a rare traffic situation and highly unlikely to occur.

The revised OWF boundaries provide additional sea room from that previously considered and, in particular, between the Morgan and Mona OWFs, is now approximately 6 NM as opposed to the approximately 3 NM previously examined. Scenarios involving complex traffic patterns which were previously challenging for the BMC and the Manannan showed no issues with the new layout.

Separately Nash Maritime have undertaken a recent fishing activity survey in May 2023 since the previous simulation sessions, due to the previously noted requirement to better understand the combined effect of fishing and the OWFs. Based on the data captured in this survey and inputs from the project Fisheries Liaison team, a representative peak number of fishing vessels was included in the simulation, centred around the Isle of Man Scallop fisheries. The masters piloting the BMC were able to identify 8 fishing vessels with the visual and radar effects of the OWFs included in the simulation. Furthermore, the ferry was able to navigate clear of the fishing fleet on route to Douglas. Any impacts on ferry routeing as a result of the fishing activity were not considered to be substantially different to those experienced during current operations.

5.3 Safe navigation in adverse meteorological conditions

5.3.1 General

The orientation of the route between the Morgan and Walney OWFs, and between the Morecambe and Mona OWFs, means that vessels transiting those routes will be beam onto any significant weather and sea conditions which prevail from the southwest.

A series of runs were completed to consider the limiting conditions for the BMC, a conventional ferry, and the Manannan, a fast catamaran, as the vessels have significantly different operational characteristics. These are described in the following sections. The limiting conditions for the new Manxman vessel were not re-examined, as no additional manoeuvring data had been made available, so the assumptions made previously were unchanged.

It had previously been discussed whether it was possible for the vessels transiting these corridors to alter course along the routes, changing from a 'more comfortable course' with the sea on one side of the bow to a 'more comfortable course' with the sea on the other side of the bow, effectively tacking along the corridors. Further consideration and simulation of this technique showed that the number of alterations required and the effect on the vessel during each turn increased the overall risk to the vessel, passengers and cargo. Therefore, it was not considered a safe tactic, particularly given the marginal advantage compared to the adverse weather routing options and such tactics were not considered in this session.

5.3.2 Ben-My-Chree

The BMC is most constrained in heavy seas on its beam, which can cause large roll motions. In seas with a significant wave height, Hs, of 2.5 m, and a relatively short wave period incident on the vessel's beam, the masters concluded that safe passage was possible, but a warning broadcast to the passengers would be prudent. With an Hs of 3 m on the beam, the roll increases to greater than 10 degrees with occasional 30 degree motions, and associated high rates of movement. It was assessed that these conditions would be unsafe.

It was concluded that the BMC should avoid taking the passage between the Morgan and Walney OWFs in south westerly seas forecast to be greater than Hs 2.5 m, as would be associated with a Force 6 to 7 wind, which would, statistically, be expected to occur monthly during the summer and fortnightly in the winter.

5.3.3 Manannan

The Manannan is most constrained with wind and sea on its bow, which can cause large pitch and roll motions. It was found that the most effective mitigation was to reduce speed to half ahead, which would generally result in a reduction of 30% speed over the ground (SOG).

It was concluded that Manannan will need to begin to reduce speed when the Hs increases above 2.5 m rather than alter course. Once the master can select a course with the sea abaft the beam, the vessel's speed can be increased.

There is a potential benefit to the Manannan taking the southerly route when on passage from Liverpool to Douglas, as it can remain in the lee of Anglesey for longer before heading north. This will still be feasible as the passage is south of the Mona OWF.

5.4 Consideration of proposed Morgan/Morecambe transmission booster station

The search areas, within which the Morgan/Morecambe transmission booster station will be located, were included as restricted navigational areas during the simulations. The areas had no effect on any of the scenarios.

It was noted that the most north westerly search area protrudes beyond the westerly extremity of the Morecambe OWF. Locating the booster station in this area would negate some benefit associated with the adjustment to the western boundary of the Morecambe OWF already proposed by the Project.

5.5 Emergency scenarios

As with the previous simulation sessions, emergency scenarios were considered as follows:

- Manoeuvring to facilitate a casualty transfer by helicopter, during which the master has discretion to manoeuvre to provide sufficient sea room for the transfer before the helicopter arrives. It was noted that the launch and transit time for the helicopter would be longer than a vessel would be navigating between the Projects.
- Manoeuvring due to a fire onboard, requiring the master to adjust the aspect of the vessel to the wind to assist with firefighting and to keep smoke away from the accommodation areas.

It was shown that it was possible to manoeuvre the BMC such that suitable positions were achieved, where the BMC was nearly stopped in the water in 50 knot winds and Hs 4 m seas.

5.6 Consideration of night time situation

HR Wallingford produced a night time simulation indicating the likely effect of the prescribed aids to navigation and aircraft warning lights associated with the OWFs (see Figure 4.1). This was examined with a simulated night time view showing likely traffic expected in the Irish Sea with normal navigation lights (Run 12) as follows:

- 24 m yacht;
- Trawler;
- Products tanker;
- Ferry.

The vessels were located in front of the OWFs and observations made from the relevant ferry's bridge at 2 to 5 NM distance.

It was clear that the proposed aids to navigation and other lights associated with the OWFs did not interfere with the normal ability to safely determine the nature and aspect of other traffic at night.

5.7 Summary

The navigation simulations demonstrated that the IoMSPC ferries can safely navigate with the OWFs in place using standard operational procedures. In particular, the amendments made to the Project boundaries have greatly improved sea room with ferries having multiple actions available to avoid collisions in compliance with the COLREGs.

The work also considered the proposed extents of the IoM OWF. This found that there was insufficient space between the IoM OWF and the Morgan and Walney OWFs to provide adequate sea room to allow the required CPAs to be maintained in the event of a traffic meeting scenario.

6 Seatruck navigation simulation session

This report provides the conclusions based on the navigation simulation session that was held with Seatruck over a 2 day period from Thursday 22 to Friday 23 Jun 2023 (see Appendix A, Table A.3 and Appendix B.3).

The main conclusion from the simulation session was that for the Seatruck vessels and routes, the proposed changes to the boundaries of the Morgan, Mona and Morecambe OWFs significantly improve sea room compared to the previous boundaries. Consequently, the changes were found alleviate the navigation issues previously identify during simulations and expressed by the stakeholder ferry operators.

This is because the changes substantially increase the navigational areas available to transiting vessels between the Projects enabling Seatruck:

- Safe continuation of routine and non-routine (e.g. for adverse weather) ferry passages;
- Increased sea room for avoiding other vessels;
- Increased sea room from structures.

6.1 Safe navigation with respect to other traffic and structures

It was demonstrated that the revised boundaries enable the bridge teams on the Seatruck ferries, following a route planned approximately midway between the OWFs, or the normal routes associated with the Liverpool traffic separation scheme (TSS) south of the Mona OWF, to:

- Take appropriate action as required by the Collision Regulations (COLREGS) for at least 2 compounded traffic situations in which the simulated ferry was the ‘give way’ vessel, whilst maintaining a closest point of approach (CPA) of greater than 1 nautical mile (NM) from the ‘stand on’ vessel(s) and other static hazards (OWFs, platforms, etc);
- Based on normally expected traffic patterns, it was agreed that a suitably qualified and experienced Officer of the Watch (OOW) will be able to deal with most situations without requiring direct support from the Master.

It was noted that the geometry of the Mona OWF in relationship to the Liverpool TSS, is likely to result in an increase in the number of situations where west bound traffic is required to give way to vessels joining the west end of the TSS from the north. Invariably this will require fast transiting vessels, such as the Seatruck ferry, to reduce speed, so increasing their transit time.

6.2 Safe navigation in adverse meteorological conditions

Seatruck routes and vessels are not adversely affected by the geometry of the OWFs in normal prevailing adverse weather patterns.

6.3 Consideration of proposed Morgan/Morecambe transmission booster station

The search areas, within which the Morgan/Morecambe transmission booster station will be located, were included as restricted navigational areas during the simulations. The areas had no effect on any of the scenarios.

It was noted that the most north westerly search area protrudes beyond the westerly extremity of the Morecambe OWF. Locating the booster station in this area would negate some benefit associated with the adjustment to the western boundary of the Morecambe OWF already proposed by the Projects.

6.4 Emergencies

As with the previous simulation sessions, emergency scenarios were considered as follows:

- Manoeuvring to facilitate a casualty transfer by helicopter, during which the master has discretion to manoeuvre to provide sufficient sea room for the transfer before the helicopter arrives. It was noted that the launch and transit time for the helicopter would be longer than a vessel would be navigating between the Projects.
- Manoeuvring due to a fire onboard, requiring the master to adjust the aspect of the vessel to the wind to assist with firefighting and to keep smoke away from the accommodation areas.

It was noted that the increased space due to the boundary changes increases the available sea room.

The Seatruck Masters advised that the most constraining emergency is a chemical fire which requires the vessel to sail directly into the wind to minimise the effect of polluting gases affecting the accommodation area. Consequently, this situation was simulated.

The simulation runs showed that the Seatruck ferry would be able to steam at 1.5 knots into the wind, in a south westerly sea state of 3m significant wave height (Hs). The experienced masters attending the session acknowledged that, given the possible effects of cavitation on the propellors and rudder, that could not be fully considered in the simulation, a speed over the ground closer to 3 or even 4 knots maybe required.

Based on this assessment it was concluded that there may be particular emergencies, such as a chemical fire that, because of the proximity of the OWFs when the incident takes place, the master is unable to take optimal action. In this case the master will need to take other mitigating measures to minimise the effect of the incident on the passengers, crew and other vessels.

6.5 Consideration of night time situation

HR Wallingford produced a night time simulation indicating the likely effect of the prescribed aids to navigation and aircraft warning lights associated with the OWFs. This was examined with a simulated night time view showing likely traffic expected in the Irish Sea with normal navigation lights as follows:

- 24 m yacht;
- Trawler;
- Products tanker;
- Ferry.

The vessels were located in front of the OWFs and observations made from the relevant ferry's bridge at 2 to 5 NM distance.

It was clear that the proposed aids to navigation and other lights associated with the OWFs did not interfere with the normal ability to safely determine the nature and aspect of other traffic at night.

Furthermore, 2 runs were conducted in night time conditions.

The conducting masters were able to determine the aspect and actions of all vessels operating in the vicinity of the OWF based on the vessel lights an movement. The proposed lighting of the OWF did not interfere with maintaining situational awareness.

6.6 Summary

The navigation simulations demonstrated that the Seatruck ferries can safely navigate with the OWFs in place using standard operational procedures. In particular, Seatruck noted that the alterations of the OWF boundaries, particularly between Morgan and Mona, resulted in a significant improvement to the efficiency and safety of operations compared to the original boundaries.

7 References

1. NASH Maritime, “Ferry Companies Simulation Scope_R04-00”, AC21-NASH-0306-002,2023.
2. HR Wallingford, ‘Morgan and Mona Offshore Wind Farms Development – Navigation Simulation Study – All sessions’, Report no. DJR6687-RT003-R05-00, 14 Mar 2023.

Appendices

A Simulation run summaries

Table A.1: Simulation run summary – Stena Line

Run ID	Route	Vessel	Wind conditions	Wind conditions	Traffic	Description	1 Ship control	2 Clearance - Fixed	3 Clearance - Ships	4 Under keel clearance	5 Respond to emergency	6 Avoid cargo shift	7 Avoid dangerous seas	8 Maintain passenger comfort	9 Impact on schedule
01	Passage between Morgan & Walney	Seatruck Power (Stena Scotia)	SW 20 knots	SW 2 m 6 s	All target vessels to test visuals	Familiarisation run to test ship characteristics and demonstrate simulator controls to participants.	S	S	S	S	NA	S	S	S	S
02	Passage between Morgan & Walney	Seatruck Power (Stena Scotia)	SW 20 knots	SW 2 m 6 s	2 x RoRo	Consider the effect of the modified boundaries on the ability of transiting ferries to respond to basic traffic scenarios.	S	S	S	S	NA	S	S	S	S
03	Passage between Morgan & Walney	Seatruck Power (Stena Scotia)	SW 20 knots	SW 2 m 6 s	3 x wind cat	Consider ability to detect and make safe adjustments in response to fast moving craft emerging from the OWF.	S	S	M	S	NA	S	S	S	S

Run ID	Route	Vessel	Wind conditions	Wind conditions	Traffic	Description	1 Ship control	2 Clearance - Fixed	3 Clearance - Ships	4 Under keel clearance	5 Respond to emergency	6 Avoid cargo shift	7 Avoid dangerous seas	8 Maintain passenger comfort	9 Impact on schedule
04	Passage between Morgan & Walney	Seatruck Power (Stena Scotia)	SW 20 knots	SW 2 m 6 s	Products tanker AHT wind cat trawler yacht	Consider ability to detect and make safe adjustments in response to developing situations at the NW end of the Morgan-Walney corridor. Traffic set to worst credible level in accordance with scoping document.	S	S	S	S	NA	S	S	S	S
05	Passage between Morgan & Walney	Seatruck Power (Stena Scotia)	SW 20 to 30 knots	SW 2-4 m 6-10 s	NA	Determine limiting sea state for transiting Morgan-Walney corridor.	S	S	S	S	NA	S	S	S	S
06	Passage between Morgan & Mona	Seatruck Power	SW 30 to 40 knots	SW 3 m 7 s	RoRo, products tanker 2 x trawler	Determine effect of improved sea room between Morgan and Mona OWFs, when considering basic traffic situations.	S	S	S	S	NA	S	S	S	S

Run ID	Route	Vessel	Wind conditions	Wind conditions	Traffic	Description	1 Ship control	2 Clearance - Fixed	3 Clearance - Ships	4 Under keel clearance	5 Respond to emergency	6 Avoid cargo shift	7 Avoid dangerous seas	8 Maintain passenger comfort	9 Impact on schedule
07	Passage between Morecambe & Mona	Stena Estrid	SW 30 to 40 knots	SW 3 m 7 s	NA	Determine the limiting sea state for transiting the Mona Morecombe corridor.	S	S	S	S	NA	S	S	S	S
08	Passage between Morecambe & Mona	Stena Estrid	SW 30 to 40 knots	SW 4.0 m 7 s	NA	Determine limiting sea state for transiting the Mona-Morecombe corridor.	S	S	S	S	NA	F	F	F	F
09	Passage between Morecambe & Mona	Stena Estrid	SW 30 to 40 knots	SW 3.5 m 7 s	NA	Determine limiting sea state for transiting the Mona-Morecombe corridor.	S	S	S	S	NA	M	M	F	M
10	Passage between Morecambe & Mona into Morgan & Mona	Stena Estrid	SW 30 to 40 knots	SW 3 m 7 s	2 x products tanker 1 wind cat	Compare previous failure situations in Morgan-Mona corridor. Scenario requires 3 large vessels to transit gap simultaneously on different navigational plans.	S	S	S	S	NA	S	S	S	S

Run ID	Route	Vessel	Wind conditions	Wind conditions	Traffic	Description	1 Ship control	2 Clearance - Fixed	3 Clearance - Ships	4 Under keel clearance	5 Respond to emergency	6 Avoid cargo shift	7 Avoid dangerous seas	8 Maintain passenger comfort	9 Impact on schedule
11	Passage between Morgan & Mona	Stena Estrid	NW 15 knots	NW 1.6 m 5.6 s	3 x products tanker (convoy) 2 x products tanker (convoy)	Compare previous failure situations in Morgan-Mona corridor. Scenario based on piloted convoys operating between Liverpool and Douglas as part of Port of Liverpool adverse weather plan.	S	S	S	S	NA	S	S	S	S
12	South of Mona	Stena Estrid	SW 50 knots	SW 3.0 m 10.0 s	1 x products tanker 1 x RoRo 1 x products tanker	Determine available safe navigable area between Liverpool TSS and Mona OWF with moderate traffic situation.	S	S	S	S	NA	S	S	S	S
13	South of Mona	Stena Estrid	SW 15 knots	SW 1.5 m 5.5 s	3 x products tanker 1 x RoRo 1 x tanker	Determine available safe navigable area between Liverpool TSS and Mona OWF with increased traffic situation from Run 12.	S	S	S	S	NA	S	S	S	S

Table A.2: Simulation run summary – IoMSPC

Run ID	Route	Vessel	Wind conditions (Dir, speed)	Wave conditions (Dir, Hs, Tp)	Traffic	Description	1 Ship control	2 Clearance - Fixed	3 Clearance - Ships	4 Under keel clearance	5 Respond to emergency	6 Avoid cargo shift	7 Avoid dangerous seas	8 Maintain passenger comfort	9 Impact on schedule
01	Heysham to Douglas	Ben-My-Chree	SW (225) 27.5 knots ±2.5 knots	SW (225) 2.5m 6.5s	1 x tanker 1 x PSV	Consider increased sea room in Morgan – Walney corridor with basic shipping situation.	S	S	S	N/A	N/A	S	S	S	S
02	Heysham to Douglas	Ben-My-Chree	SW (225) 27.5 knots ±2.5 knots	SW (225) 2.5m 6.5s	3 x OWF vessels 2 x cats 2 x yachts 2 x tankers 8 x trawlers	Consider increased sea room in Morgan Walney corridor with extreme shipping situation.	S	S	S	N/A	N/A	S	S	S	S
03	Heysham to Douglas	Ben-My-Chree	SW (225) 50 knots	SW (225) 4m 10s	2 x ferries	Consider increased sea room in Morgan – Mona corridor with 2 ferries meeting heading west. Interrupted due to ship model issue with agreement of all attendees.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Run ID	Route	Vessel	Wind conditions (Dir, speed)	Wave conditions (Dir, Hs, Tp)	Traffic	Description	1 Ship control	2 Clearance - Fixed	3 Clearance - Ships	4 Under keel clearance	5 Respond to emergency	6 Avoid cargo shift	7 Avoid dangerous seas	8 Maintain passenger comfort	9 Impact on schedule
04	Douglas to Heysham	Ben-My-Chree	SW (225) 50 knots	SW (225) 4m 10s	2 x ferries	Consider increased sea room in Morgan - Mona corridor with 2 ferries meeting heading east (slight impact on vessel schedule due to action taken).	S	S	S	N/A	N/A	S	S	S	S
05	Heysham to Douglas	Ben-My-Chree	SW (225) 50 knots	SW (225) 4m 10s	2 x ferries	Repeat of Run 03 Consider increased sea room in Morgan - Mona corridor with 2 ferries meeting heading west.	S	S	S	N/A	N/A	S	S	S	S
06	Liverpool to Douglas	Manannan	SW (225) 15 knots	SW (225) 2.5m 5.5s	2 x ferries 1 x PSV 1 x tug	Consider increased sea room in Morgan – Mona – Morecambe corridors in weekly conditions with traffic.	S	S	S	N/A	N/A	S	S	S	S

Run ID	Route	Vessel	Wind conditions (Dir, speed)	Wave conditions (Dir, Hs, Tp)	Traffic	Description	1 Ship control	2 Clearance - Fixed	3 Clearance - Ships	4 Under keel clearance	5 Respond to emergency	6 Avoid cargo shift	7 Avoid dangerous seas	8 Maintain passenger comfort	9 Impact on schedule
07	Douglas to Liverpool	Manannan	SW (225) 15 knots	SW (225) 2.5m 5.5s	2 x ferries 1 x PSV 1 x tug	Consider increased sea room in Morgan – Mona corridor in weekly conditions with traffic and visibility down to 0.5 NM.	S	S	S	N/A	N/A	S	S	S	S
08	Liverpool to Douglas	Manannan	SW (225) 15 knots	SW (225) 2.5m 5.5s	N/A	Emergency so vessel required to return to Liverpool at narrowest point in the Mona – Morecambe corridor.	S	S	S	N/A	S	S	S	S	S
09	Liverpool to Douglas south of Mona	Manannan	SW (225) 20 knots	SW (225) 2m 6.0s	3 x tankers 1 x ferry	Consider increased sea room south of Mona with traffic and Liverpool TSS.	S	S	S	N/A	N/A	S	S	S	S
10	Heysham to Douglas	Ben-My-Chree	SW (225) 27.5 knots ±2.5 knots	SW (225) 2.5m 6.5s	4 x 24m trawlers	Consider increased sea room meeting fishing vessels at W exit of the Walney – Morgan corridor.	S	S	S	N/A	N/A	S	S	S	S

Run ID	Route	Vessel	Wind conditions (Dir, speed)	Wave conditions (Dir, Hs, Tp)	Traffic	Description	1 Ship control	2 Clearance - Fixed	3 Clearance - Ships	4 Under keel clearance	5 Respond to emergency	6 Avoid cargo shift	7 Avoid dangerous seas	8 Maintain passenger comfort	9 Impact on schedule
11	IOM OWF	Ben-My-Chree	SW (225) 27 knots ±2.5 knots	SW (225) 2.5m 6.0s	3 x trawlers 1 x tanker	Consider gap between Morgan, Walney and proposed IOM OWFs with traffic.	S	F	F	N/A	N/A	S	S	S	S
12	Night view	Ben-My-Chree	-	-	1 x OWF vessel 1 x yacht 1 x tanker 1 x trawler	Mona OWF viewed at night with a range of traffic both in front of and within the OWF.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13	Emergency in Morgan-Mona corridor	Ben-My-Chree	SW (225) 35 knots ±5 knots	SW (225) 3.0m 7.0s	NA	Consider increased sea room with emergency in Morgan – Mona corridor.	S	S	S	N/A	S	N/A	S	S	N/A

Table A.3: Simulation run summary - Seatruck

Run ID	Route	Vessel	Wind conditions	Wind conditions	Traffic	Description	1 Ship control	2 Clearance - Fixed	3 Clearance - Ships	4 Under keel clearance	5 Respond to emergency	6 Avoid cargo shift	7 Avoid dangerous seas	8 Maintain passenger comfort	9 Impact on schedule
01	Morgan and Mona corridor (HEY-WAR)	Seatruck Power	SW 15 knots	SW 1.5 m 5.5 s	All target vessels to test visuals	Familiarisation.	S	S	S	S	NA	S	S	S	S
02	Passage between Morgan & Walney	Seatruck Power	SW 30 knots	SW 2 m 6 s	2 x RoRo 1 x PSV	Consider effect of modified boundaries on ability of transiting ferries to respond to basic traffic scenarios. Comparison with previous Seatruck Run 12.	S	S	S	S	NA	S	S	S	S
03	Morgan and Mona corridor (DUB-HEY)	Seatruck Power	SW 30 knots	SW 3 m 7 s	1 x RoRo 1 x PSV 1 x fishing vessel 1 x products tanker	Consider ability to detect and make safe adjustments in response in a busy shipping situation including fast moving craft emerging from OWFs.	S	S	S	S	NA	S	S	S	S

Run ID	Route	Vessel	Wind conditions	Wind conditions	Traffic	Description	1 Ship control	2 Clearance - Fixed	3 Clearance - Ships	4 Under keel clearance	5 Respond to emergency	6 Avoid cargo shift	7 Avoid dangerous seas	8 Maintain passenger comfort	9 Impact on schedule
04	Morgan and Mona corridor (DUB-HEY)	Seatruck Power	SW 30 to 40 knots	SW 3 m 7 s	2 x convoys (3 x products tankers)	Consider ability to detect and make safe adjustments in response to developing situations. Traffic set to worst credible level in accordance with scoping document.	S	S	S	S	NA	S	S	S	S
05	Morgan and Mona corridor (DUB-HEY)	Seatruck Power	SW 30 knots	SW 3 m 7 s	NA	Assess minimum speed vessel can maintain in event of an emergency which requires the vessel to heave-to or head into wind.	S	S	S	S	NA	S	S	NA	NA
06	South of Mona (LIV-DUB)	Seatruck Power	WNW 40 knots	WNW 2.9 m 8.3 s	1 x RoRo 2 x products tanker	Consider effect of revised boundaries at Mona and how additional sea room affects traffic heading to Dublin via the TSS.	S	S	S	S	NA	S	S	S	M

Run ID	Route	Vessel	Wind conditions	Wind conditions	Traffic	Description	1 Ship control	2 Clearance - Fixed	3 Clearance - Ships	4 Under keel clearance	5 Respond to emergency	6 Avoid cargo shift	7 Avoid dangerous seas	8 Maintain passenger comfort	9 Impact on schedule
07	Morgan and Mona corridor (DUB-HEY)	2 x Seatruck (Power & Progress)	NW 30 to 40 knots	NW 3 m 7 s	2 x convoy (3 x products tankers) 2 x yachts 2 x wind cat	Consider high traffic levels in Morgan-Mona corridor and the ability to identify transiting vessel in the vicinity of the OWF at night.	S	S	S	S	NA	S	S	S	S
08	Morgan and Mona corridor (DUB-HEY)	2 x Seatruck (Power & Progress)	NW 30 to 40 knots	NW 3 m 7 s	1 x products tanker northbound 1 x products tanker southbound	Consider moderate traffic levels in Morgan-Mona corridor and ability to identify transiting vessel in vicinity of OWFs at night. Revisit situation from Run 07 with north bound convoy complying with COLREGS.	S	S	S	S	NA	S	S	S	S

B Simulation run synopses and plots

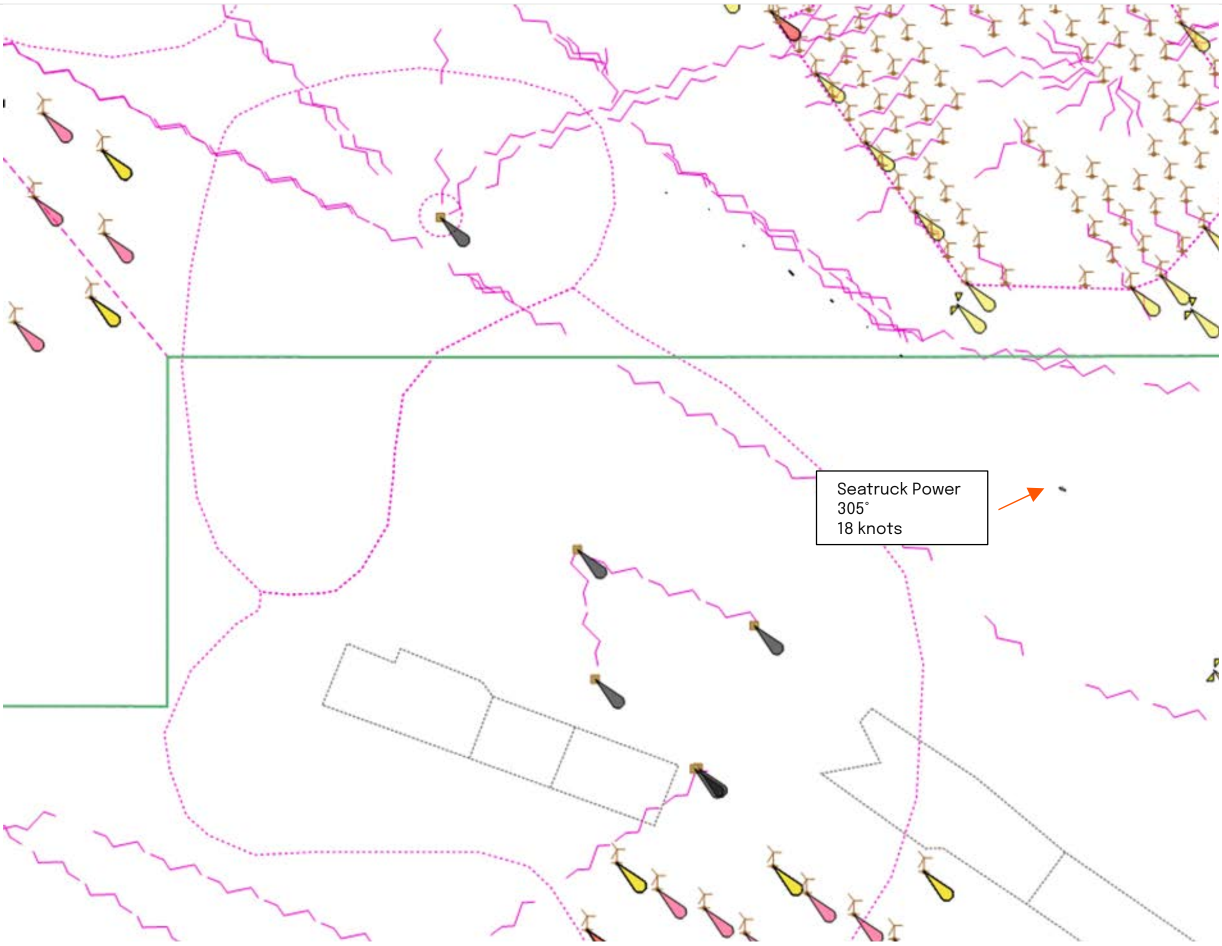
B.1 Stena Line

Run: 01

Location: Passage Morgan Walney corridor

Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Seatruck Power (Stena Scotia)	295°	SF	SW (225°)	20 knots	2m	6s

Scenario
Familiarisation run conducted to adjust to simulator and check visual models of vessels.



Actions of Vessels

Time	Seatruck Power	Target vessel	Comments
-	-	-	-

Run commentary
Passing traffic identifiable against windfarms visually and by radar

Objective Assessment

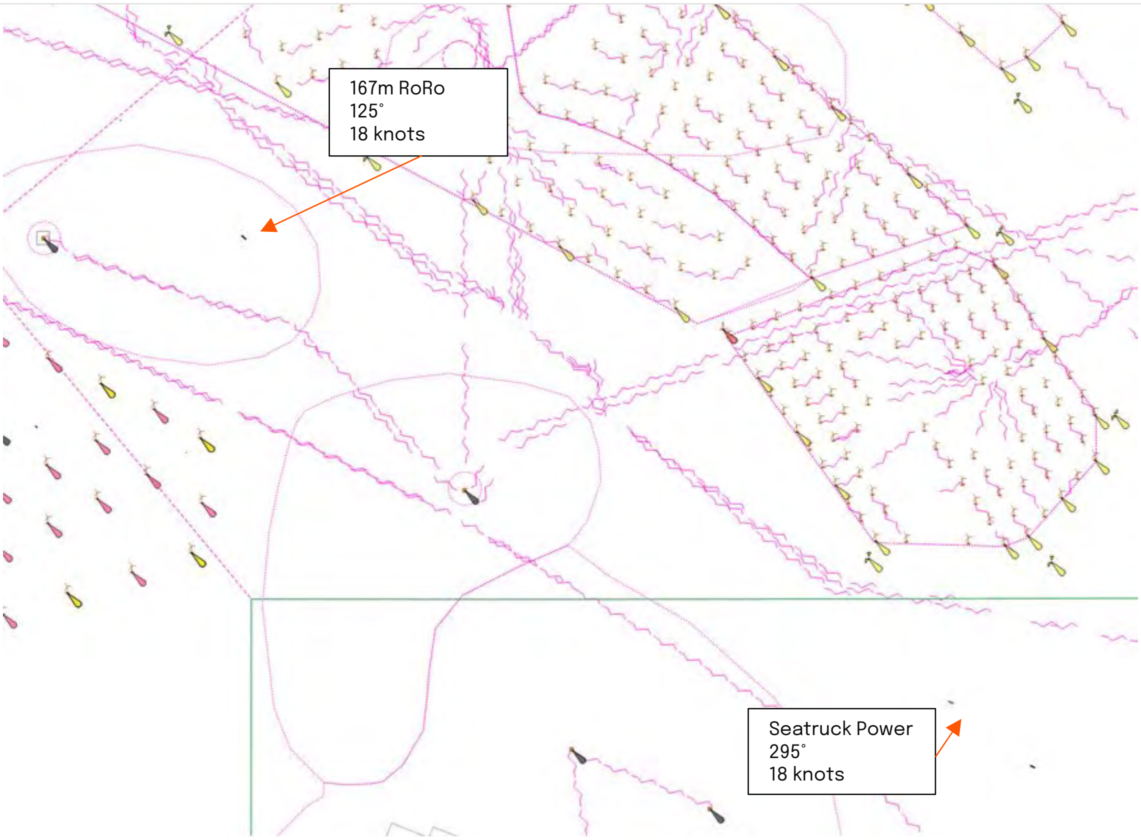
Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	S	
Impact on schedule	S	

Run: 02

Location: Passage Morgan Walney corridor

Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Seatruck Power (Stena Scotia)	295°	SF	SW (225°)	20 knots	2m	6s

Scenario
The scenario was set up to induce a head on situation requiring action by both vessels. A second vessel was included in the scenario to add complexity but not to interfere. Non interfering ferry following Seatruck power (Stena Scotia)



Actions of Vessels

Time	Seatruck Power	Target vessel	Comments
18	At 6 nm separation situation identified visually and by radar - alteration of course by 15° to starboard.	Alter course by 15° to stbd	
27	Situation past and clear vessel alters to resume navigational track	No action required	

Run commentary
Comments on traffic scenario : 1NM CPA achieved on traffic and fixed structures

Objective Assessment

Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	

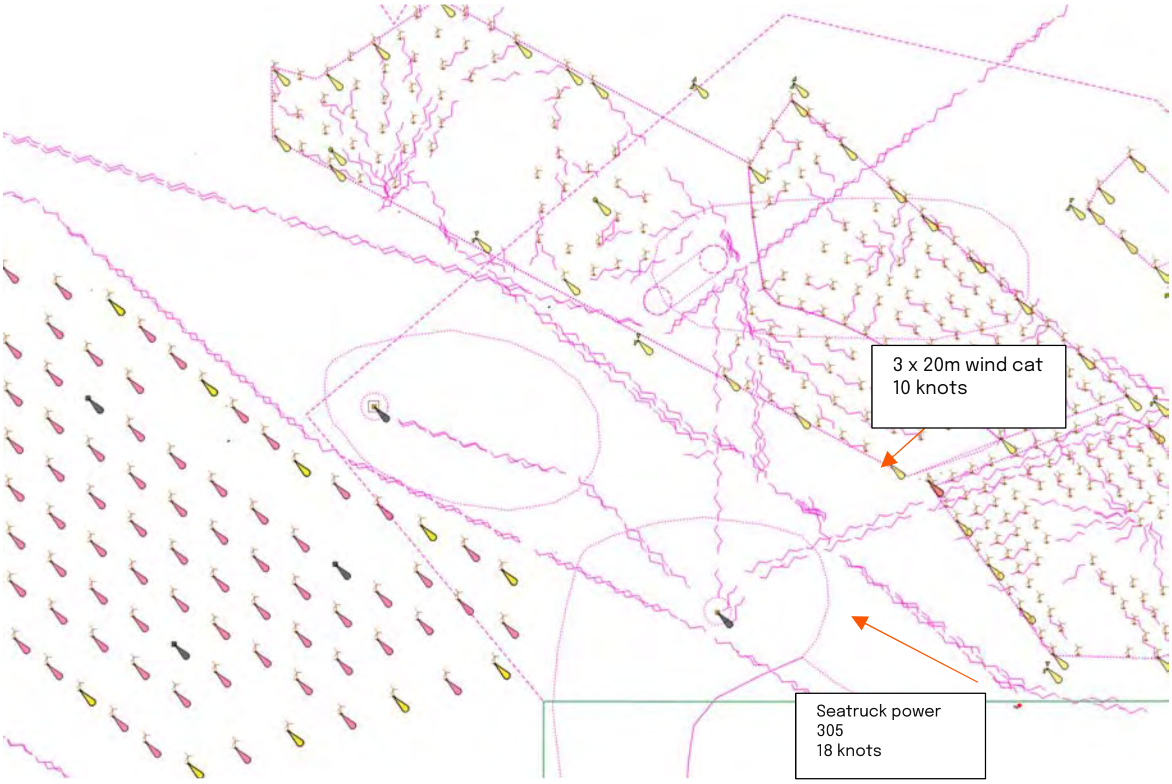
Criteria	Grading	Comment
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	S	
Impact on schedule	S	

Run: 03

Location: Passage Morgan Walney corridor

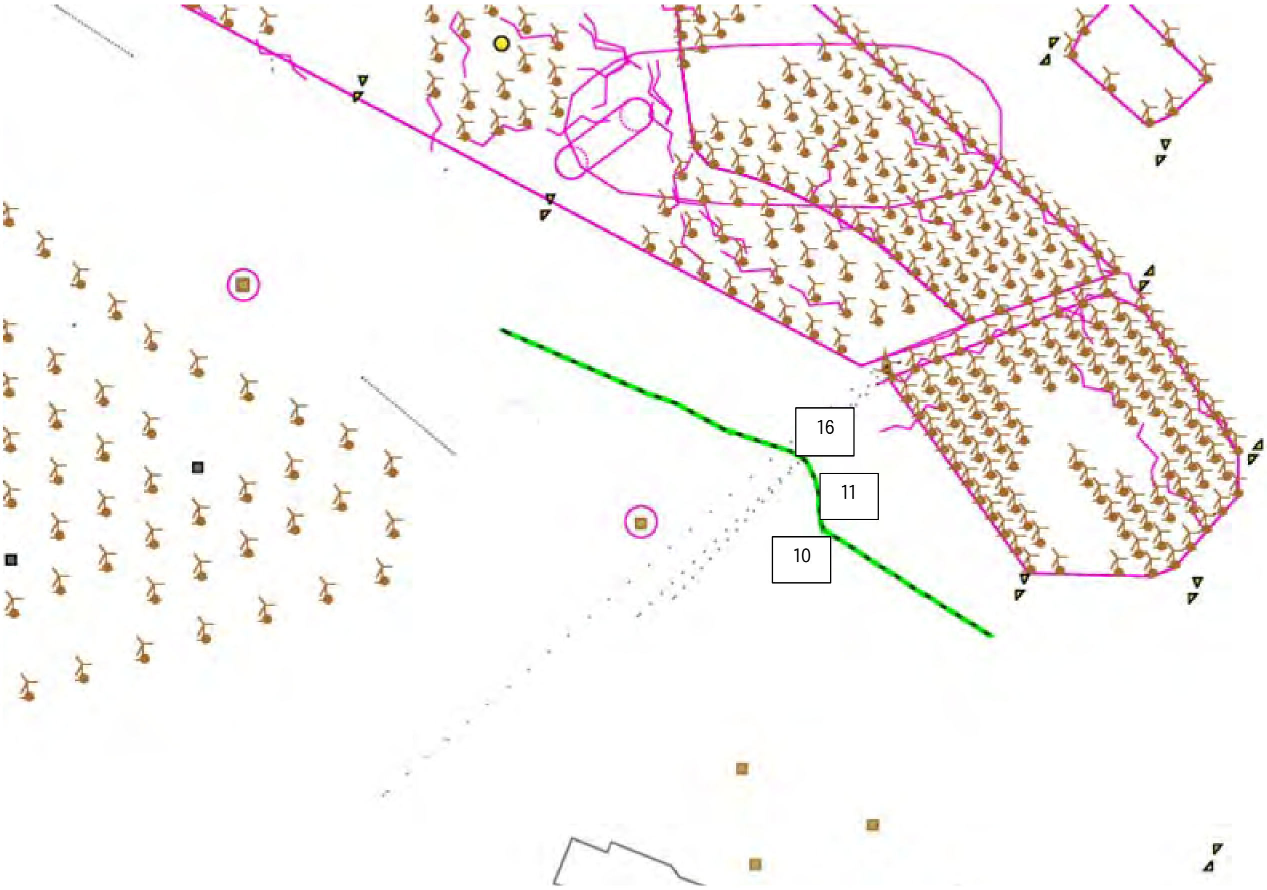
Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Seatruck Power	305˚	SF	SW (225˚)	20 knots	2.0m	6.0s

Scenario
To consider the ability of the vessel to detect and make safe adjustments in response to fast moving craft emerging from the OWF The Ferry is transiting Morgan Walney channel following passage plan. Main scenario is 3 x OWF support vessels crossing, requiring the ferry to give way. The support vessel are on diverging courses to add complexity. The OWF were initially line astern at 300m. The simulation did not run as intended with OWF 2 and 3 slowing down and creating a significantly more complex scenario. The scenario specifically addresses concerns that the OWF support vessels may emerge from the wind farms and present an unusual and difficult to assess hazard.



Actions of Vessels

Time	Seatruck Power/Stena Scotia	Target vessel	Comments
10	As the OWF observed emerging from the OWF – Ferry reduces speed to assess situation	No 1 OWF vessel maintains course and speed – OWF 2&3 slow down.	The reduction in speed by the OWF 2 and 3 is unexpected requiring re appraisal of the situation
11	Alteration of course by 60° to starboard	All maintain course and speed	Action results in support vessel 1 passing 1.5nm ahead of ferry and with a CPA of 1500 m on the ferry port bow.
14	Alteration to port to pass astern on OWF 1 and ahead of OWF 2 & 3	All maintain course and speed	Action results in passing 1400m ahead of the OWF support vessels with a CPA of 1100m on the ferry's starboard quarter.
16	Alteration of heading back towards navigational track passing between support vessels 2 and 3	All maintain course and speed	Action results in passing safely ahead of the 3rd support vessel but with a CPA of 08nm astern.



Run: 04

Location: Passage Morgan Walney corridor

Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Seatruck Power	295°	SF	SW (225°)	20 knots	2m	6s

Scenario

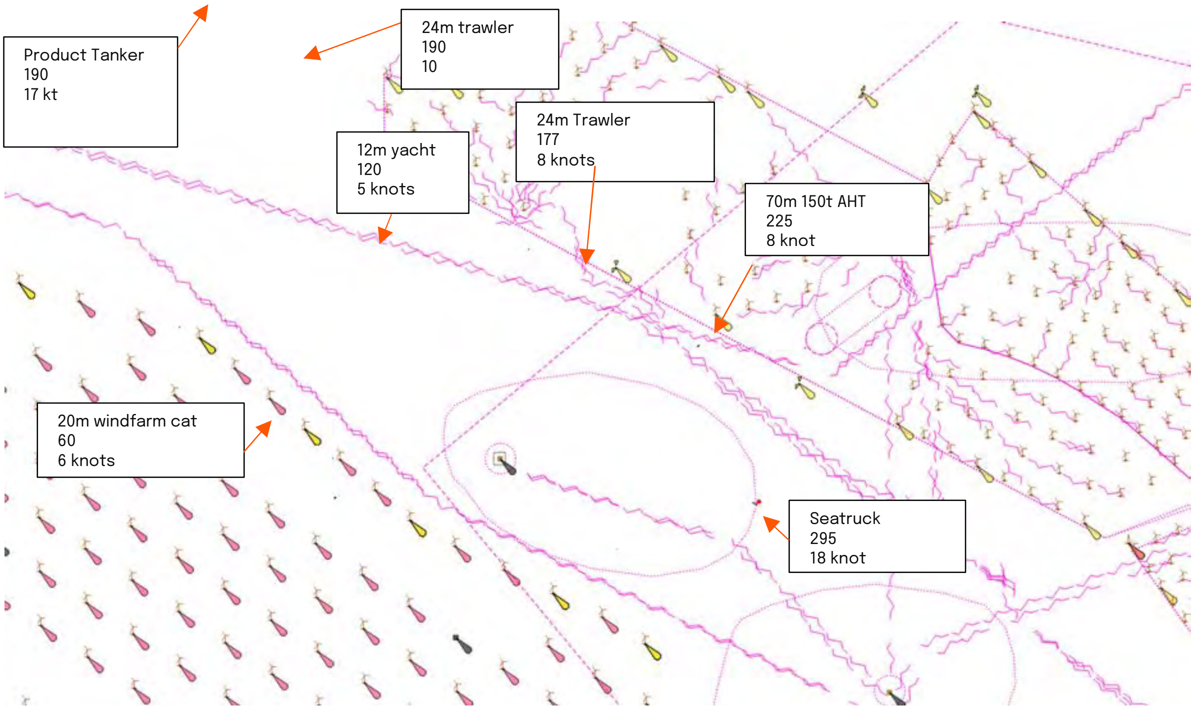
To consider the ability of the vessel to detect and make safe adjustments in response to developing situations at the north west end of the morgan Walney channel. Traffic set to reasonable worst credible level in accordance with scoping document.

The Scenario is a continuation from Run 3.

The ferry is transiting Morgan Walney corridor with complex traffic scenario including slow moving yachts, fishing vessels and faster moving OWF support craft.

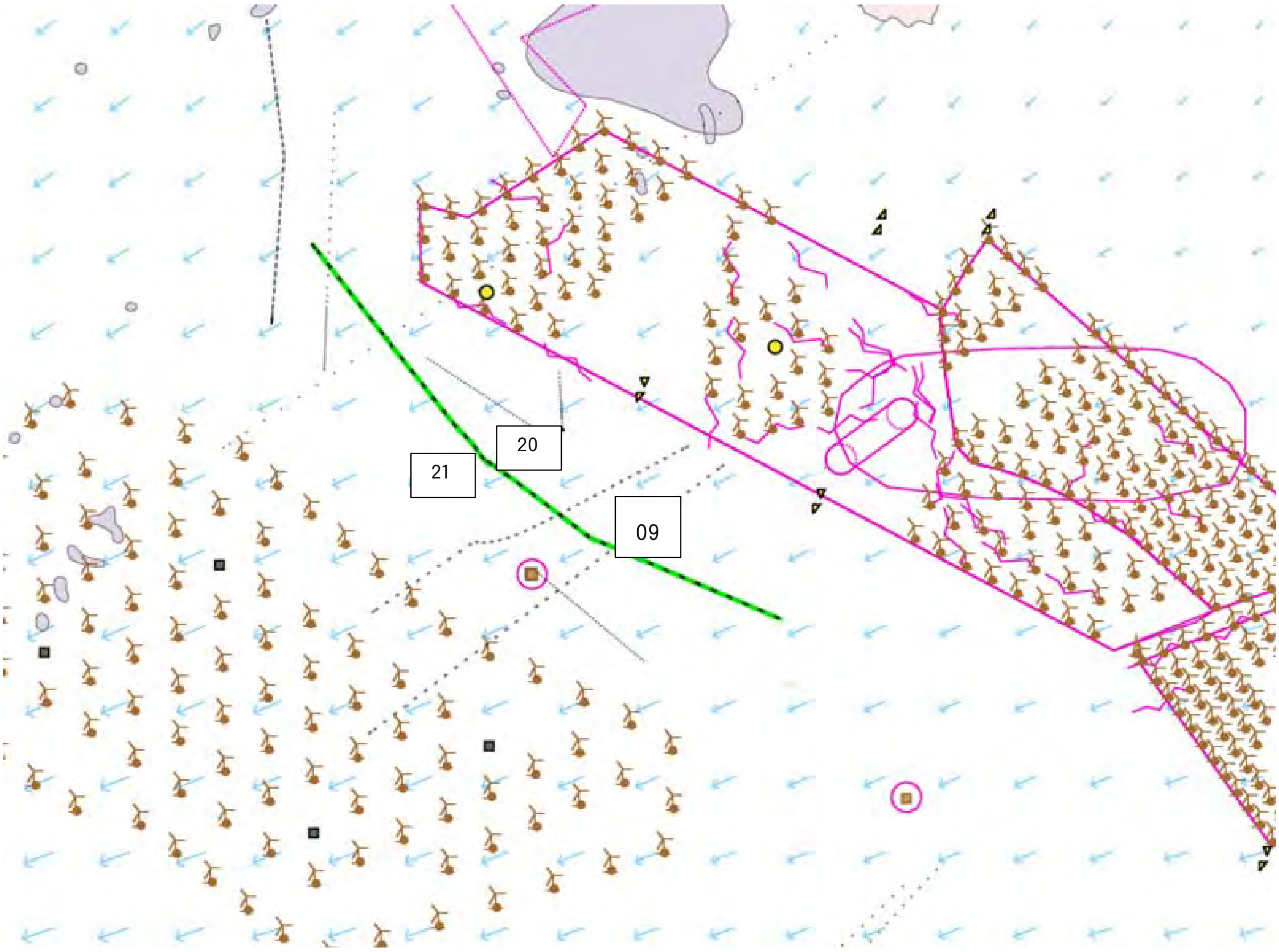
The slower moving craft are intended to test building situational awareness.

The 24m trawler and Product tanker heading south are to check the width and area of navigable water at the north west end of the corridor, when south bound traffic requires action by the transiting ferry.



Actions of Vessels

Time	Sea truck	Southbound vessel	Comments
09	Ferry passes 1500m ahead of 70m AHT	Maintain course and speed	Assessed as safe CPA by master
20	Reduction in speed from 18 knots to 10 knots to assess situation	Maintain course and speed	
21	Alteration of course by 20° to starboard (325)	Maintain course and speed	Action results in 1nm CPA on Walney OWF, slow moving trawler and >1nm on southbound product tanker.



Run commentary
Comments on traffic scenario : Traffic set to reasonable challenging level. Despite the busy traffic scenario the master of the ferry was able to maintain situational awareness and take action as required by the collision regulations. The additional space provided by amendments to the OWF boundaries enable the transiting ferry to take action maintain suitable CPA on OWF and southbound traffic.

Objective Assessment

Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	

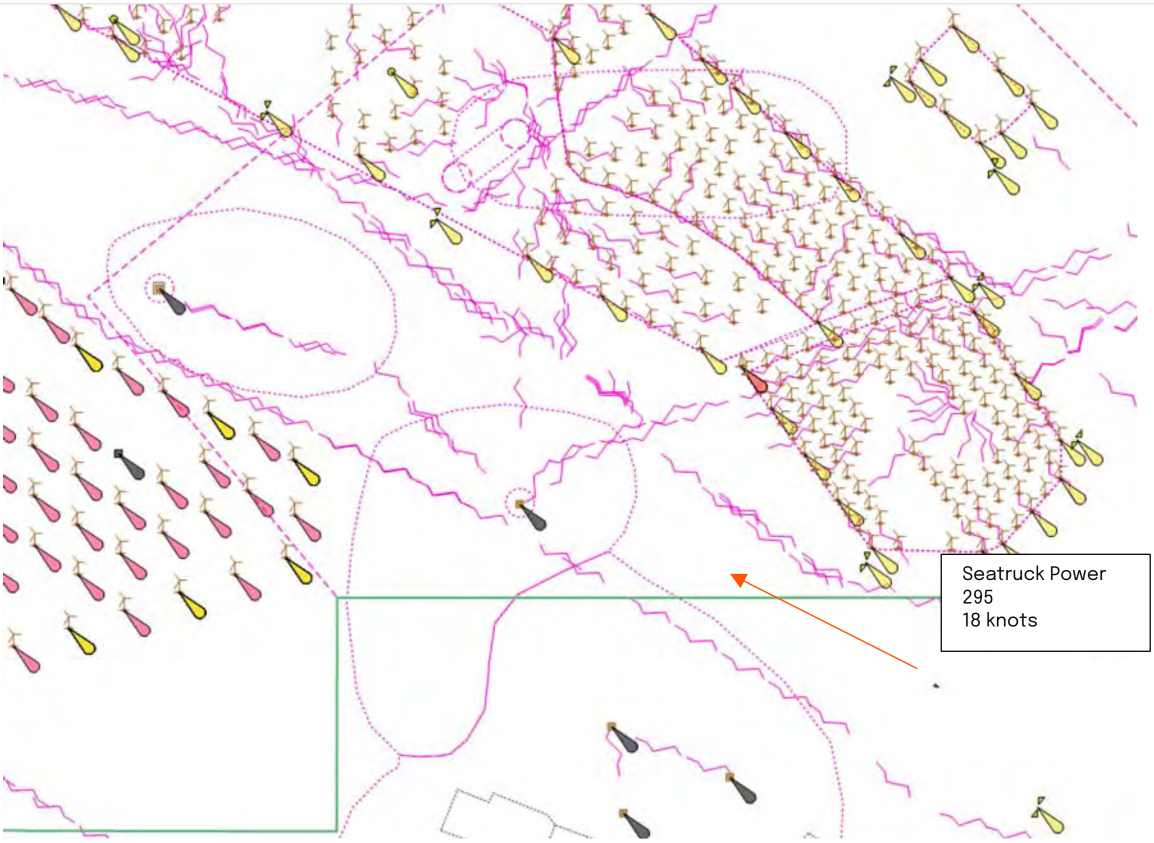
Criteria	Grading	Comment
Maintain passenger comfort	S	
Impact on schedule	S	

Run: 05

Location: Passage Morgan Walney corridor

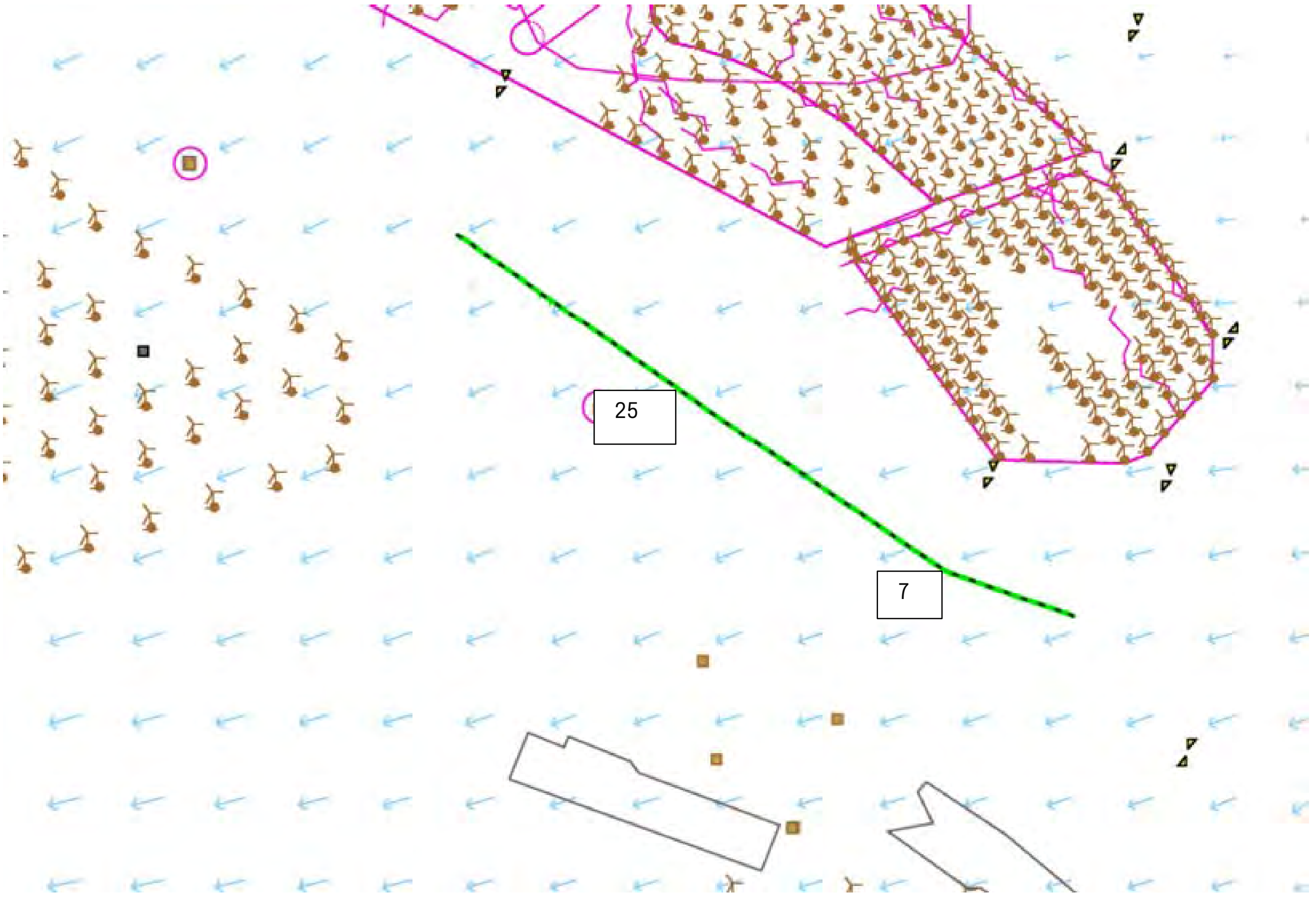
Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp	Current
Seatruck Power	295˚	SF	SW (225˚)	20-30 knots	2-4m	6-10s	Grid

Scenario
To determine the limiting sea state for transiting the Morgan Walney Corridor



Actions of Vessels

Time	Seatruck Power	Target vessel	Comments
7	Alter course by 20˚ to stbd	N/A	
25	Reduce speed from 18 knots to 16.5 knots	N/A	



Run Commentary
Comments on traffic scenario : N/A
Limiting sea state assessed as Hs 3m on beam

Objective Assessment

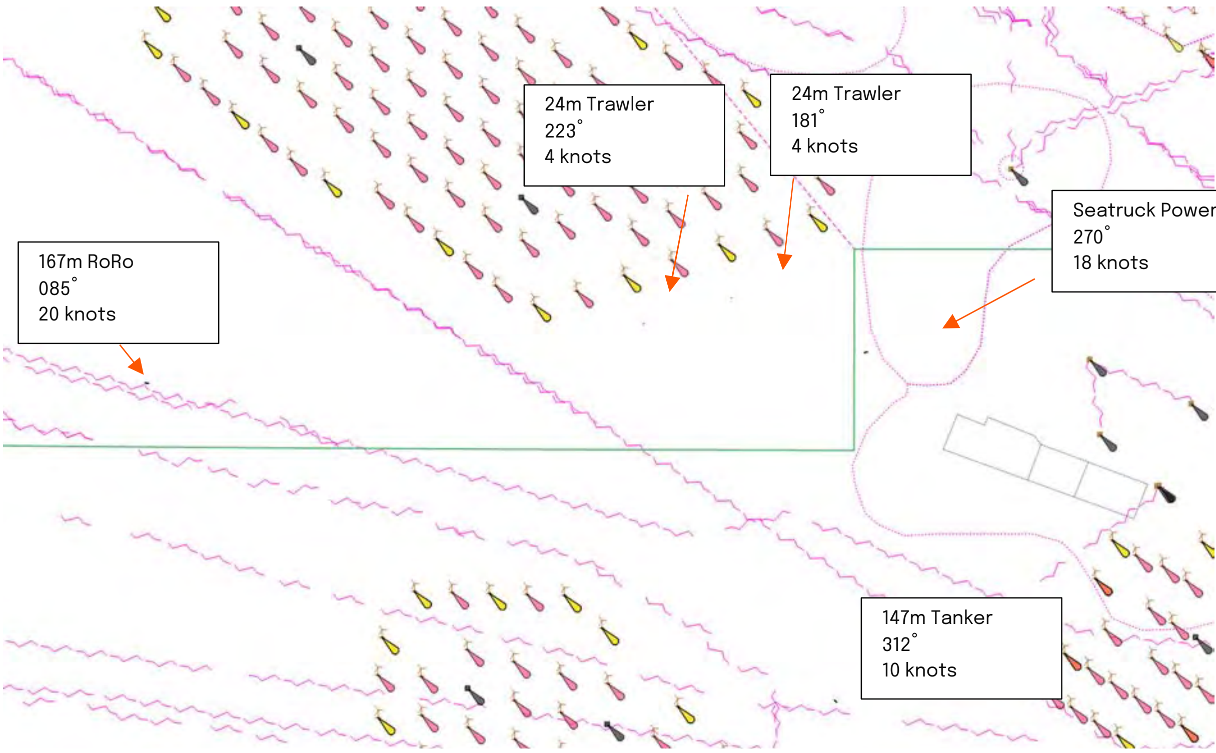
Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	S	
Impact on schedule	S	

Run: 06

Location: Passage between Morgan & Mona

Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Seatruck Power (Stena Scotia)	295°	SF	SW (225°)	30-40 knots	3m	7s

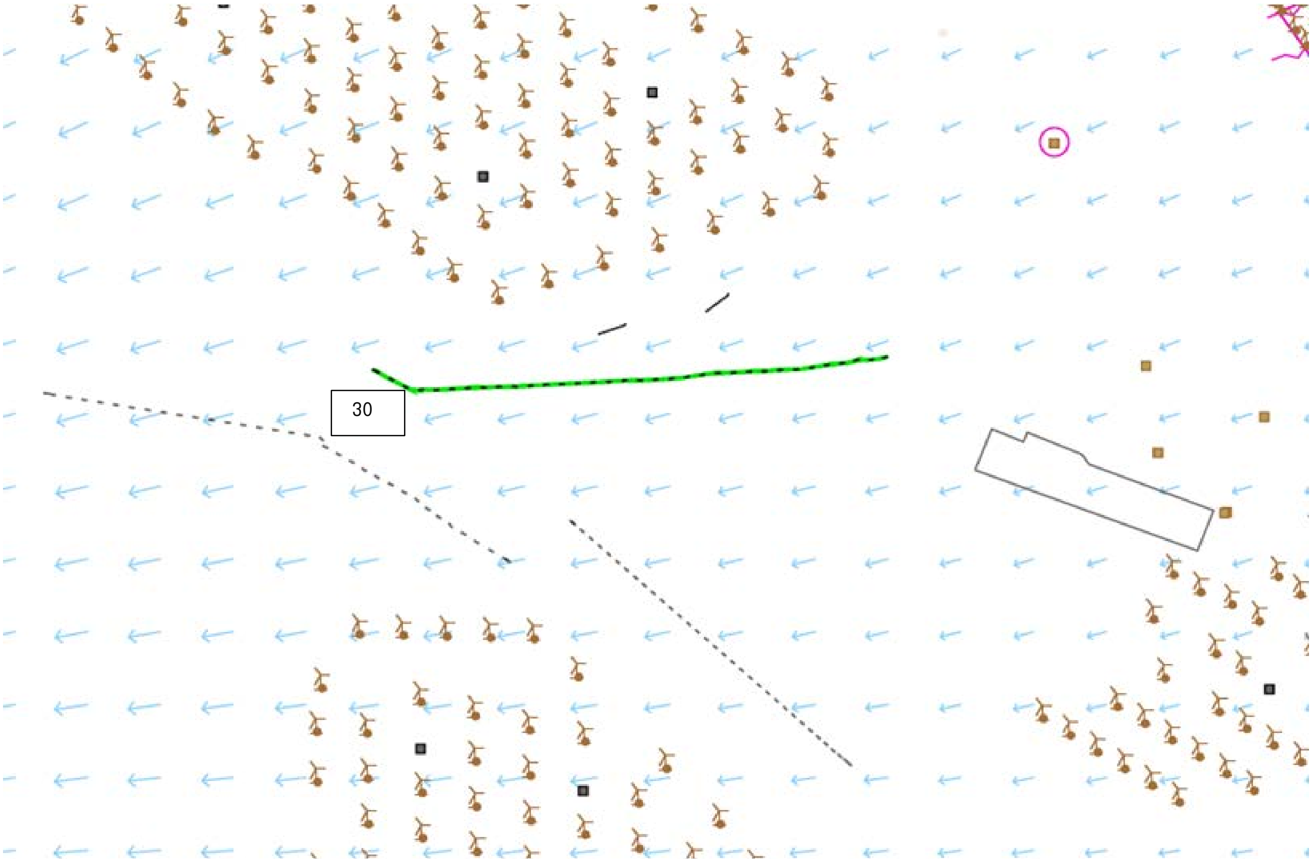
Scenario
To determine the effect the improved sea room between Morgan and Mona OWF, when considering basic traffic situations. Seatruck (Stena Scotia) attempting direct passage in limiting conditions. The traffic level was set to include a south and north bound vessel arriving at the mid point between Morgan and Mona windfarms at the same time as the transiting ferry. Additional traffic in the form of slow moving trawlers were included to increase the complexity.



Actions of Vessels

Time	Seatruck Power	Target vessel	Comments
02	Adjusts track to pass closer to Morgan OWF based on developing situation	Maintain course and speed	Action taken by Stena master avoids the scenario set up – but demonstrates clearly the effect of the increased navigable area between Morgan and Mona

Time	Seatruck Power	Target vessel	Comments
30	Alteration of course by 25° to starboard	NA	The master of the ferry alters course to resume navigational plan.



Run commentary
Comments on traffic scenario : The ferry establishes the situation and adjusts track to pass over 1nm south of Morgan OWF. By taking early action the ferry is able to keep well clear of the situation developing between the RoRo and tank developing at the mid point of the channel. The RO RO and the ferry take action and maintain CPA greater than 1nm on each other and Mona OWF. Although the scenario did not play out as envisaged the actions taken by the master of the ferry are reasonable and demonstrate the space available between Morgan and Mona OWF.

Objective Assessment

Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	

Criteria	Grading	Comment
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	S	
Impact on schedule	S	

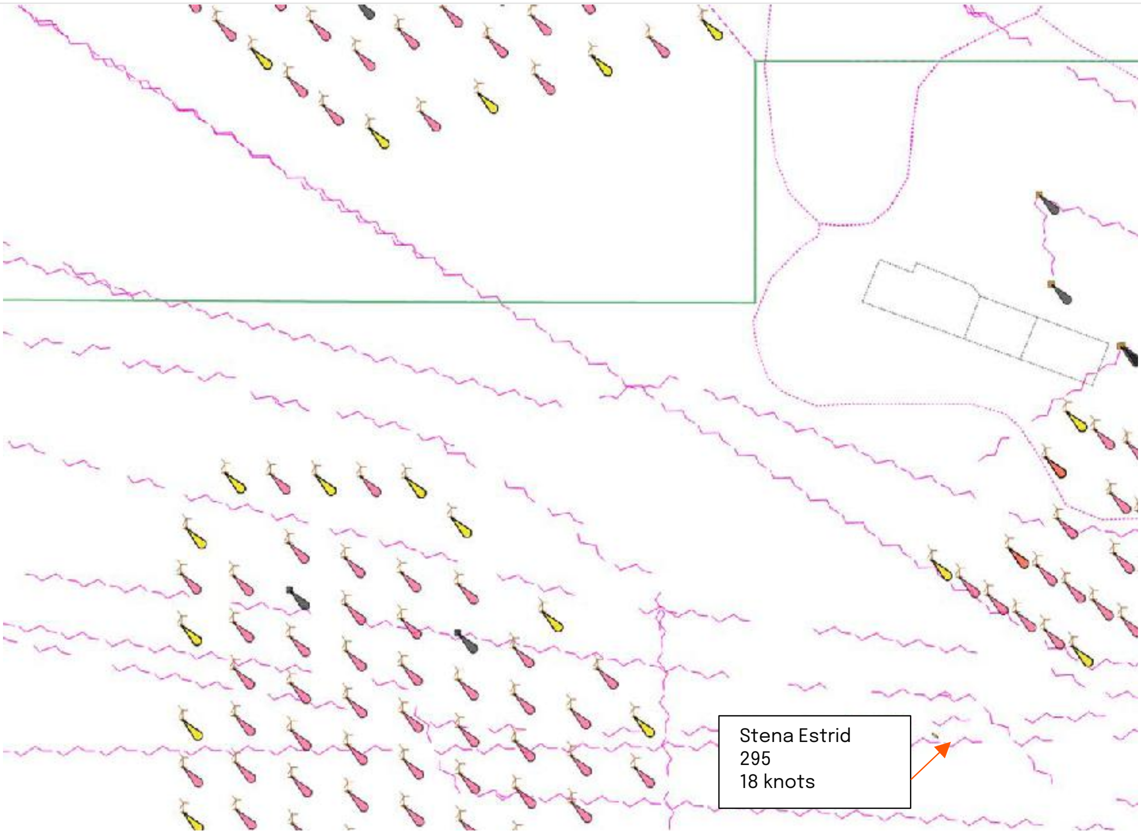
Run: 07

Location: Passage Morecambe Mona corridor

Run Aims : To determine the limiting sea state for transiting the Mona Morecambe corridor

Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Stena Estrid	295°	SF	SW (225°)	30-40 knots	3m – 4m	7s

Scenario
Stena Estrid attempting direct passage in limiting conditions Transit between Mona and Morecambe the determine limiting wave conditions due to vessel motions and control. No traffic



Actions of Vessels

Time	Stena Estrid	Target vessel	Comments
23	Alteration of heading by 30° (265)	N/A	

Run commentary
Comments on traffic scenario : N/A Comments on sea state: It is assessed that the vessel can transit with freedom of heading in South Westerly 3m sea.

Objective Assessment

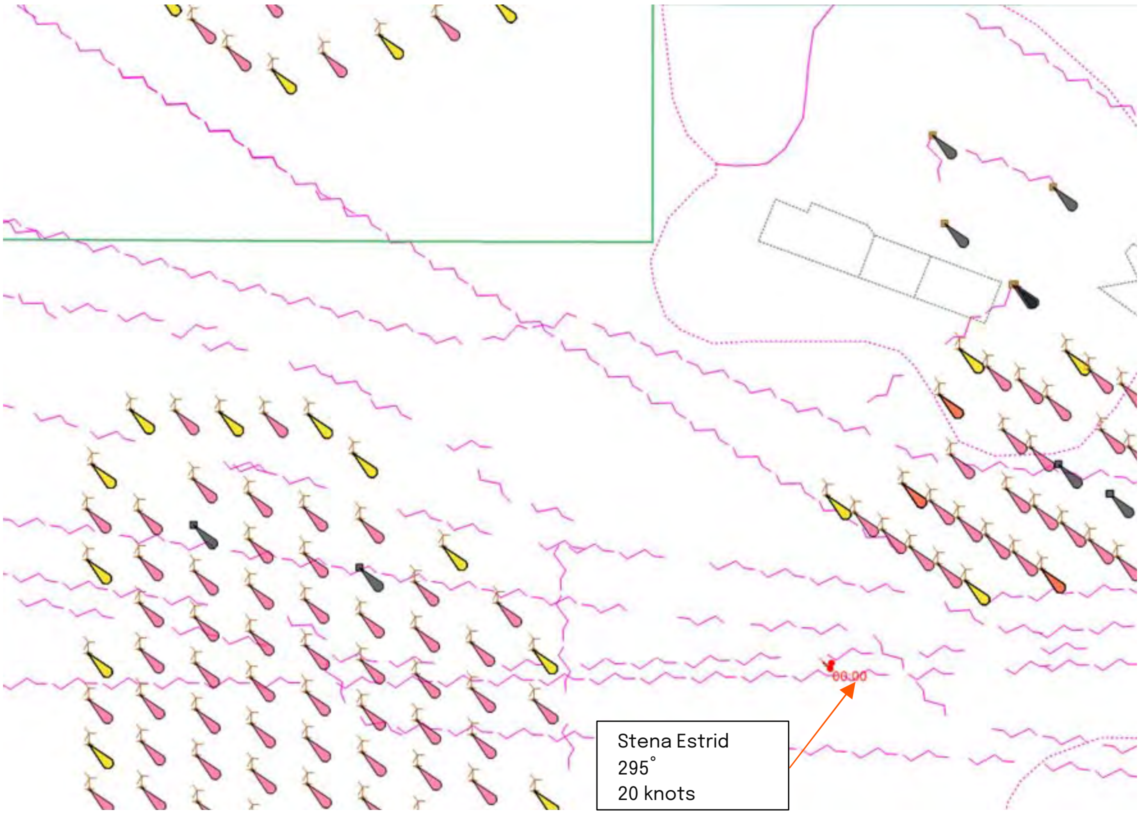
Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	S	
Impact on schedule	S	

Run: 08

Location: Passage Morecambe Mona corridor

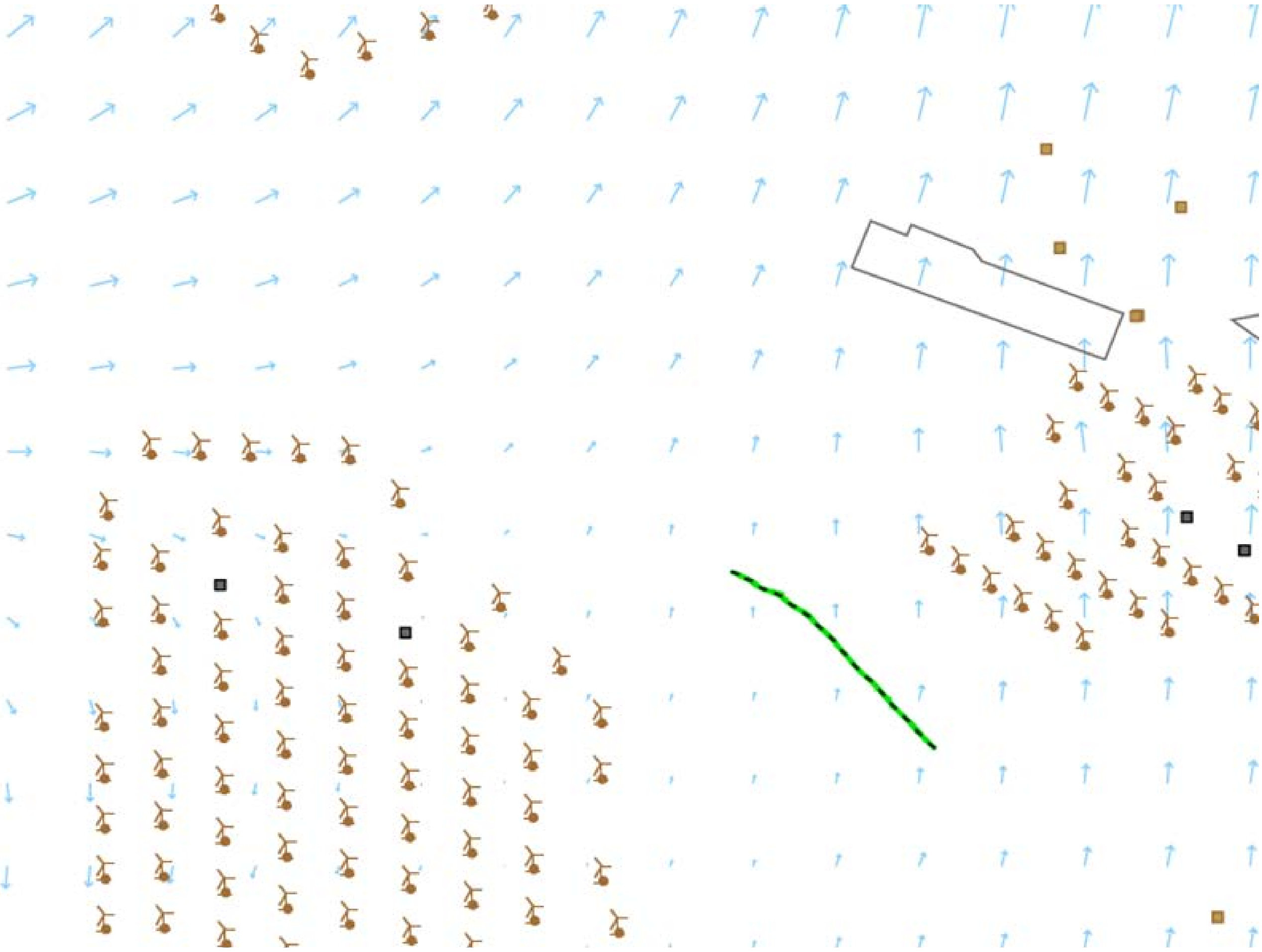
Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Stena Estrid	295˚	SF	SW (225˚)	30-40 knots	4m	7s

Scenario
To determine the limiting sea state for transiting the Mona Morecambe corridor Further assessment following discussions for Run 7



Actions of Vessels

Time	Stena Estrid	Target vessel	Comments



Run commentary
The motions of the vessel are out of limits due to the significant hazard posed to passengers and cargo, based on the rate of roll.

Objective Assessment

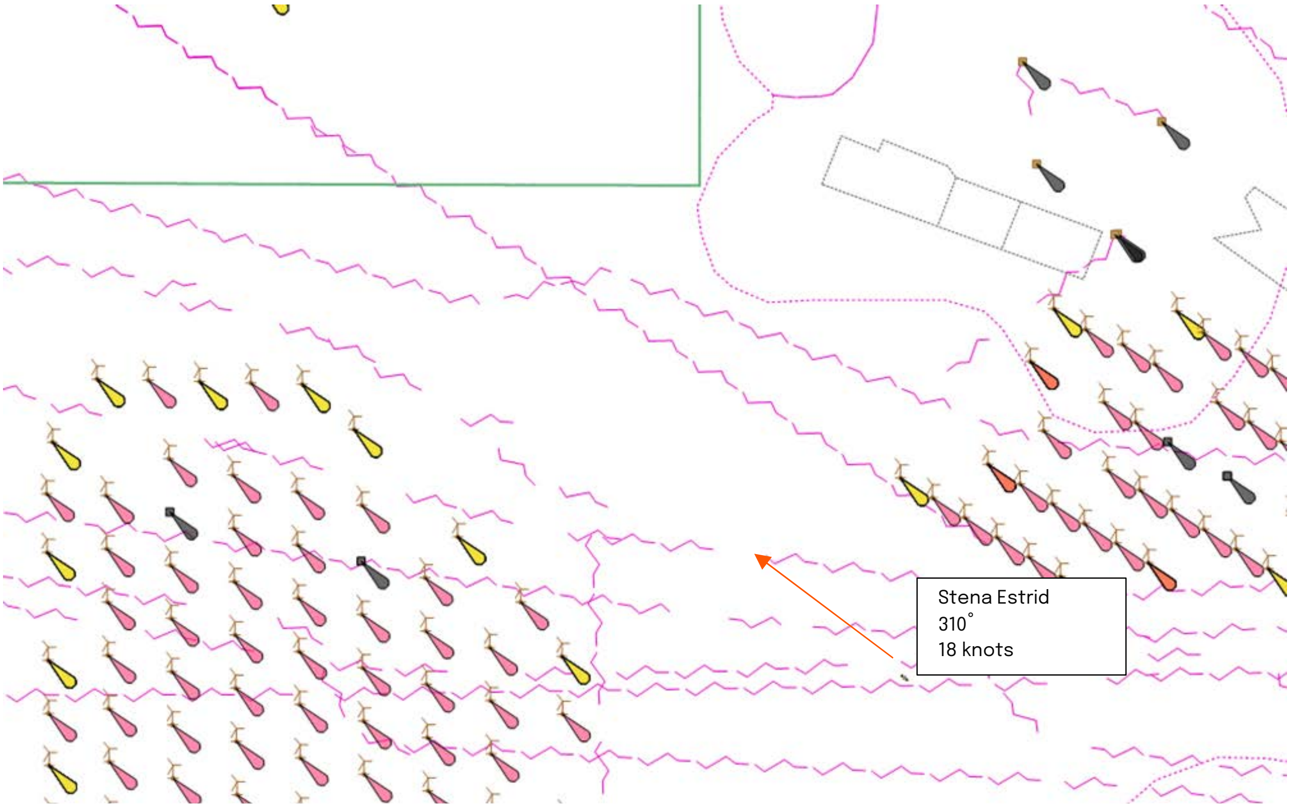
Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	F	
Avoid dangerous seas	F	
Maintain passenger comfort	F	
Impact on schedule	F	

Run: 09

Location: Passage Morecambe Mona corridor

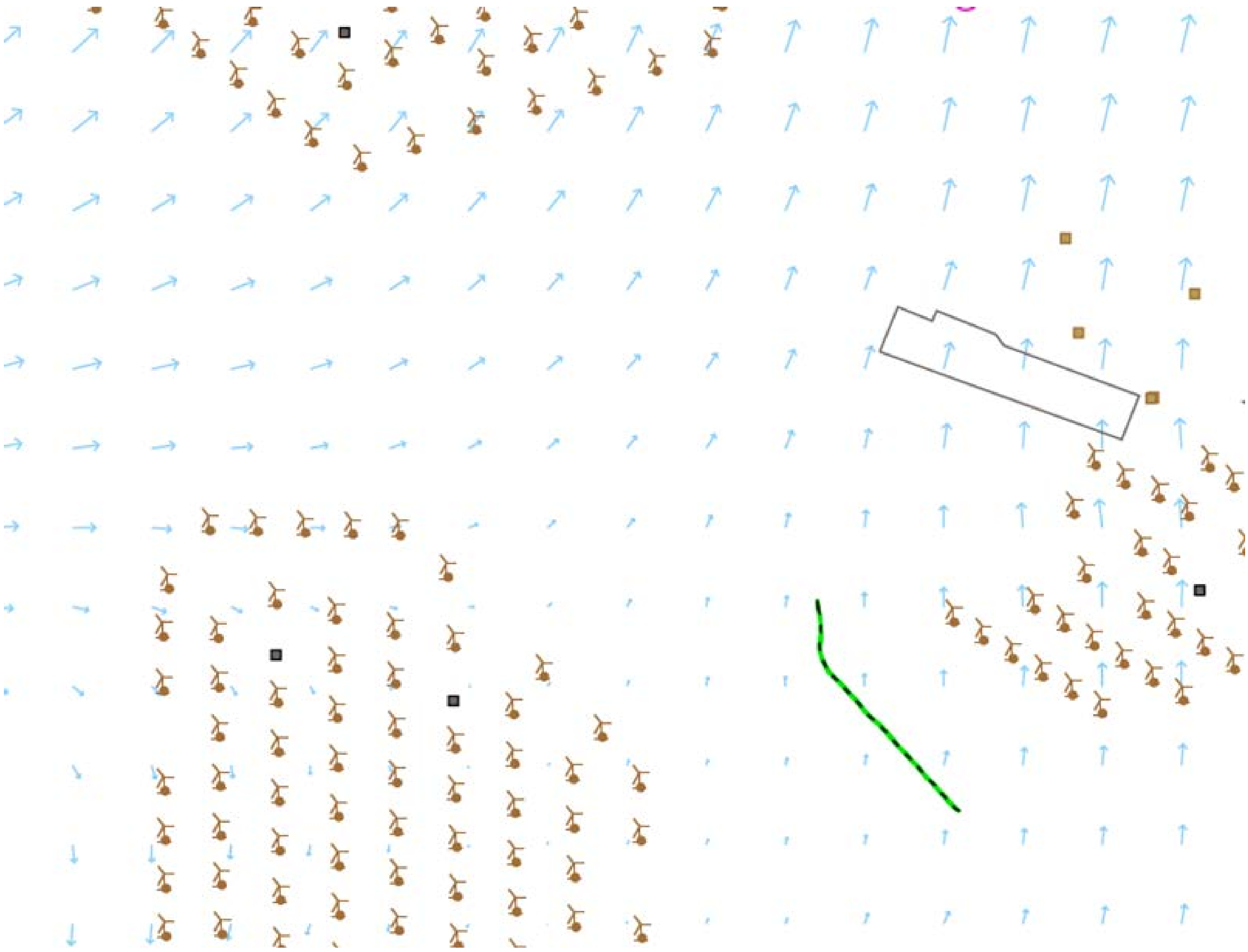
Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Stena Estrid	310˚	SF	SW (225˚)	30-40 knots	3.5m	7s

Scenario
To determine the limiting sea state for transiting the Mona Morecombe corridor



Actions of Vessels

Time	Stena Estrid	Target vessel	Comments
11	Alteration of course by 50˚ to stbd (000)		



Run commentary
The motions of the vessel are out of limits due to the hazard posed to passengers, based on the rate of roll. It is also noted that the cargo within vehicles maybe damaged if not properly secure.

Objective Assessment

Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	M	
Avoid dangerous seas	M	
Maintain passenger comfort	F	
Impact on schedule	M	

Run: 10

Location: Passage between Morecambe and Mona into Morgan & Mona

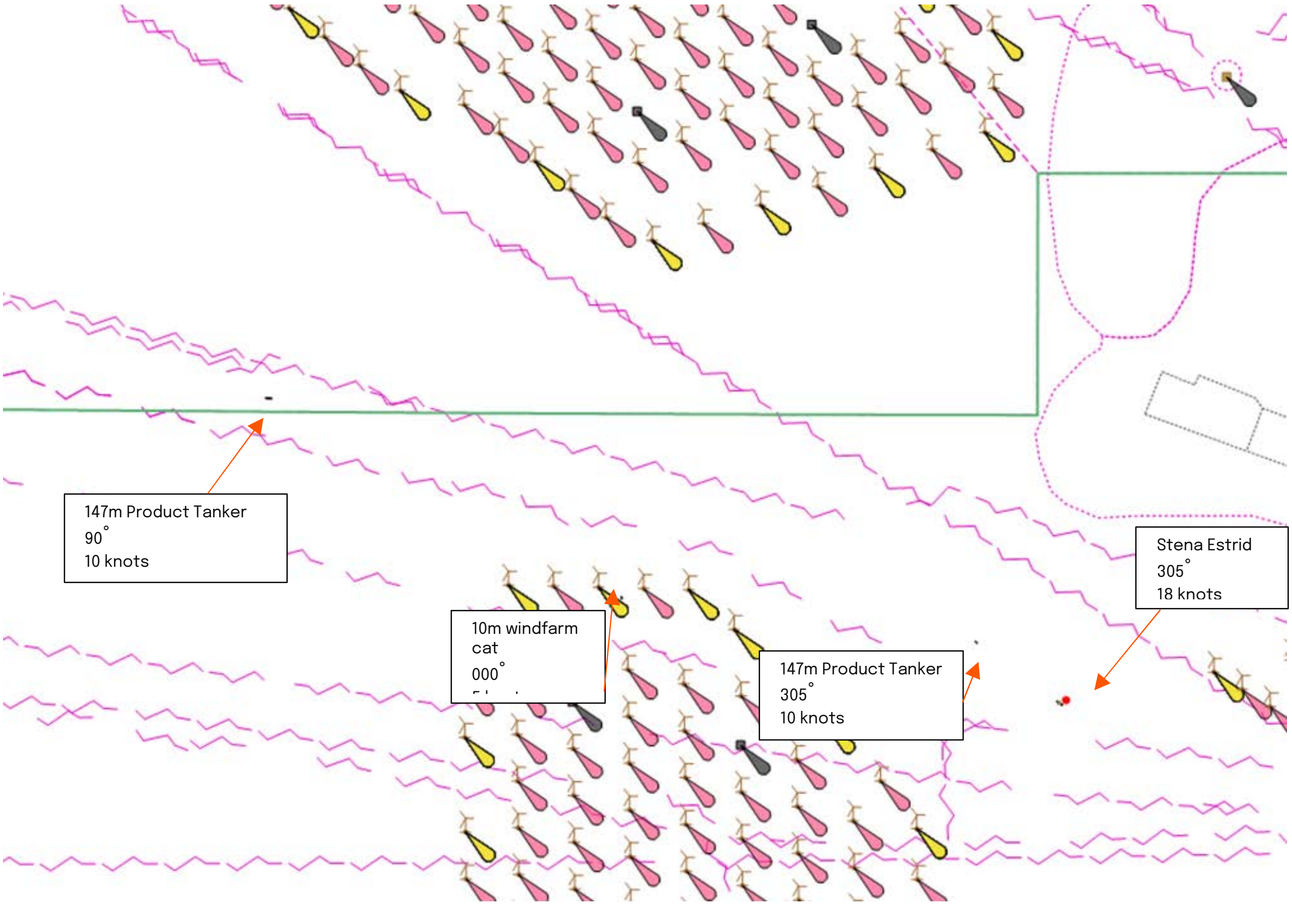
Run Aims :

- To compare previous failure situations in Morgan Mona corridor. Scenario requires 3 large vessels to transit gap simultaneously on different navigational plans.

Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Stena Estrid	305˚	SF	SW (225˚)	20-30 knots	3-4m	6-10s

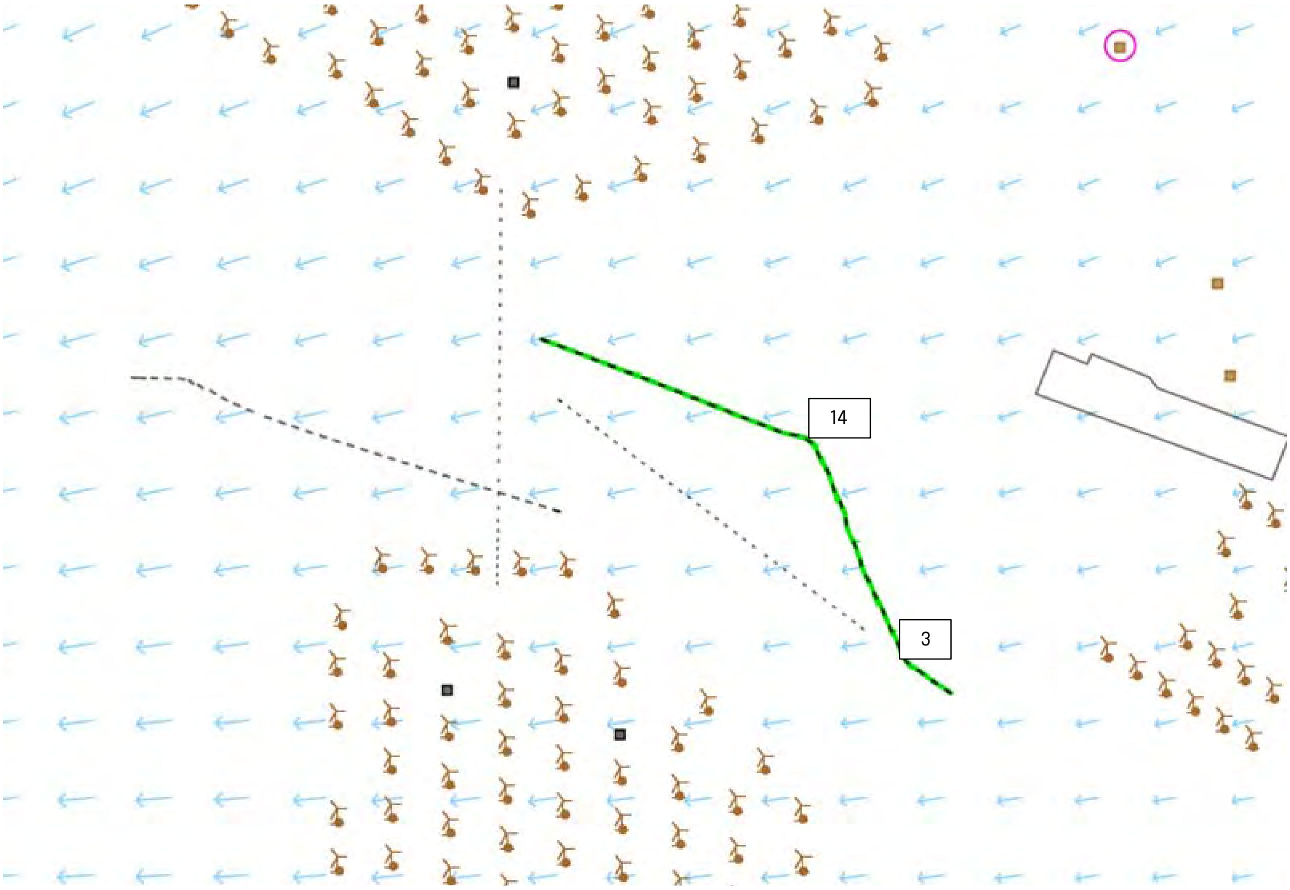
Scenario
To compare previous failure situations in Morgan Mona corridor. Scenario requires 3 large vessels to transit gap simultaneously on different navigational plans. Stena Estrid attempting direct passage in limiting conditions sea state increase once clear of lee of Anglesey. The run is based on the Stena Run 4 (Summer 2022) The Stena Ferry is required to overhaul a westbound product taker and also keep clear of an inbound product tanker. An OWP support craft is also transiting to add complexity.

Scenario



Actions of Vessels

Time	Stena Estrid	Target vessel	Comments
3	Alteration of course by 35° stbd (340)	West bound tanker maintains course and speed. Eastbound tanker alters to starboard to increase CPA on westbound tanker passing at least 1nm clear of Mona OWF.	Alteration to overtake slower moving westbound product tanker results in passing >1nm
14	Alteration of course by 50° to port (290)	-	The ferry is able to be altered back to port to pick up the navigational plan.



Run commentary
Comments on traffic scenario :
The ferry is able to overtake the ferry with a CPA >1nm and then turn towards the Morgan Mona corridor keeping well clear of the eastbound tanker.
The eastbound tanker alters course to starboard to pass between the westbound tanker and the wind farm CPA are kept greater than 1nm on fixed structures and other shipping.

Objective Assessment

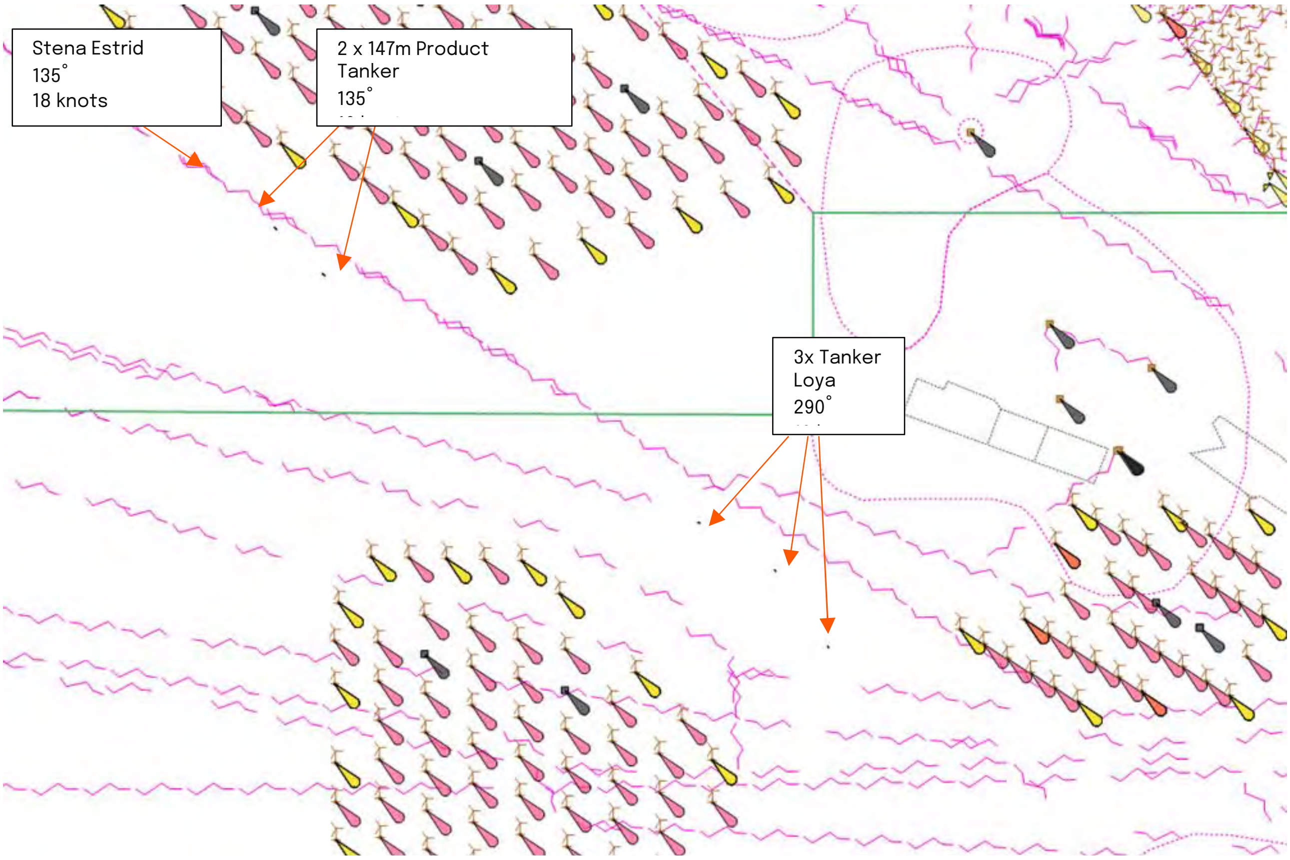
Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	S	
Impact on schedule	S	

Run: 11

Location: Passage Morgan Mona corridor

Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Stena Estrid	135˚	SF	NW (315˚)	15 knots	1.6m	5.6s

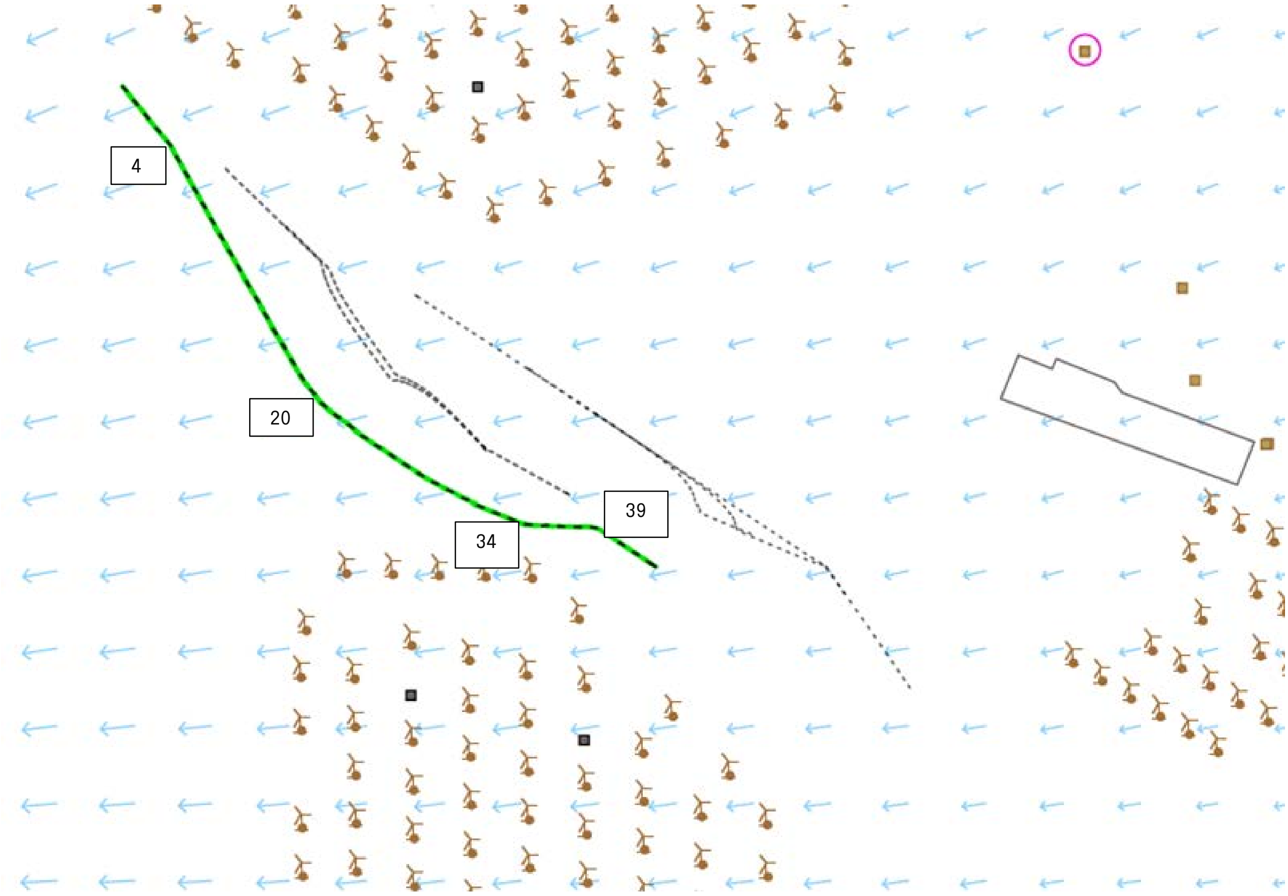
Scenario
To compare previous failure situations in Morgan Mona corridor. Scenario requires 3 large vessels to transit gap simultaneously on different navigational plans. Scenario is based on piloted convoys operating between Liverpool and Douglas as part of Port of Liverpool adverse weather plan. Scenario is based on piloted convoys operating between Liverpool and Douglas as part of Port of Liverpool adverse weather plan. The pilots cannot board at Liverpool so transfers are conducted at Douglas. The 2 convoys are set up head on situation, requiring both to alter course to starboard. The Stena ferry is overtaking the eastbound convoy and has to alter further to starboard and keep clear of eth OWF.



Actions of Vessels

Time	Stena Estrid	Target vessel	Comments
04	Alteration of course by 10˚ to stbd (145˚)		Stena Estrid alters course to over haul east bound convoy.

Time	Stena Estrid	Target vessel	Comments
09	NA	Convoys alter to starboard for head at head situation	Both convoys alter to starboard as required by colregs for head on situation
20	Alteration of course by 25˚ to port (120˚)		Stena Estrid alters to Parallel the convoy maintain 1nm CPA
34	Alteration of course by 20˚ to port (090˚)		Stena Estrid alters ahead of the east bound convoy to pass safely between it and the Mona OWF
39	Alteration of course by 30˚ to port (120˚)		Stena Estrid alters to resume the planned navigational track.



Run commentary
Comments on traffic scenario : Stena Estrid is able to develop a situational picture and take safe manoeuvring action as required by the rules to maintain CPA> 1nm on other vessels and fixed structures.

Objective Assessment

Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	

Criteria	Grading	Comment
Clearance – Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	S	
Impact on schedule	S	

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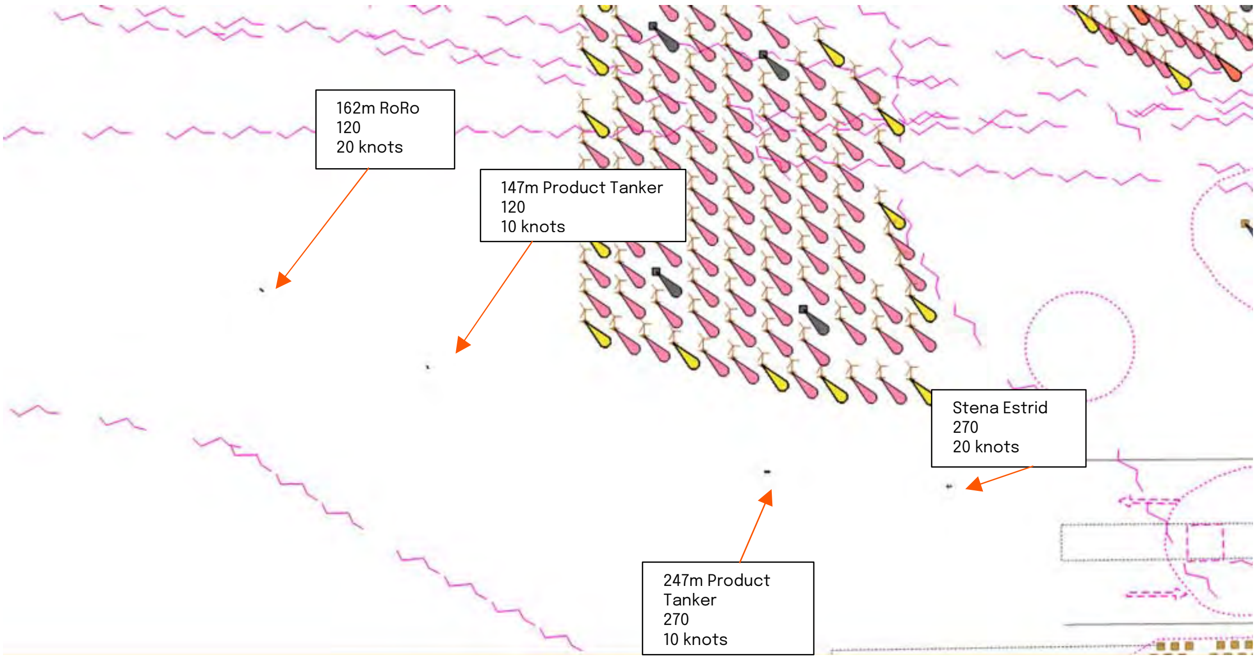
Run: 12

Location: Passage south of Mona

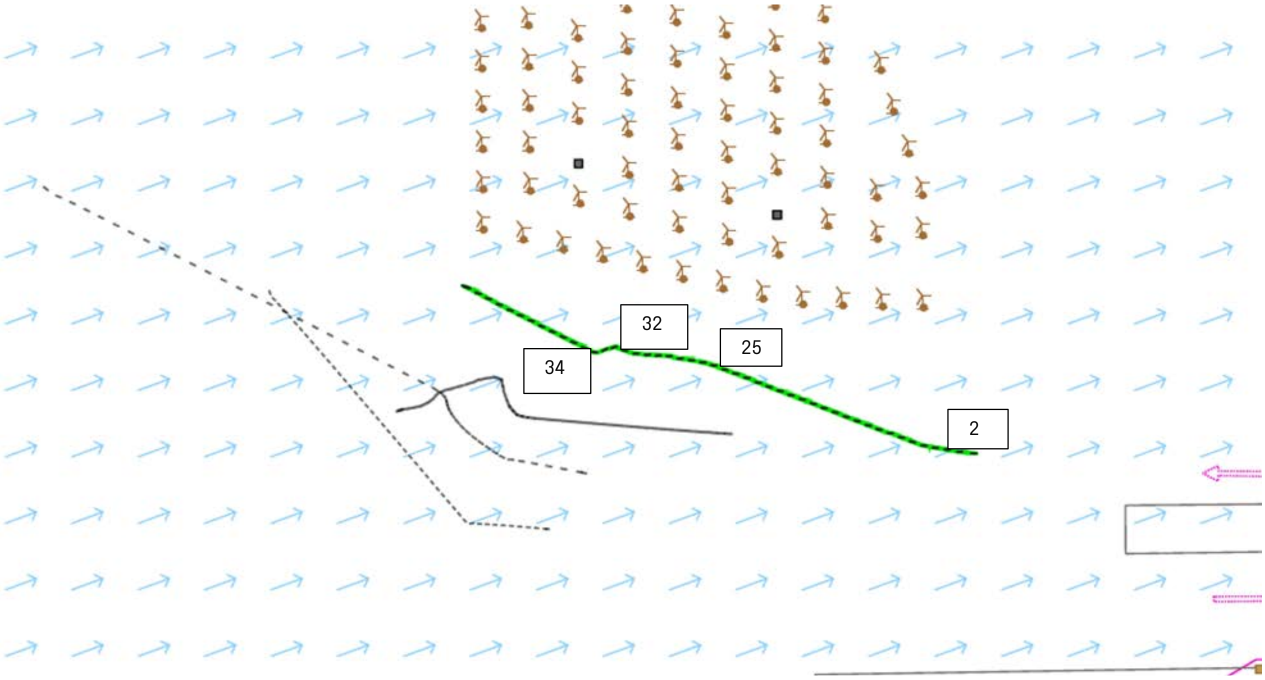
Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Stena Estrid	270	SF	SW (225)	50 knots	3m	10s

Scenario
To determine the available safe navigable area between Liverpool TSS and Mona OWF with moderate traffic situation. Stena Estrid transiting westbound, just clearing the TSS is required to overhaul slower moving Tanker and avoid traffic eastbound to join the TSS.



Actions of Vessels

Time	Stena Estrid	Target vessel	Comments
2	Alteration of course by 10 degrees to stbd, heading 280	Maintain course and speed	Alteration made to overhaul slower moving westbound tanker
25	Alteration of course by 15 degrees to port, heading 265	Maintain course and speed	Alteration made to parallel the tanker course and maintain CPA > 1nm on OWF and tanker
32	Alteration of course by 20 degrees to port (245)	Maintain course and speed	Alteration to regain navigational track
34	Alteration of course by 40 degrees to stbd (285)	Maintain course and speed	Alteration to wards Douglas once all traffic passed and clear



Run commentary
Comments on traffic scenario :   The increased space to the south of Mona OWF provides sufficient sea room for vessel transiting and joining the TSS to manoeuvre safely in accordance with the collision regulations.

Objective Assessment

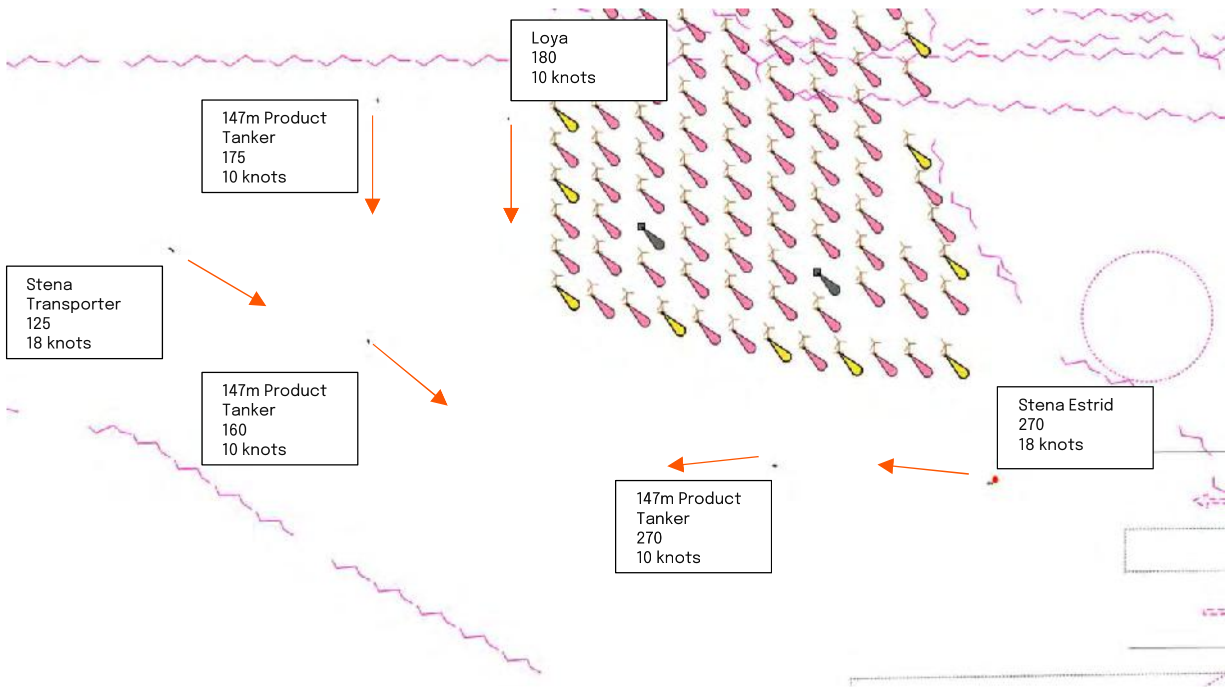
Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	S	
Impact on schedule	S	

Run: 13

Location: Passage south of Mona exiting TSS

Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Stena Estrid	270	SF	SW (225)	15 knots	1.5m	5.5s

Scenario
To determine the available safe navigable area between Liverpool TSS and Mona OWF with increased traffic situation from run 12. Stena Estrid transiting westbound, just clearing the TSS is required to overhaul slower moving Tanker and avoid traffic eastbound to join the TSS. South and east bound vessel are also requiring Stena Ferry to give way potentially forcing track towards mona wind farm

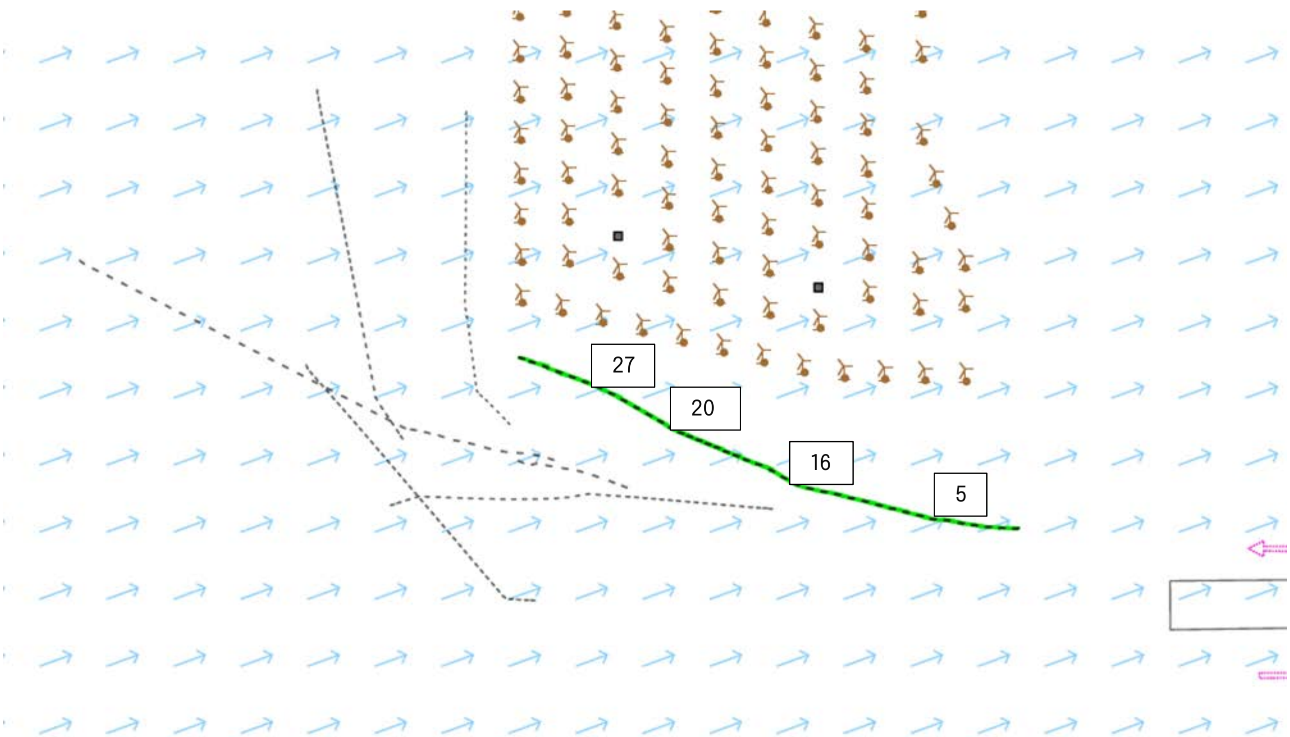


Actions of Vessels

Time	Stena Estrid	Target vessel	Comments
5	Reduction in speed from 18 knots to 16 knots. Alteration of Heading from 270˚ to 280˚	Maintain course and speed or follow navigational plan	Altered course to begin to overhaul westbound tanker and reduced speed to assess the southbound traffic.
16	Alteration of Heading from 280˚ to 290˚	Maintain course and speed or follow navigational plan	Altered further to starboard to increase CPA on eastbound ferry.
20	Reduction in speed from 17 knots to 11.5 knots	Maintain course and speed or follow navigational plan	Reduced speed to avoid crossing situation with southbound coaster Loya

Time	Stena Estrid	Target vessel	Comments
27	Increase in speed from 11.5 knots to 17 knots	Maintain course and speed or follow navigational plan	The speed of the ferry is increased to passage speed once the Loya is clear.

Run commentary
Comments on traffic scenario : It should be noted that had the Stena vessel altered to port to overhaul the tanker to the south then the situation would not have developed. There is sufficient space for the west bound ferry to deal with a complex and challenging situation giving way to 4 vessels, keeping clear of a vessel being overtaken and maintaining a CPA>1nm on the OWF.



Objective Assessment

Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	

Criteria	Grading	Comment
Maintain passenger comfort	S	
Impact on schedule	S	

B.2 IoMSPC

Run: 01

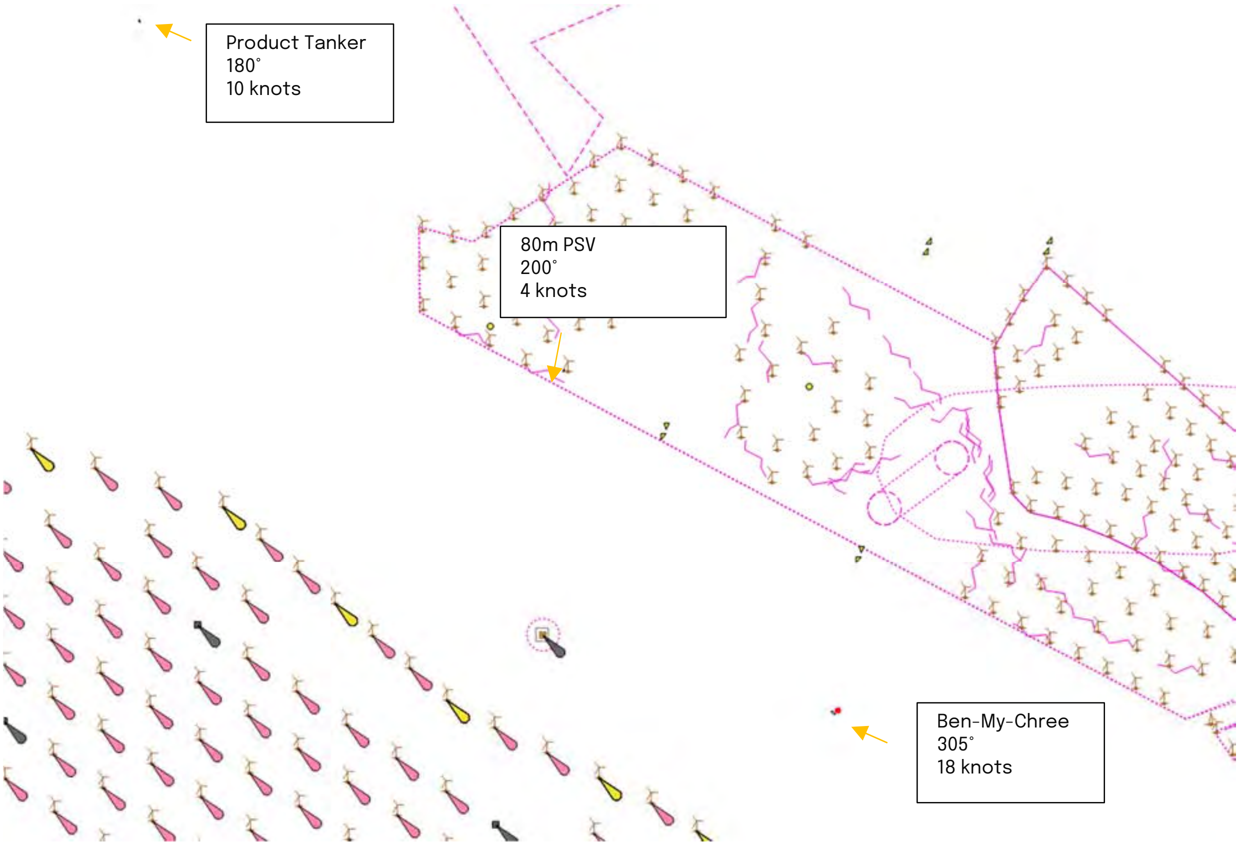
Location: Morgan – Walney

Run Aims :

Consider increased sea room in Morgan Walney corridor with basic shipping situation

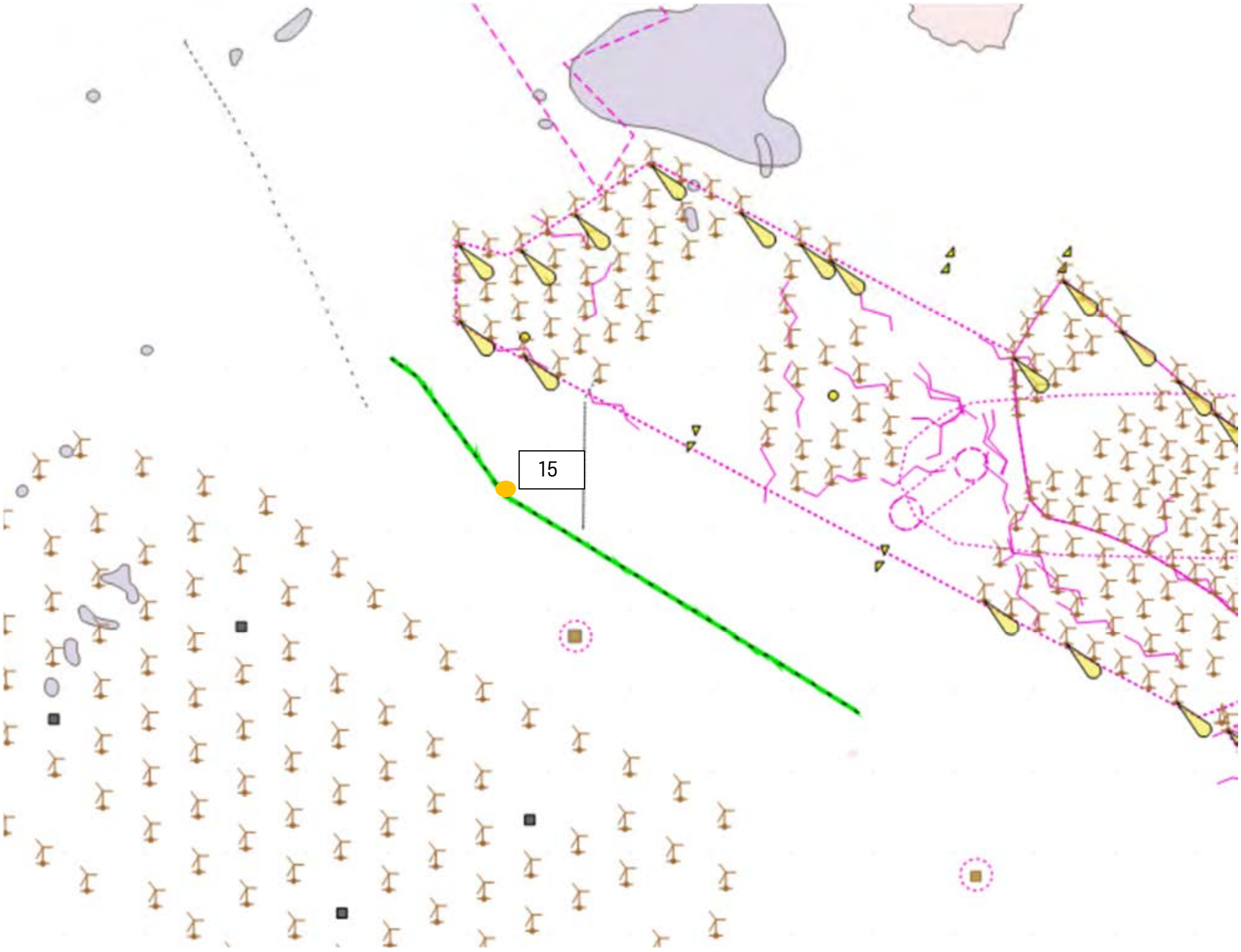
Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp
Ben-My-Chree	300˚	John Pirrie	225˚	25-30 knots	2.5m	6.5s

Scenario
Route attempting to follow baseline course through Morgan-Walney corridor with passing OWF maintenance vessel.



Actions of Vessels

Time	Ben-My-Chree	Target vessel	Comments
15	Adjust heading to 325˚	Product tanker	Visual from 10 miles, tracking



Run Commentary
Took the corridor between Morgan and Walney in the 2.5m sea state. Anything above this sea state would be considered too high for the Morgan – Walney route. Route is viable, able to follow baseline course. Encountered PSV from Walney to Morgan. Able to track the ship and determined no risk (maintained heading and speed). Picked up incoming tanker from 10NM on radar, south-easterly heading. Tracking showed risk of collision and some action was required. Altered course to starboard to allow required CPA (over 1NM from tanker and 1.1NM from OWF). Meeting occurred at the pinch point between the two OWFs. Captain commented that it was a straightforward situation. Sea room to come to starboard. Did consider going to port – could have justified if early and clear enough. Not possible to maintain CPAs with the previous configuration.

Criteria	Outcome
Ship control	Success
Clearance from fixed infrastructure	Success
Clearance from other ships	Success
Under keel clearance	N/A
Response to an emergency	N/A
Cargo shift	Success
Dangerous seas	Success
Passenger comfort	Success
Vessel schedule	Success

Run: 02

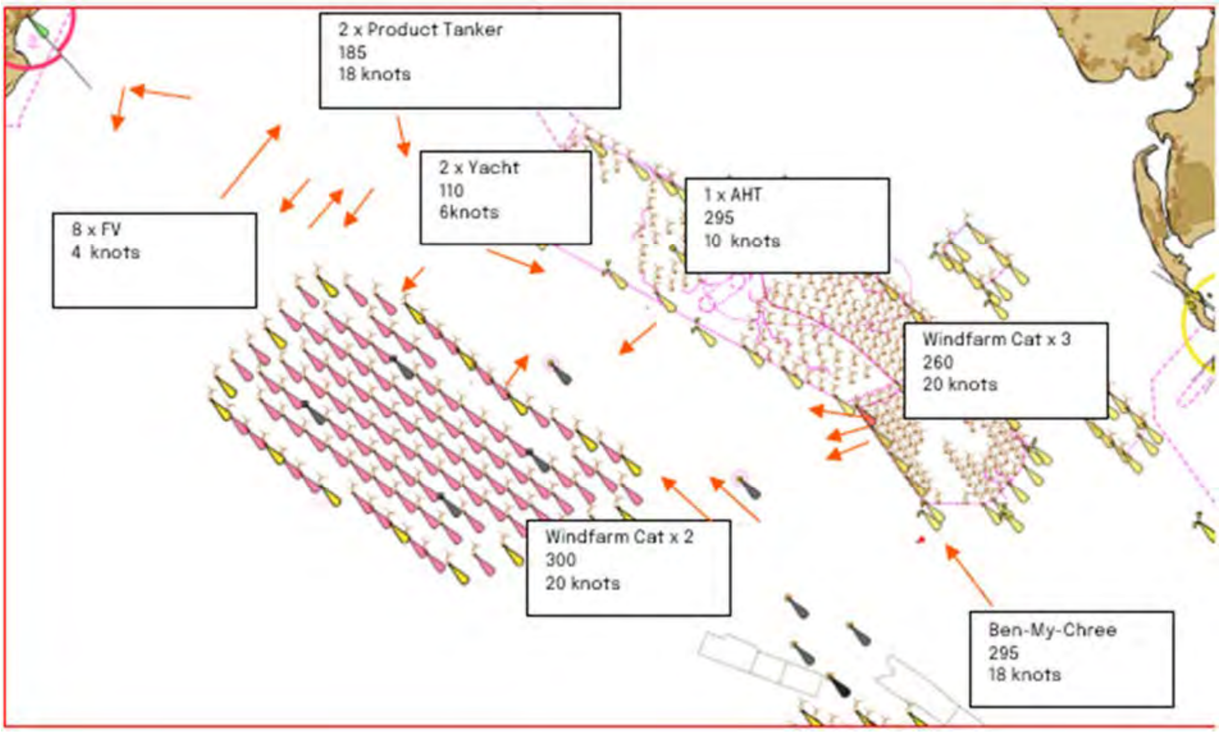
Location: Morgan – Walney

Run Aims:

Consider increased sea room in Morgan - Walney corridor with basic shipping situation

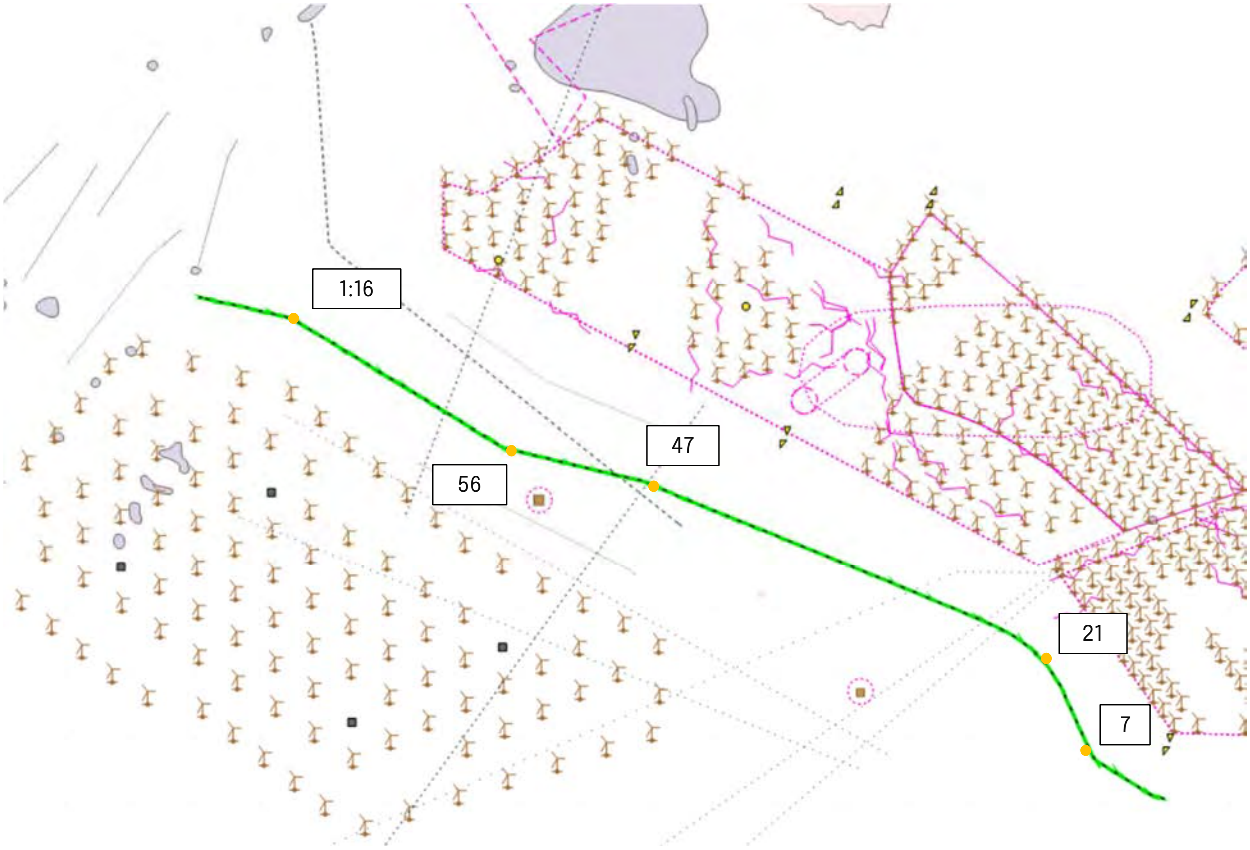
Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp
Ben-My-Chree	300˚	John Pirrie	225˚	25-30 knots	2.5m	6.5s

Scenario
3 x OWF vessels crossing from Walney to Morgan at speed – emerging suddenly from Walney, requiring action as give-way
1 x AHT crossing Walney to Morgan – Loitering then crossing requiring action as crossing vessel
2 x yachts, 1 manoeuvring randomly attempting to run north
1x product tanker running passage requiring action as head on
1 x product tanker joining the channel from north requiring action as give way vessel – turned towards just before CPA requiring further action
8 x FV (based distribution 10-11 May) all moving randomly or loitering close to known fishing spots between Morgan and Douglas



Actions of Vessels

Time	Ben-My-Chree	Target vessel	Comments
07	Alteration of course (337°)	OWF Catamaran exiting OWF	
21	Return to base course (297°)	OWF Catamaran exiting OWF	
47	Adjust heading 10° to port (285°)	OWF Catamaran exiting OWF	
56	Adjust heading 20° to starboard (305°)	Sailing yacht along edge of corridor	
1:16	Adjust heading 20° to port (285°)	Trawlers heading 030° at end of OWF corridor	



Run Commentary
Met OWF vessel heading south-west with risk of collision, so changed heading to starboard which resolved without impacting CPA on OWF. Met product tanker with yacht ahead. Starboard alteration would have cause further issues and therefore early alteration to port was carried out which took the ship out of the close-quarters situation. Fishing trawlers were at the exit of the Morgan – Walney channel. Took a course to the south to avoid. Additional width in the Morgan – Walney channel allowed for all cases of risk of collision to be avoided and improved navigation.

Criteria	Outcome
Ship control	Success
Clearance from fixed infrastructure	Success
Clearance from other ships	Success
Under keel clearance	N/A
Response to an emergency	N/A
Cargo shift	Success
Dangerous seas	Success
Passenger comfort	Success
Vessel schedule	Success

Run 03

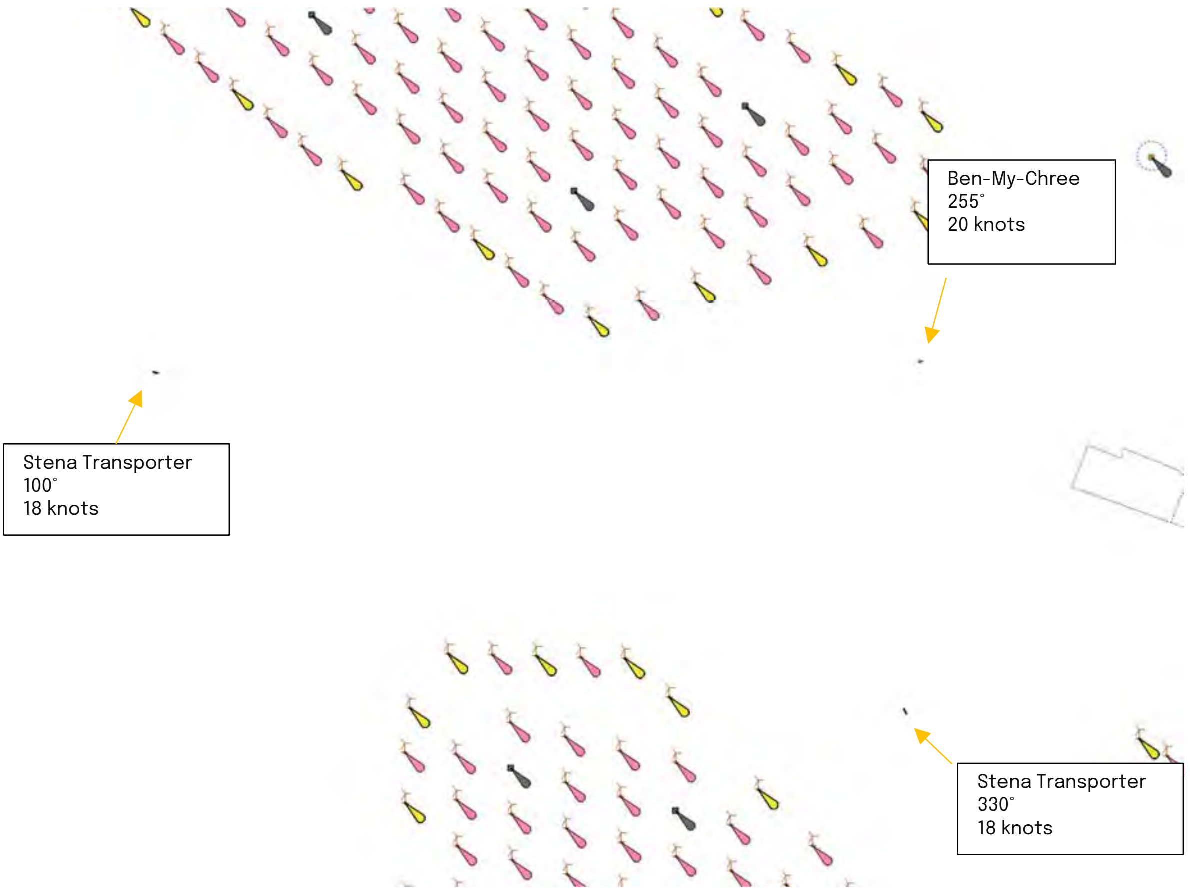
Location: Morgan – Mona

Run Aims:

Consider increased sea room in Morgan - Mona corridor with 2 ferries meeting heading west

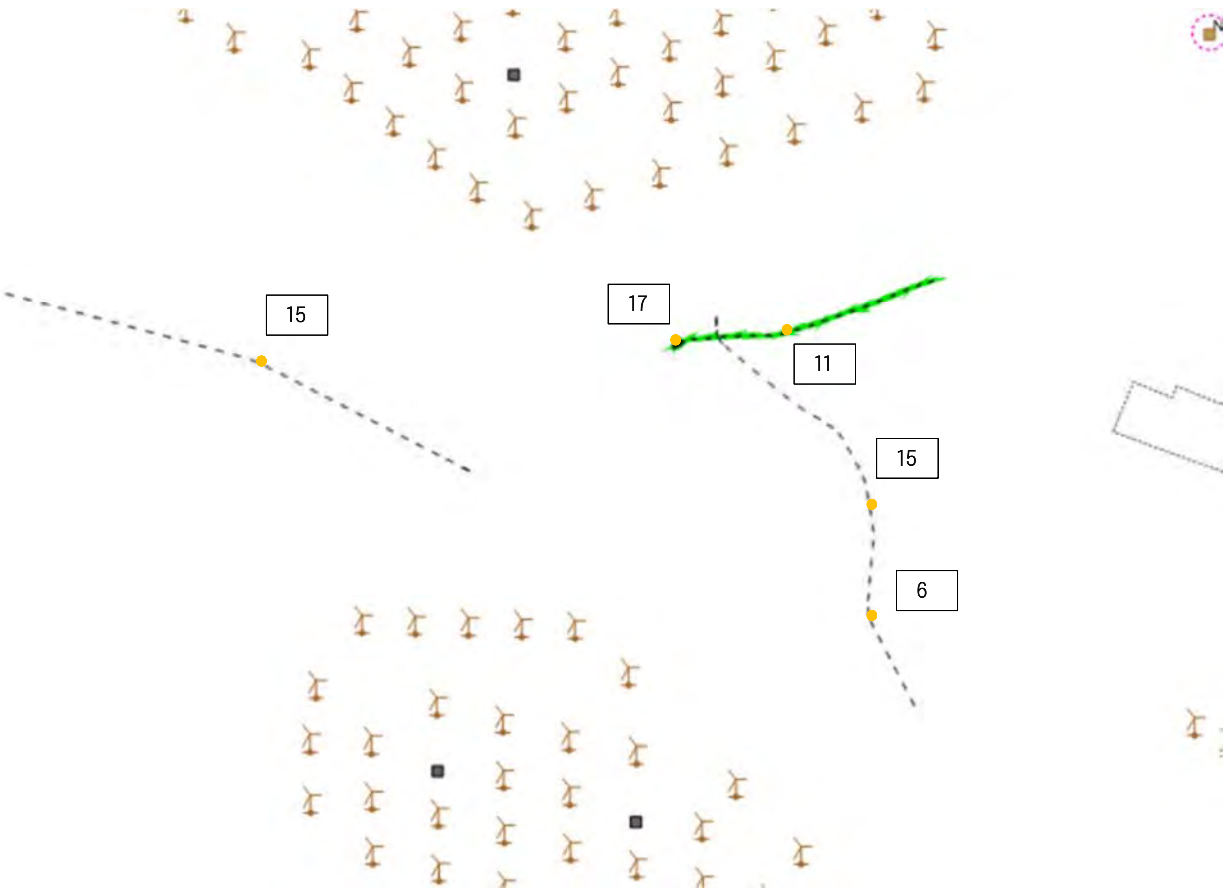
Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp
Ben-My-Chree	300°	John Pirrie	225°	50 knots	4m	10s

Scenario
Meeting and passing a ferry heading outbound through Morgan-Mona gap while head-to-head with inbound traffic



Actions of Vessels

Time	Ben-My-Chree	Target vessel	Comments
06	–	Stena Ferry west-bound adjusts heading to 005°	
11	Adjust heading to 270°		
15		Stena Ferry east-bound adjust heading 20° to starboard (130°) Stena Ferry west-bound adjusts heading to follow the stern of the Ben-My-Chree.	
17	Loss of control		



Run Commentary
On assessing the vessel meeting situation the Captain chose to slow right down, then vessel experienced excessive ship motions in adverse conditions to allow the vessel to stay on same course. However, slightly overly conservative combination of wind and wave forces on ship model meant that the Captain could not proceed as expected, so run stopped. Scenario to be re-run with a different avoidance strategy.

Criteria	Outcome
Ship control	Fail, but due to issue with ship model (over conservatism of combined wind and wave forces)
Clearance from fixed infrastructure	N/A
Clearance from other ships	N/A
Under keel clearance	N/A
Response to an emergency	N/A
Cargo shift	N/A
Dangerous seas	N/A
Passenger comfort	N/A
Vessel schedule	N/A

Run 04

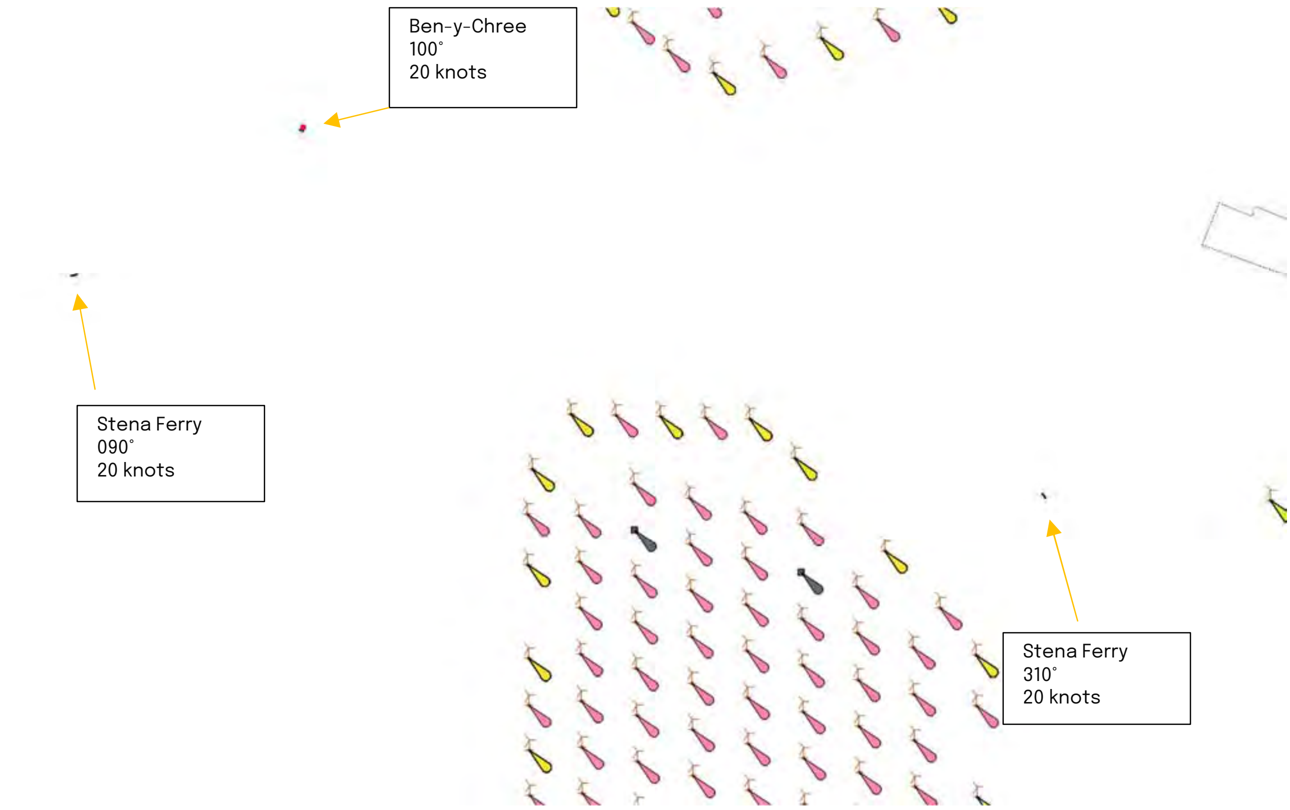
Location: Morgan - Mona - Morecambe

Run Aims:

Consider increased sea room in Morgan - Mona corridor with 2 ferries meeting heading east

Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp
Ben-My-Chree	110˚	John Pirrie	225˚	50 knots	4m	10s

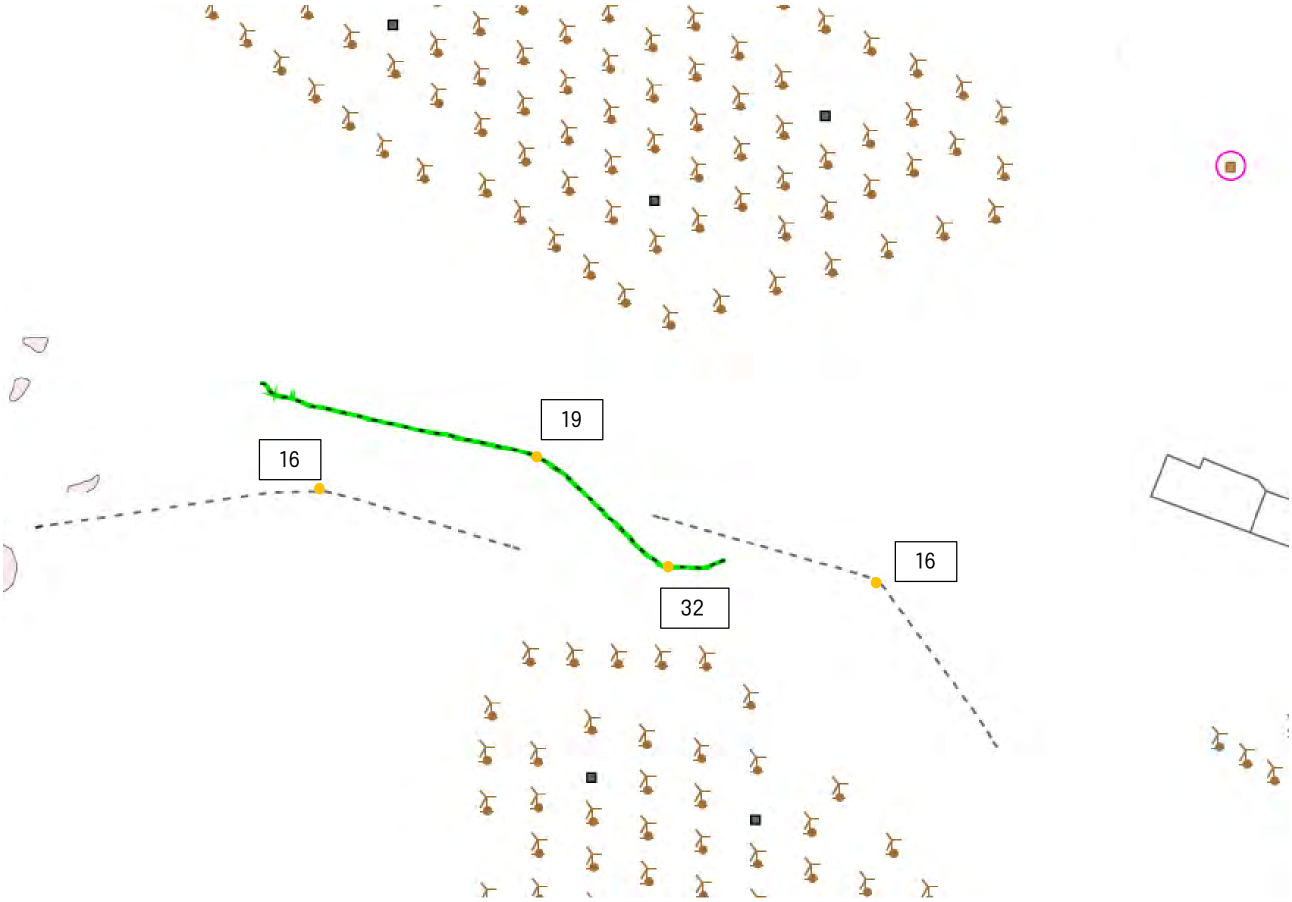
Scenario
Meeting outbound ferry in Morgan-Mona gap while passing a vessel in adverse weather conditions.



Actions of Vessels

Time	Ben-My-Chree	Target vessel	Comments
16	-	Stena Ferry west-bound adjusts heading 30˚ to port. Stena Ferry east-bound adjusts heading 25˚ to starboard.	
19	Adjusts heading 45˚ to starboard (145˚)	-	

32	Return to original heading (100˚)	-	



Run Commentary
One other ferry overtaking and another on starboard bow. Took early action to avoid vessel on stbd bow and course was feasible, so kept on it to keep clear. Adequate CPAs achieved from ferries and OWFs.

Criteria	Outcome
Ship control	Success
Clearance from fixed infrastructure	Success
Clearance from other ships	Success
Under keel clearance	N/A
Response to an emergency	N/A
Cargo shift	Success
Dangerous seas	Success
Passenger comfort	Success
Vessel schedule	Success (a few minutes delay)

Run 05 – Repeat of Run 03 with different strategy

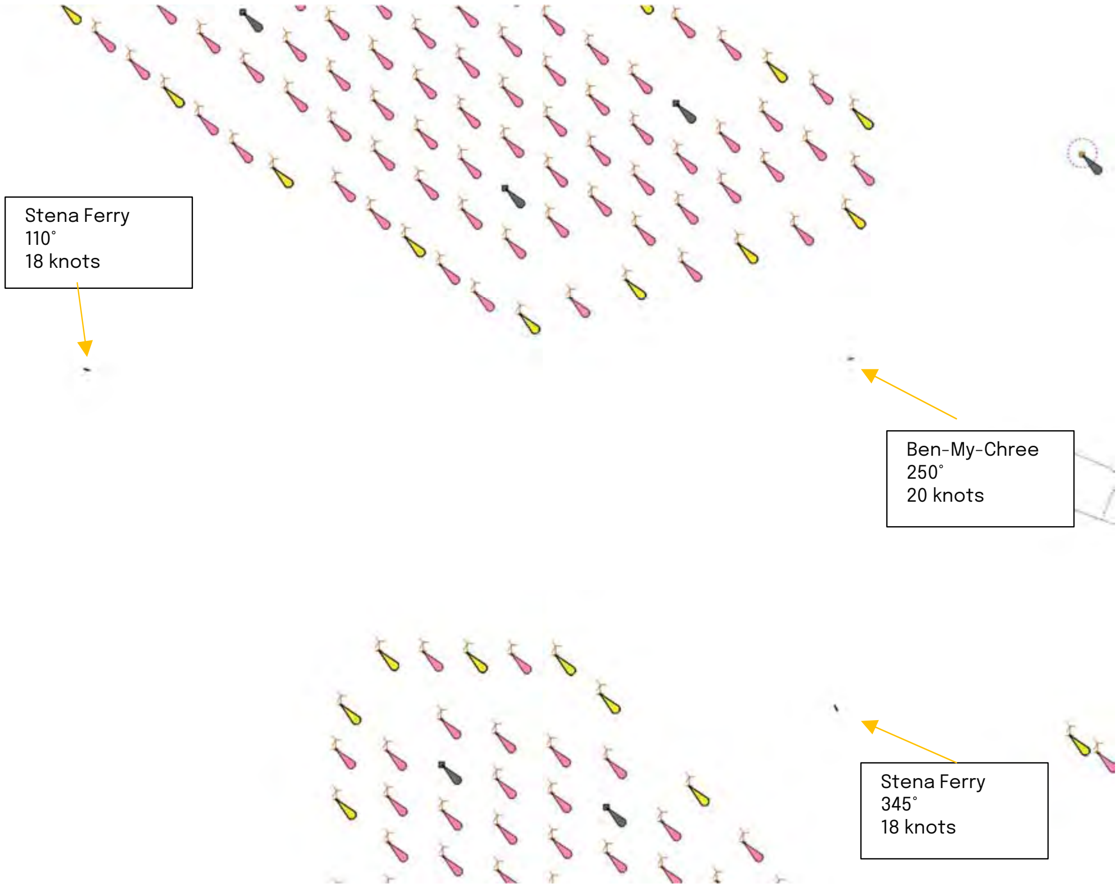
Location: Morgan – Mona

Run Aims:

Consider increased sea room in Morgan - Mona corridor with 2 ferries meeting heading west

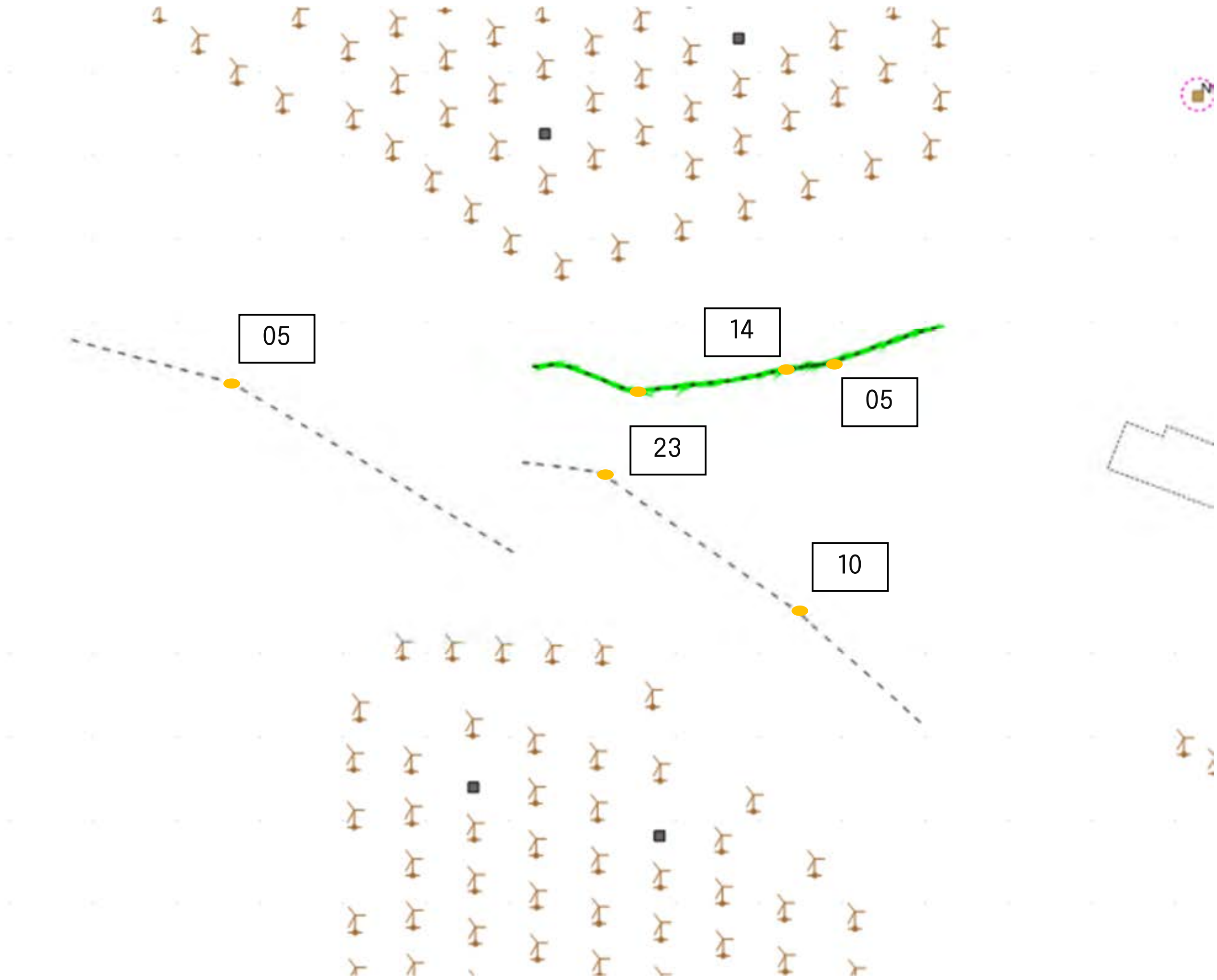
Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp
Ben-My-Chree	250°	John Pirrie	225°	50 knots	4m	10s

Scenario
Meeting 2 inbound traffic in Morgan-Mona gap in adverse weather conditions outbound to Douglas



Actions of Vessels

Time	Ben-My-Chree	Target vessel	Comments
05	Reduced speed to 4 knots	Stena Ferry east-bound adjust heading 10˚ to starboard (120˚)	
10	–	Stena Ferry west-bound adjust heading 10˚ to port (335˚)	
14	Increased speed to 17 knots		
23	Adjust heading 30˚ to starboard (280˚)	Stena Ferry west-bound adjust heading 20˚ to port (325˚)	



Run Commentary
Rerun of Run 03 which had a ship model issue, but with a different strategy of reducing speed (Full Ahead down to Slow for about 5 mins) which opened up CPA to other vessel to allow safe passage. Came onto heading 290 which was better than 270 in Run 03. Experienced rolling, but only for short time on 290 heading. Alteration of course is generally preferable to slowing/stopping.

Criteria	Outcome
Ship control	Success
Clearance from fixed infrastructure	Success
Clearance from other ships	Success
Under keel clearance	N/A
Response to an emergency	N/A
Cargo shift	Success
Dangerous seas	Success
Passenger comfort	Success
Vessel schedule	Success (slight impact due to speed reduction)

Run: 06 (Run 10 from Summer 2022, which was marked marginal)

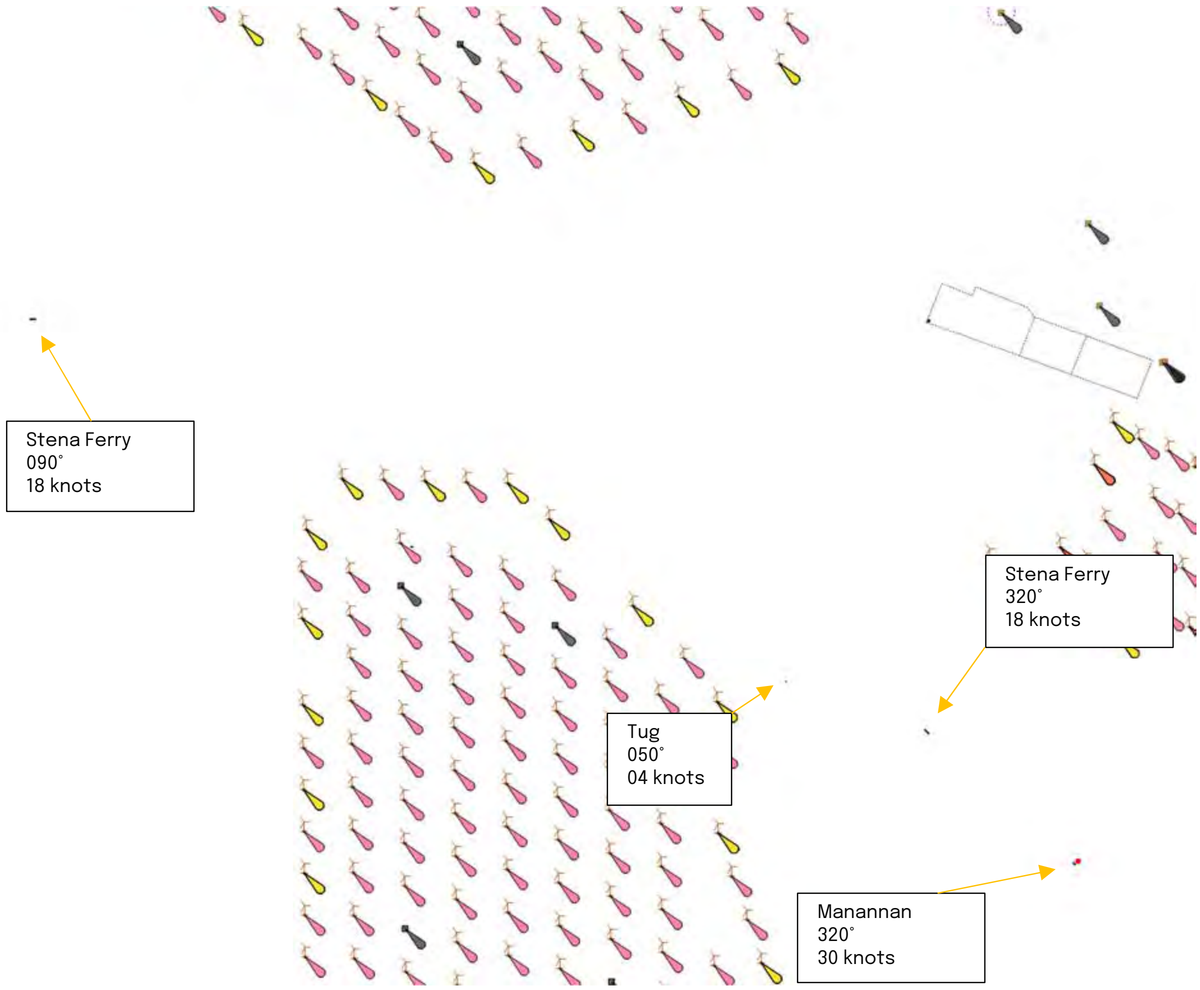
Location: Morgan – Mona

Run Aims :

Consider increased sea room in Morgan – Mona corridor in weekly conditions with traffic. Transit from Liverpool to Douglas.

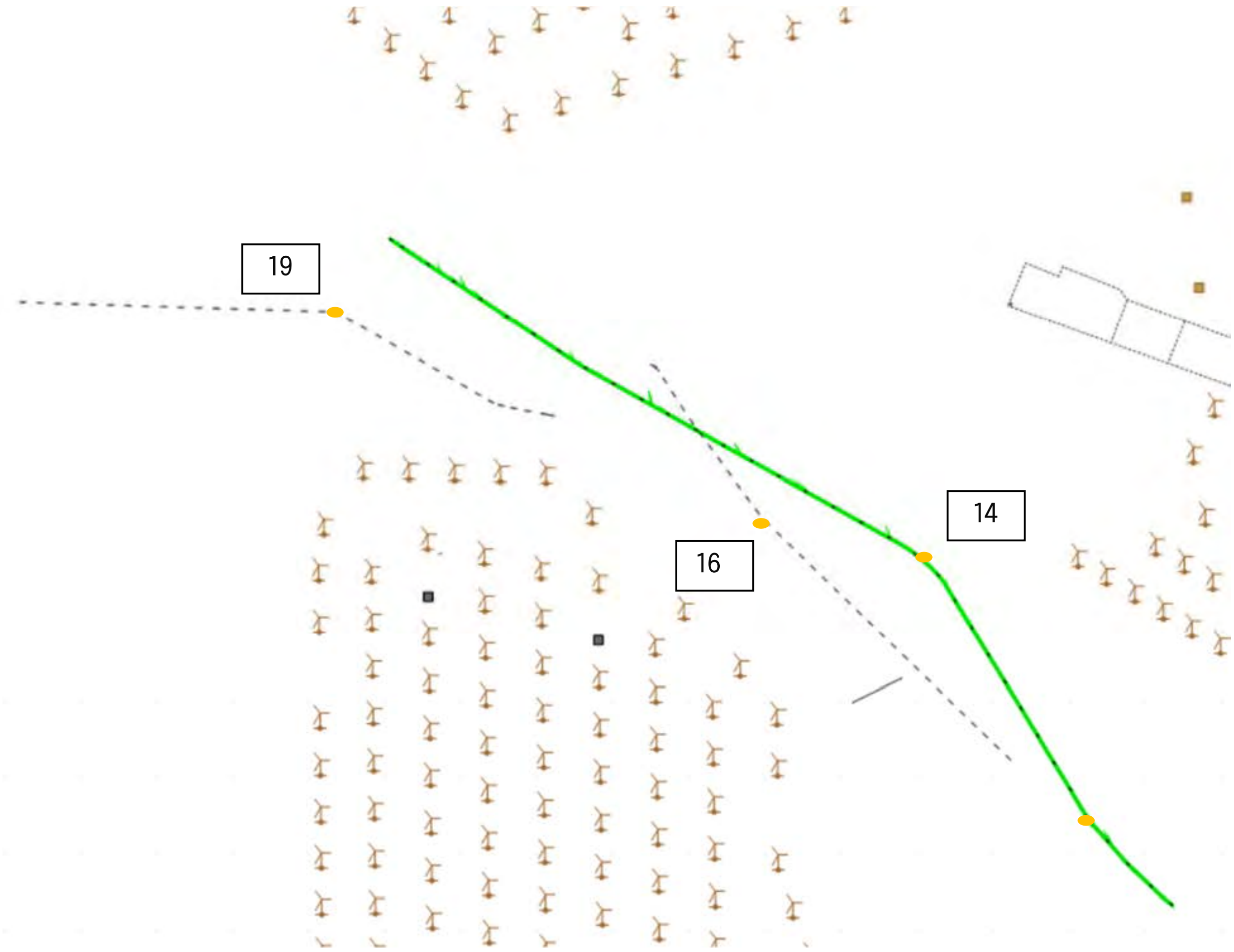
Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp
Manannan	310˚	JP	225˚	15 knots	1.5m	5.5s

Scenario
Route attempting to follow baseline course while passing a slower vessel and encounter inbound traffic in Morgan-Mona gap.



Actions of Vessels

Time	Manannan	Target vessel	Comments
05	Adjust heading 15˚ to starboard to overtake while maintaining CPA		Could not pass to port side as Tug crossing gap had restricted options.
14	Adjust heading to port 30˚ (305˚)		
16	-	Stena Ferry west-bound adjust heading 10˚ to starboard to keep 1NM CPA from east-bound ferry	
19	-	Stena Ferry east-bound adjust heading to maintain 1NM CPA from Manannan and west-bound ferry	



Run Commentary
Over taking vessel between Morecambe and Mona: Saw risk of collision so decided to overtake on starboard side with at least 1NM from passing ship and OWF. Change to wind farm boundary provides sufficient space. Booster station location had no impact on run. No problem seeing the vessel within the wind farm. Visibility of vessel not impacted by OWF. Also met a ferry in the Morgan – Mona corridor, steadied up on track for Douglas, and identified ferry on way to Liverpool. Was stand-on vessel and oncoming vessel changed course appropriately and still maintained CPAs.

Criteria	Outcome
Ship control	Success
Clearance from fixed infrastructure	Success
Clearance from other ships	Success
Under keel clearance	N/A
Response to an emergency	N/A
Cargo shift	Success
Dangerous seas	Success
Passenger comfort	Success
Vessel schedule	Success

Run: 07 (Run 14 from Summer 2022, which was marked marginal)

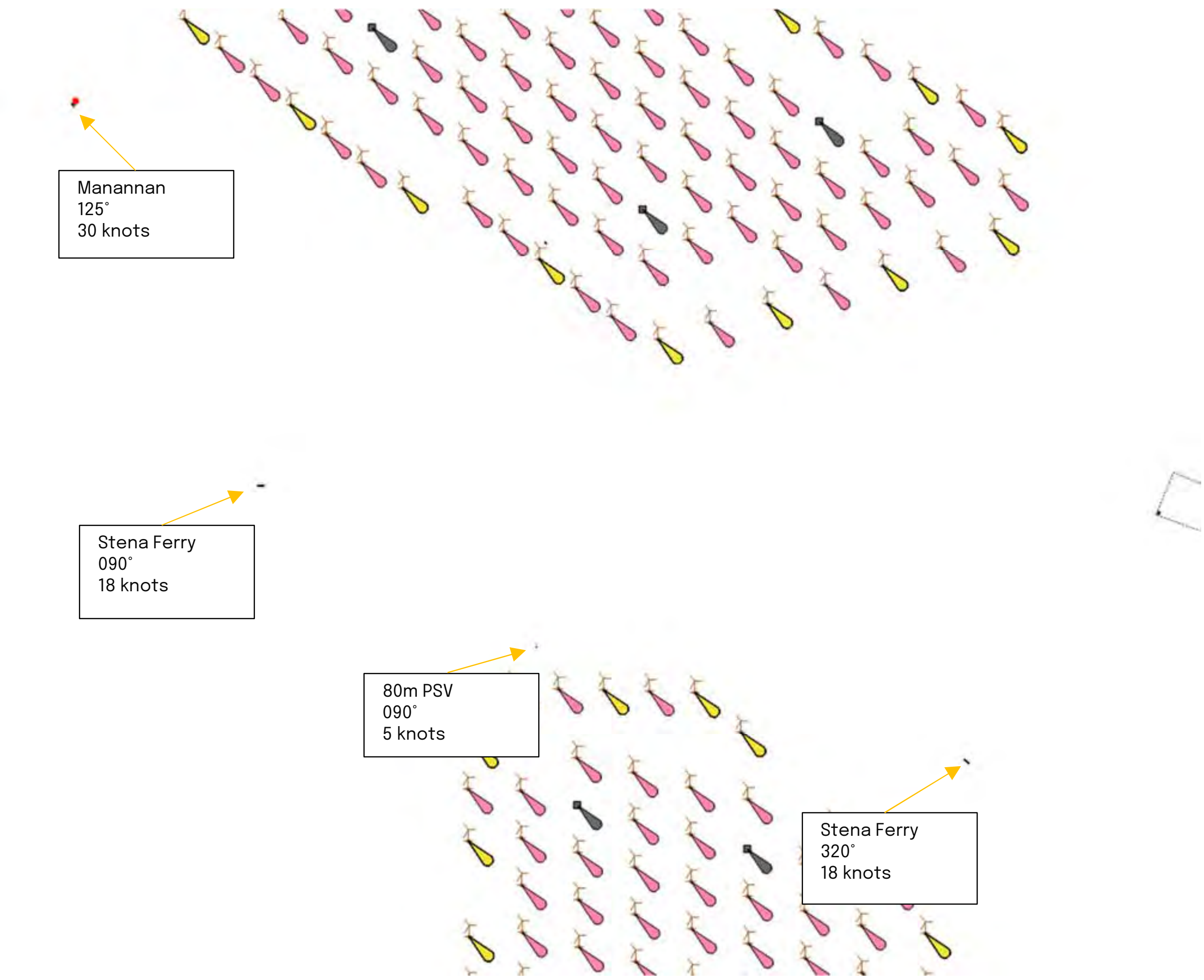
Location: Morgan – Mona

Run Aims :

Consider increased sea room in Morgan – Mona corridor in weekly conditions with traffic. Transit from Douglas to Liverpool with visibility down to 0.5nm.

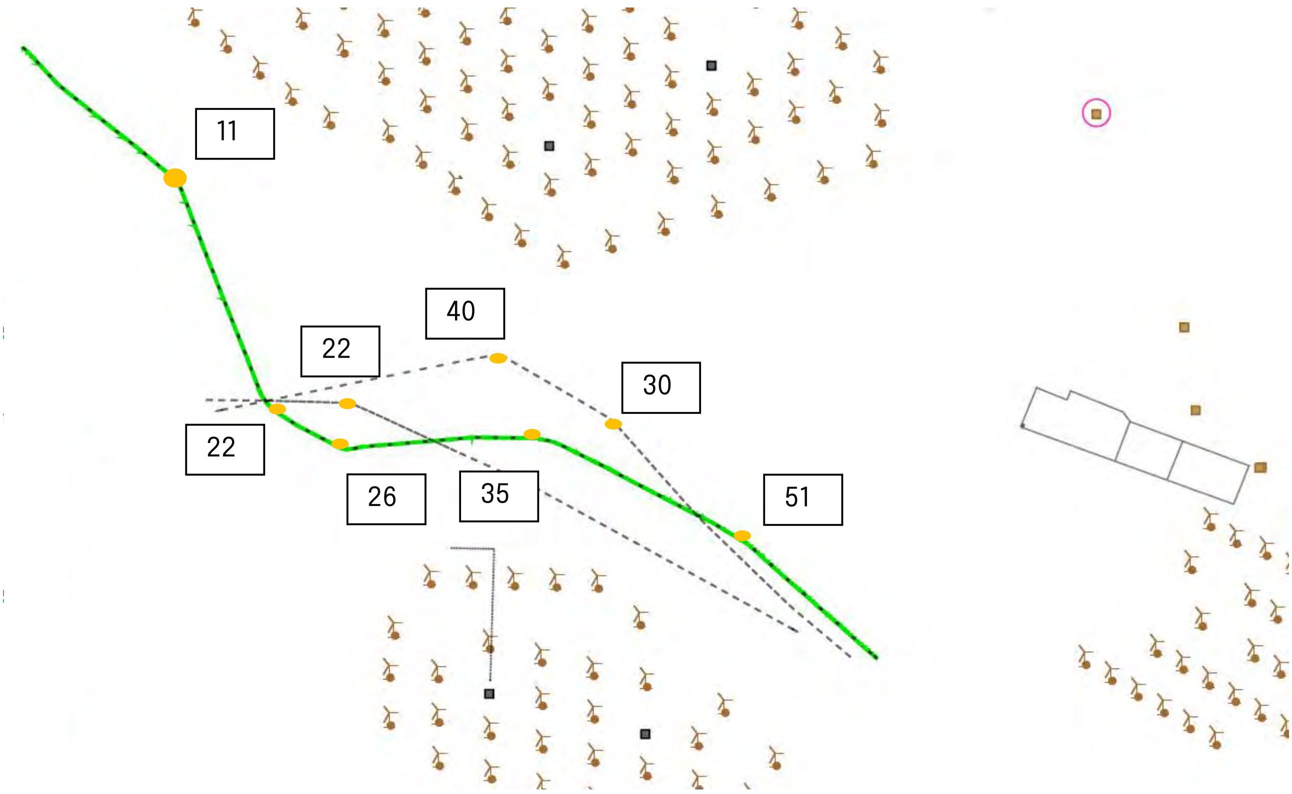
Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp
Manannan	125˚	JP	225˚	15 knots	1.5m	5.5s

Scenario
Route attempting to follow baseline course through Morgan-Mona gap with outbound traffic and OWF maintenance vessels outside of OWF area.



Actions of Vessels

Time	Manannan	Target vessel	Comments
11	Adjust heading by 30° to starboard (155°)	–	
22	Adjust heading by 30° to port (125°)	Adjust heading by	
26	Adjust heading by 35° to port (090°)	–	
30	–	Adjust heading by 20° to port (300°)	
35	Adjust heading by 30° to starboard (120°)	–	
40	–	Adjust heading by 40° to port (260°)	
51	Adjust heading by 10° to starboard (130°)	–	



Run Commentary
CPA maintained while in reduced visibility. Able to continue transit while following COLREGs.

Criteria	Outcome
Ship control	Success
Clearance from fixed infrastructure	Success
Clearance from other ships	Success
Under keel clearance	N/A
Response to an emergency	N/A
Cargo shift	Success
Dangerous seas	Success
Passenger comfort	Success
Vessel schedule	Success

Run: 08

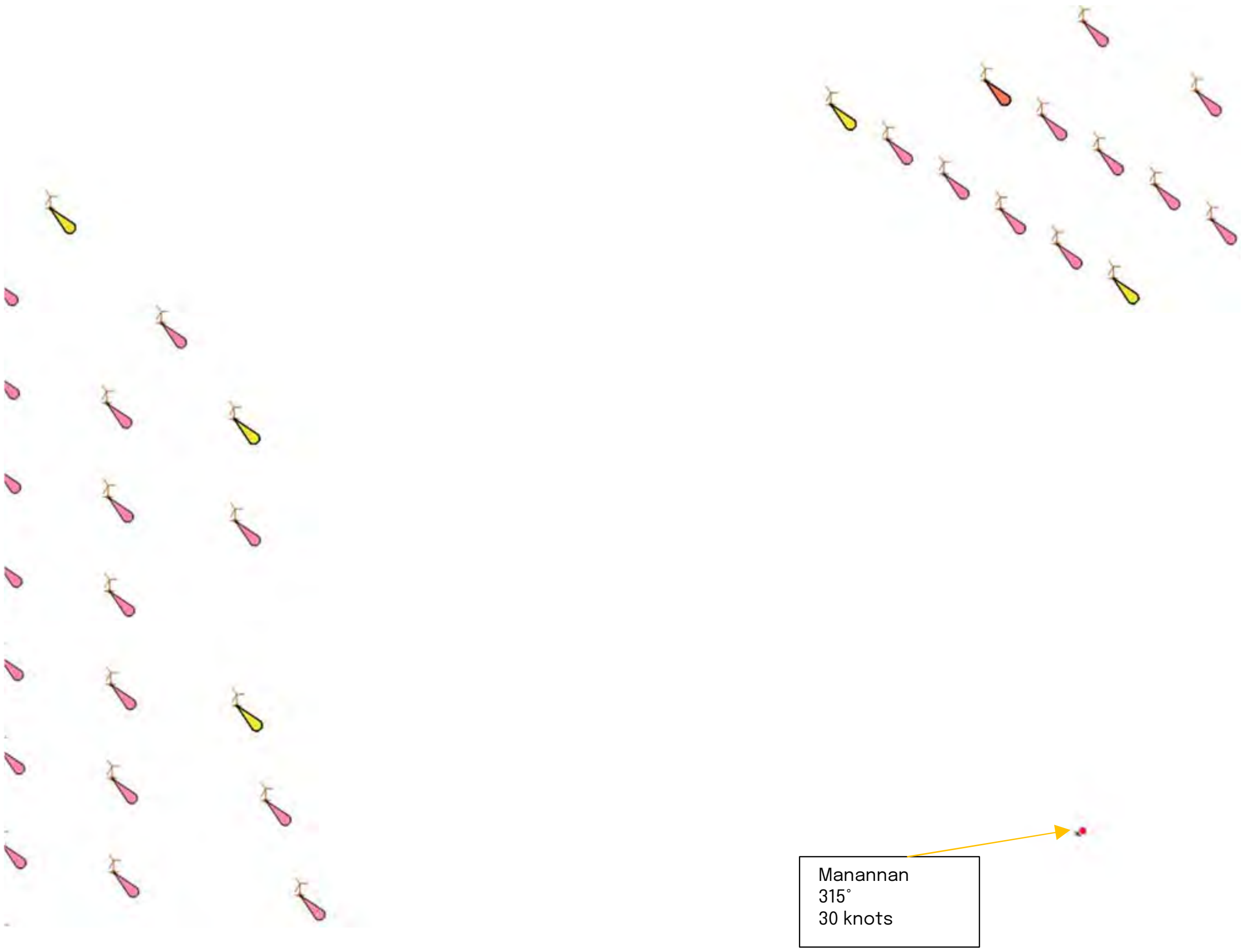
Location: Mona - Morecambe

Run Aims :

Consider requirement to return to Liverpool due to emergency

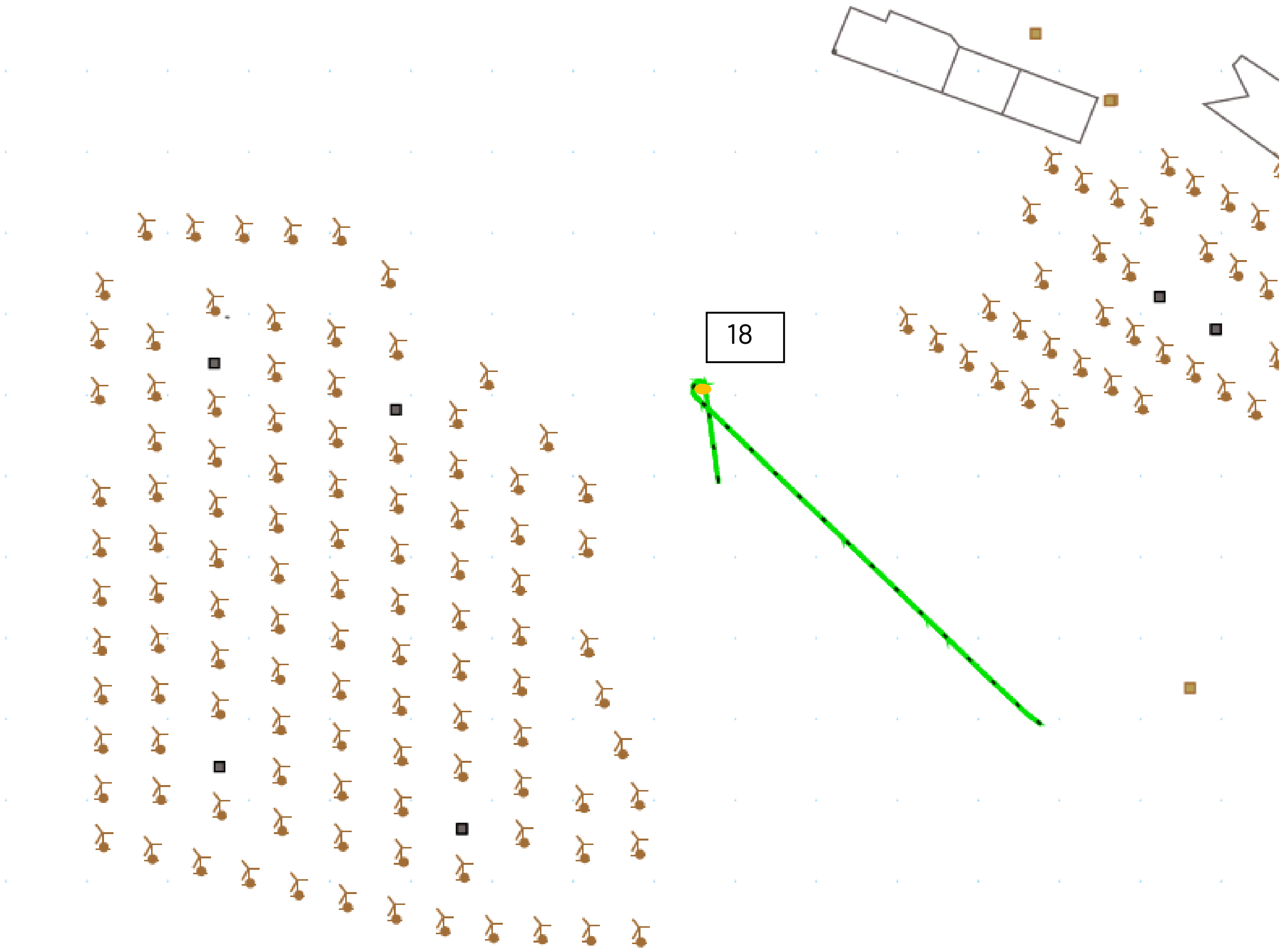
Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp
Manannan	315˚	JP	225˚	15 knots	1.5m	5.5s

Scenario
Emergency scenario onboard vessel which requires returning to port immediately in a constrained area of the OWF's



Actions of Vessels

Time	Manannan	Target vessel	Comments
18	Reduce speed to 20 knots and adjust heading by 205˚ (170˚)		



Run Commentary
Vessel was required to return to Liverpool due to an emergency, at the narrowest point in the Mona – Morecambe gap. No issues. Master noted this should be feasible in all locations.

Criteria	Outcome
Ship control	Success
Clearance from fixed infrastructure	Success
Clearance from other ships	Success
Under keel clearance	N/A
Response to an emergency	Success
Cargo shift	Success
Dangerous seas	Success
Passenger comfort	Success
Vessel schedule	Success

Run: 09

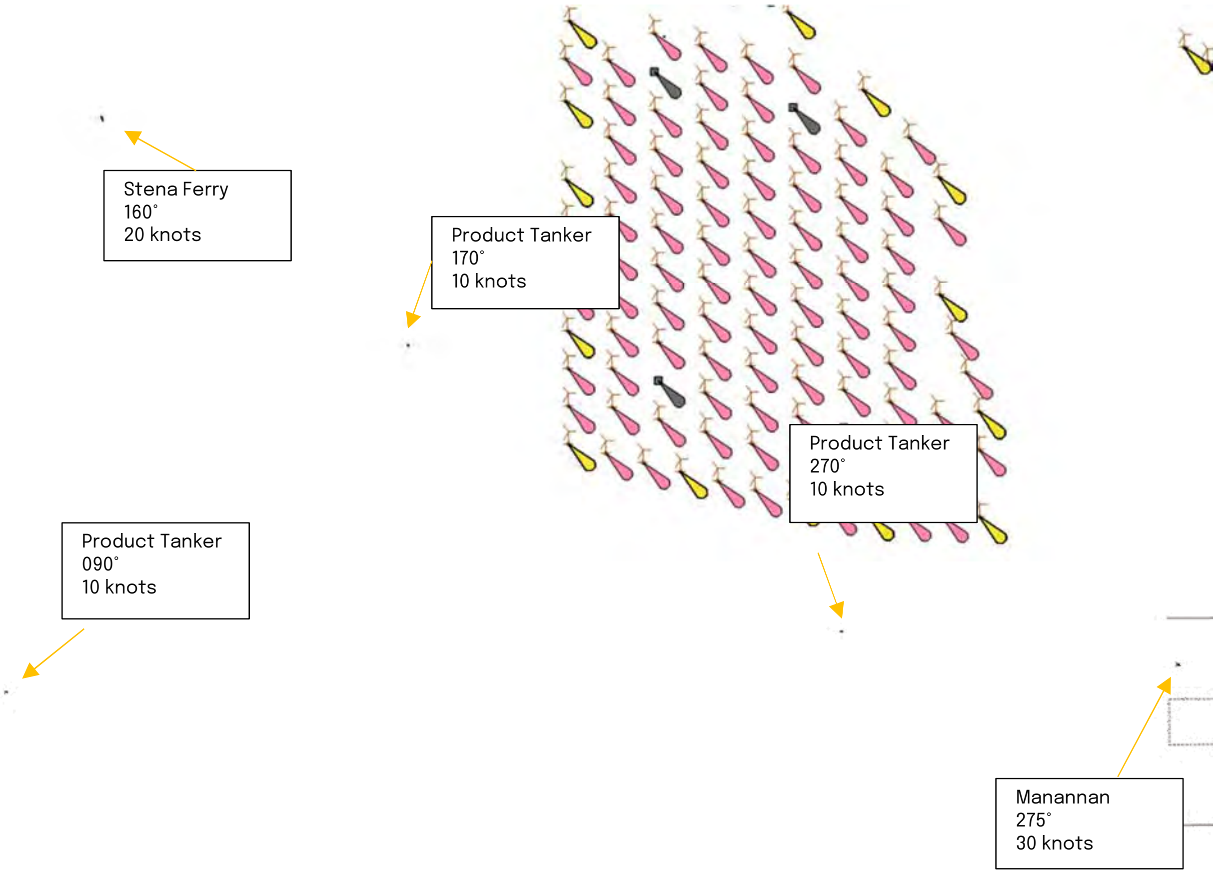
Location: South Mona

Run Aims :

Consider impact of traffic if transiting south of Mona on route from Liverpool to Douglas

Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp
Manannan	275˚	JP	225˚	20 knots	2.5m	5.5s

Scenario
Exiting TSS and passing a slower vessel with inbound traffic attempting to join TSS.



Actions of Vessels

Time	Manannan	Target vessel	Comments
15	Adjust heading by 10˚ to starboard (285˚)	-	
29	Adjust heading by 60˚ to starboard (345˚)	-	

Run Commentary
Relocation of southern border of Mona OWF provides increased sea room to allow the Mananan to overtake tanker. Decided to overtake to starboard with space available for further alterations if required. Slight alteration to port required to maintain 1NM CPA with no issues. This completed the planned runs with the Manannan.

Criteria	Outcome
Ship control	Success
Clearance from fixed infrastructure	Success
Clearance from other ships	Success
Under keel clearance	N/A
Response to an emergency	N/A
Cargo shift	Success
Dangerous seas	Success
Passenger comfort	Success
Vessel schedule	Success

Run: 10 (repeat of Run 02, with revised fishing vessels)

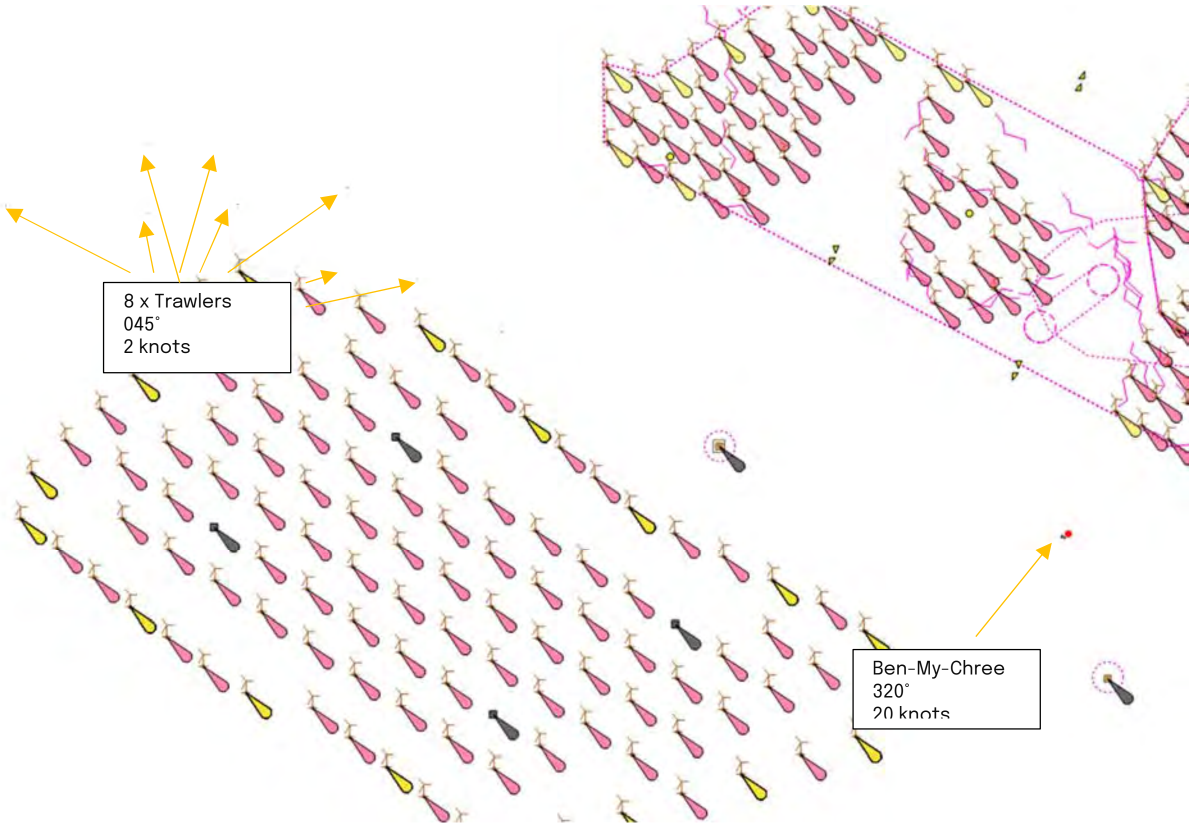
Location: South Mona

Run Aims :

Consider impact of fishing vessels at exit of the Walney – Morgan corridor.

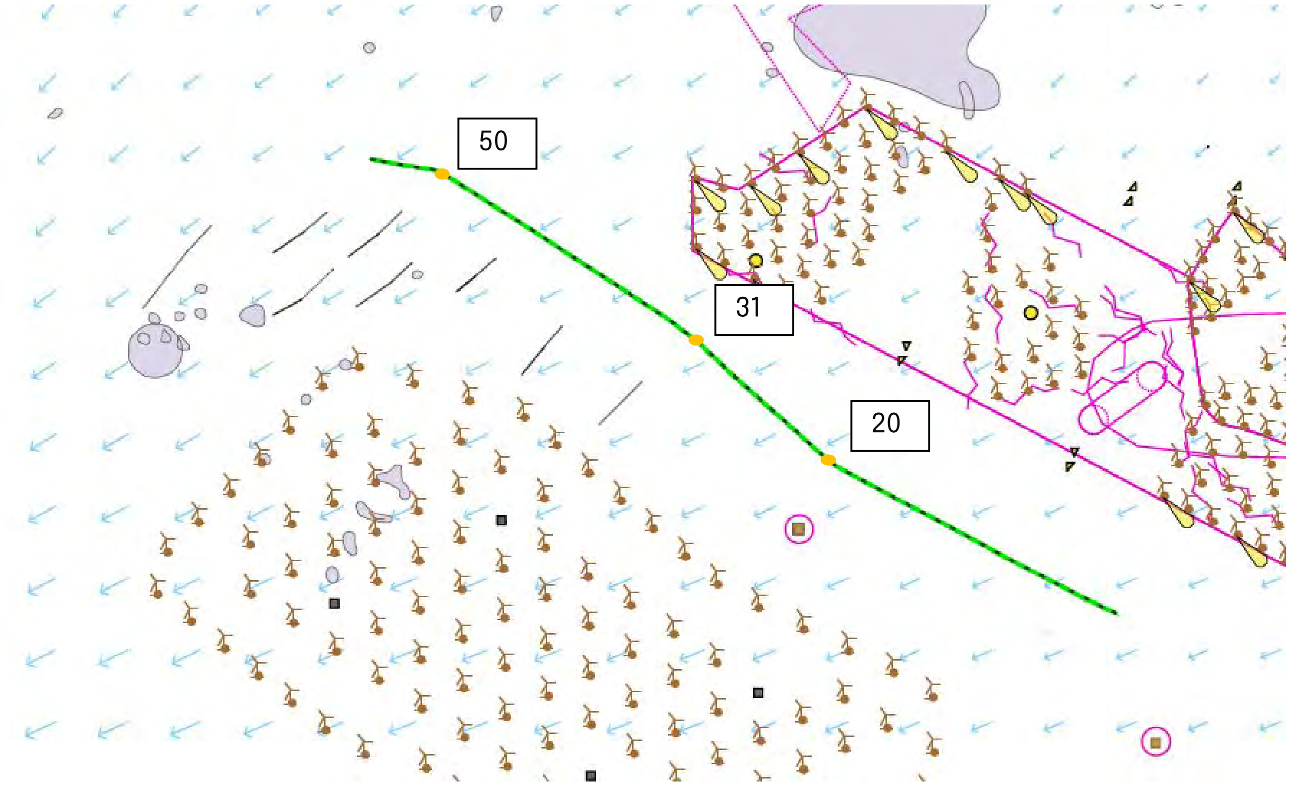
Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp
Ben-My-Chree	320˚	John Pirrie	225˚	25-30 knots	2.5m	6.5s

Scenario
Route attempting to follow baseline course once outside of Morgan-Walney corridor.



Actions of Vessels

Time	Ben-My-Chree	Target vessel	Comments
20	Adjust heading 10˚ to starboard (330˚)	-	Making new course with visual of trawlers in corridor
31	Return to original heading (320˚)	-	
50	Once clear of trawlers, adjust heading for Douglas (290˚)	-	



Run Commentary
Straightforward manoeuvre. Fishing vessels on the southern side of the boundary. Captain went to the starboard side to maintain a minimum 1NM CPA. Easiest to avoid the fishing fleet and took a route to the east of the trawlers. Increased width and removal of "hump" provided the range of options available.

Criteria	Outcome
Ship control	Success
Clearance from fixed infrastructure	Success
Clearance from other ships	Success
Under keel clearance	N/A
Response to an emergency	N/A
Cargo shift	Success
Dangerous seas	Success
Passenger comfort	Success
Vessel schedule	Success

Run: 11 – new run examining the IoM OWF

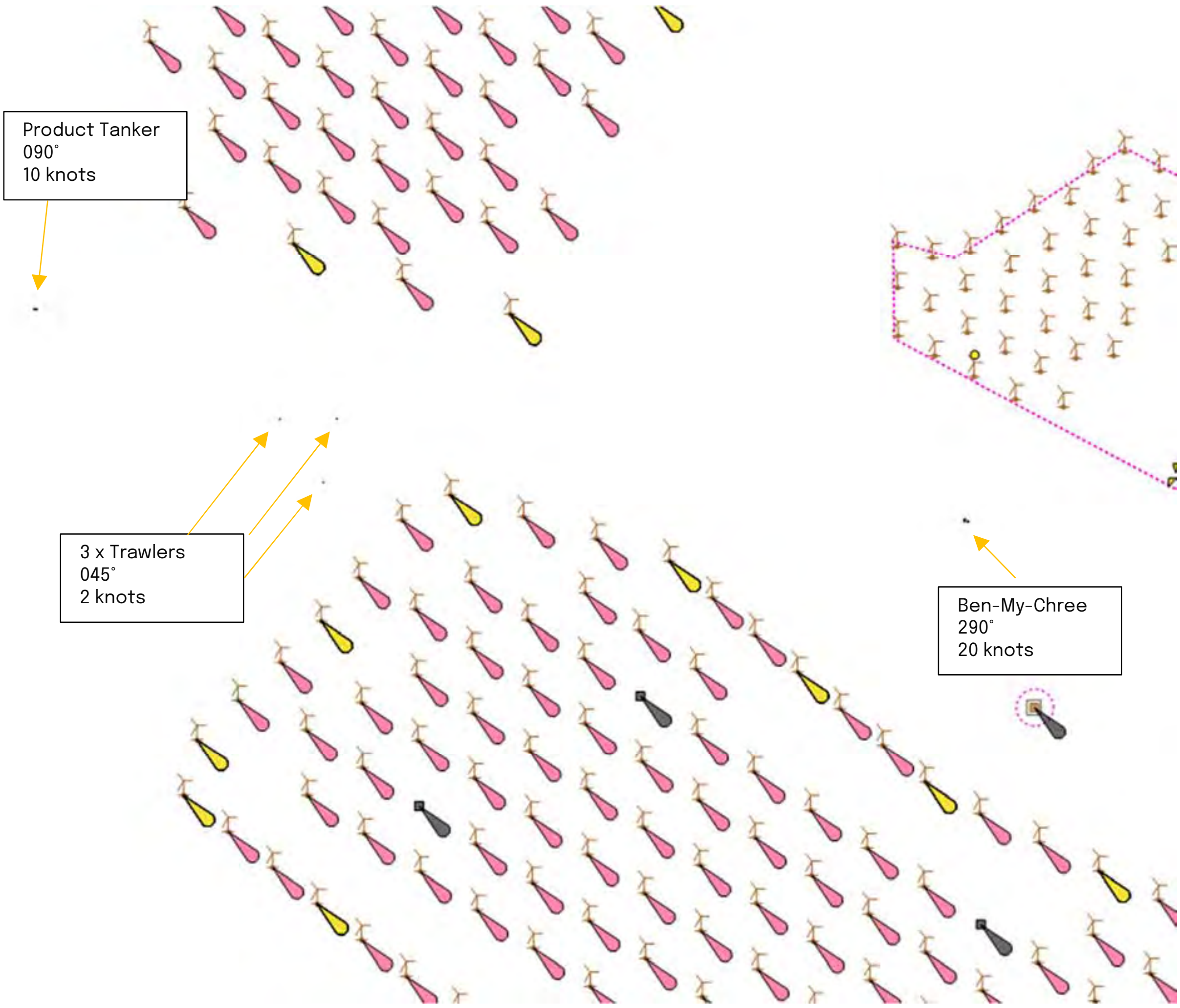
Location: North of Morgan

Run Aims :

Consider impact of head-on situation with BMC and a coastal vessel with 3 fishing vessels in the vicinity, at W exit of the Walney – Morgan corridor.

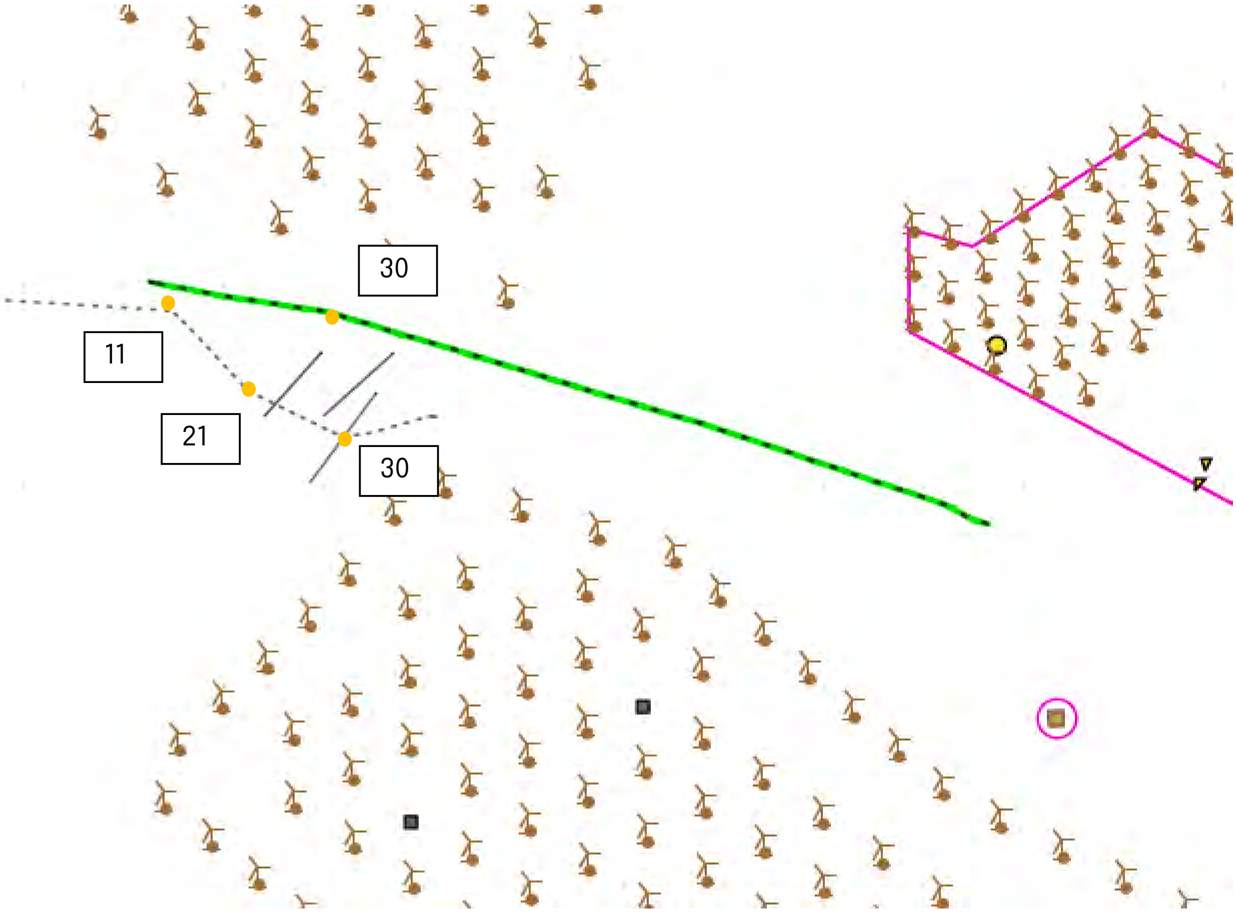
Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp
Ben-My-Chree	280°	JP	225°	20 knots	2.5m	6.0s

Scenario
Attempting to transit between Morgan and IOM proposed OWF with a west-bound product tanker as traffic and 3 x IOM fishing vessels in practice.



Actions of Vessels

Time	Ben-My-Chree	Target vessel	Comments
11	-	Product tanker adjusts heading 50° to starboard (140°)	
21	-	Product tanker adjusts heading to follow astern of the trawlers (115°)	
30	Adjust heading 10° to port (280°)	Product tanker returns to heading for middle of Morgan-IOM corridor (075°)	



Run Commentary
Both vessels should alter course to starboard, according to COLREGs, with east-bound ship having to come within 1 NM of fishing vessels, but avoiding them, and then attempted to get back on track – so CPAs were less than 1NM. Captain altered course for fishing vessels, to pass between them and OWF, but by then the coastal vessel had come round, so passed with significantly less than 1NM to IoM OWF. So such manoeuvres are possible, but there are no safety margins and the required CPAs are not met. Both vessels required to take action, so evaluation criteria below apply to both vessels.

Criteria	Outcome
Ship control	Success
Clearance from fixed infrastructure	Fail
Clearance from other ships	Fail
Under keel clearance	N/A
Response to an emergency	N/A
Cargo shift	Success
Dangerous seas	Success
Passenger comfort	Success
Vessel schedule	Success (small alteration only)

Run 12 Night scene

Run Commentary
Despite the simulator not showing other vessel masthead and stern lights, due to a technical problem, the night scene was demonstrated with vessels moving both in front of and within the Mona OWF. It confirmed that moving vessels could be seen within and in front of the OWF, due to the relatively wide spacing of the wind turbines and as their lights are at an elevation of over 150m above the sea surface. Also OWF lights make it readily apparent. Still concerns that a vessel required to show only a steady read light, may not be readily apparent. Current experience of issues with craft appearing from Burbo Bank OWF, although the spacing of the wind turbines is much closer.

Run: 13 – Emergency scenario, coming head to wind in Morgan-Mona gap

Location: Morgan – Mona gap

Run Aims :

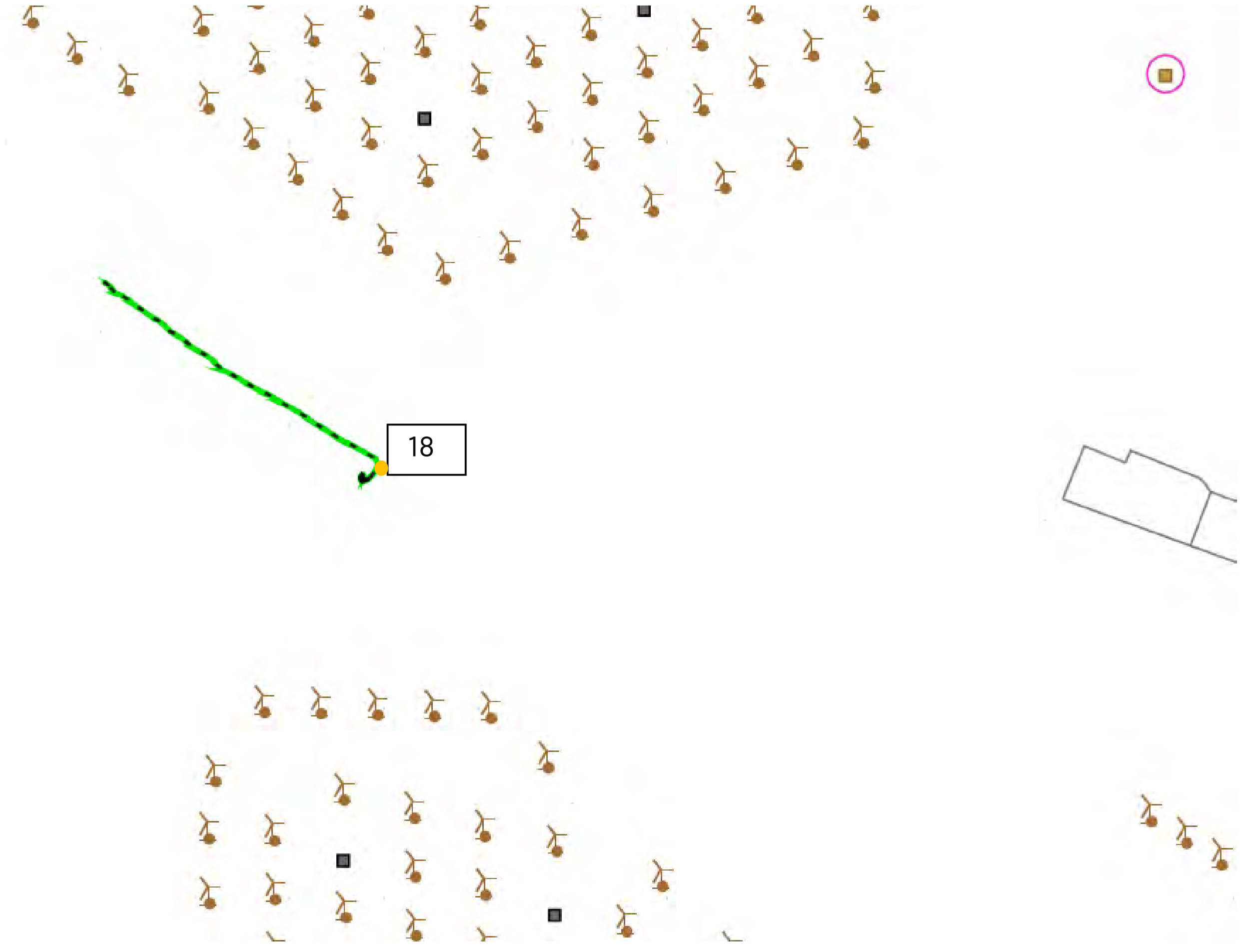
Consider impact of emergency situation (fire, spillage, preparing for helicopter evacuation) that requires the BMC to come head to wind within the Morgan – Mona gap.

Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp
Ben-My-Chree	121°	JP	225°	31-40 knots	3m	7.0s

Scenario
Emergency scenario attempting to come head to wind in the Morgan-Mona gap

Actions of Vessels

Time	Ben-My-Chree	Target vessel	Comments
18	Adjust heading to head to wind (240°)	-	Expected to follow the directions of the coastguard or make head to wind.



Run Commentary
On passage in monthly conditions, so with Hs 3m sea state, and incident occurring in narrowest part of Morgan-Mona gap, such that the vessel needed to come head to wind and slow to rectify the situation. Was able to keep ship's bow to wind using bow thruster and ship's engine and could continue for some time.

Criteria	Outcome
Ship control	Success
Clearance from fixed infrastructure	Success
Clearance from other ships	Success
Under keel clearance	N/A
Response to an emergency	Success
Cargo shift	N/A as assumed cause of emergency
Dangerous seas	Success
Passenger comfort	Success (would have been more comfortable once they came head to wind)
Vessel schedule	N/A

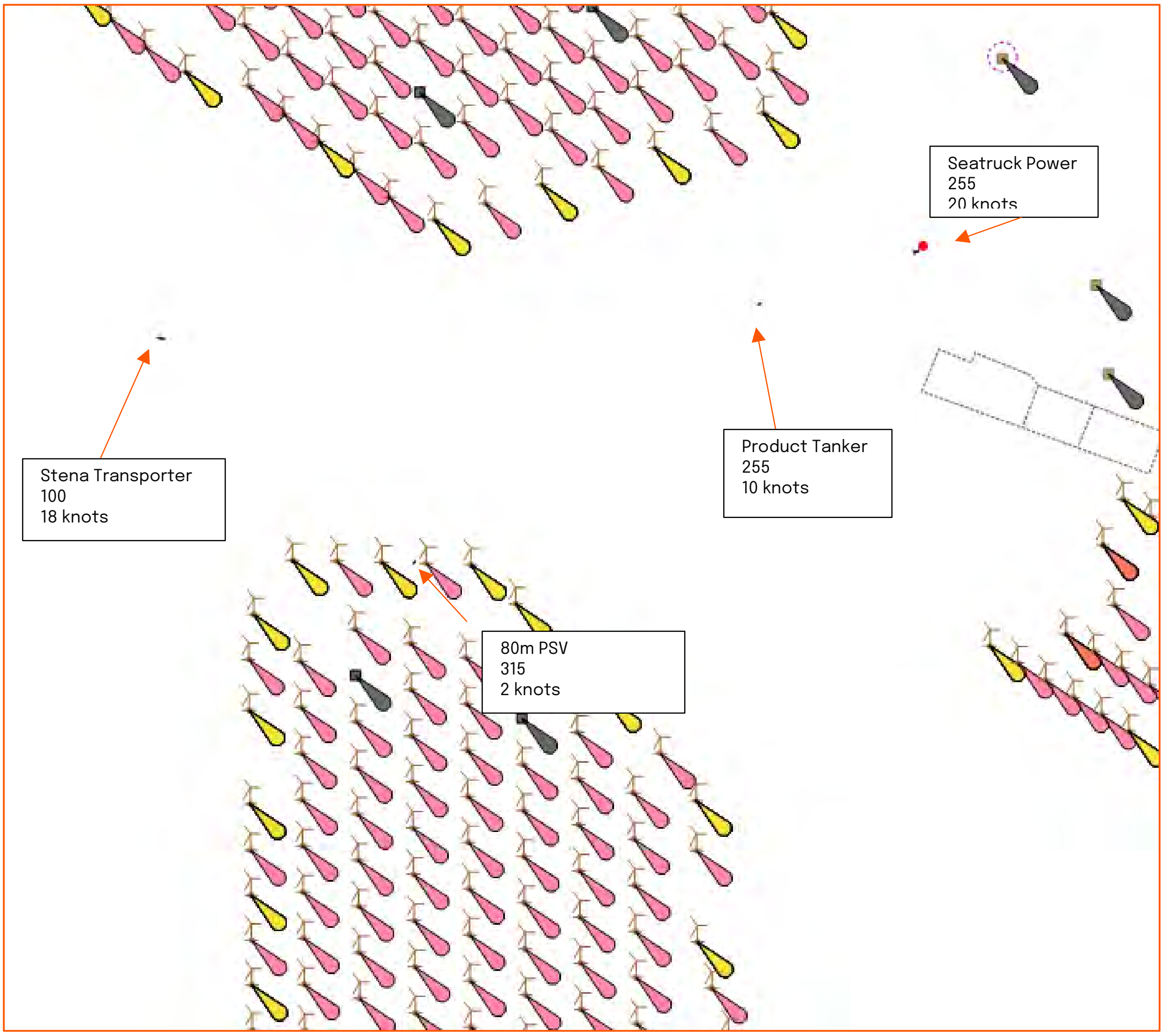
B.3 Seatruck

Run: 01

Location: Morgan and Mona corridor (HEY-WAR)

Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Seatruck Power	255	AK	SW (225)	15 knots	1.5m	5.5s

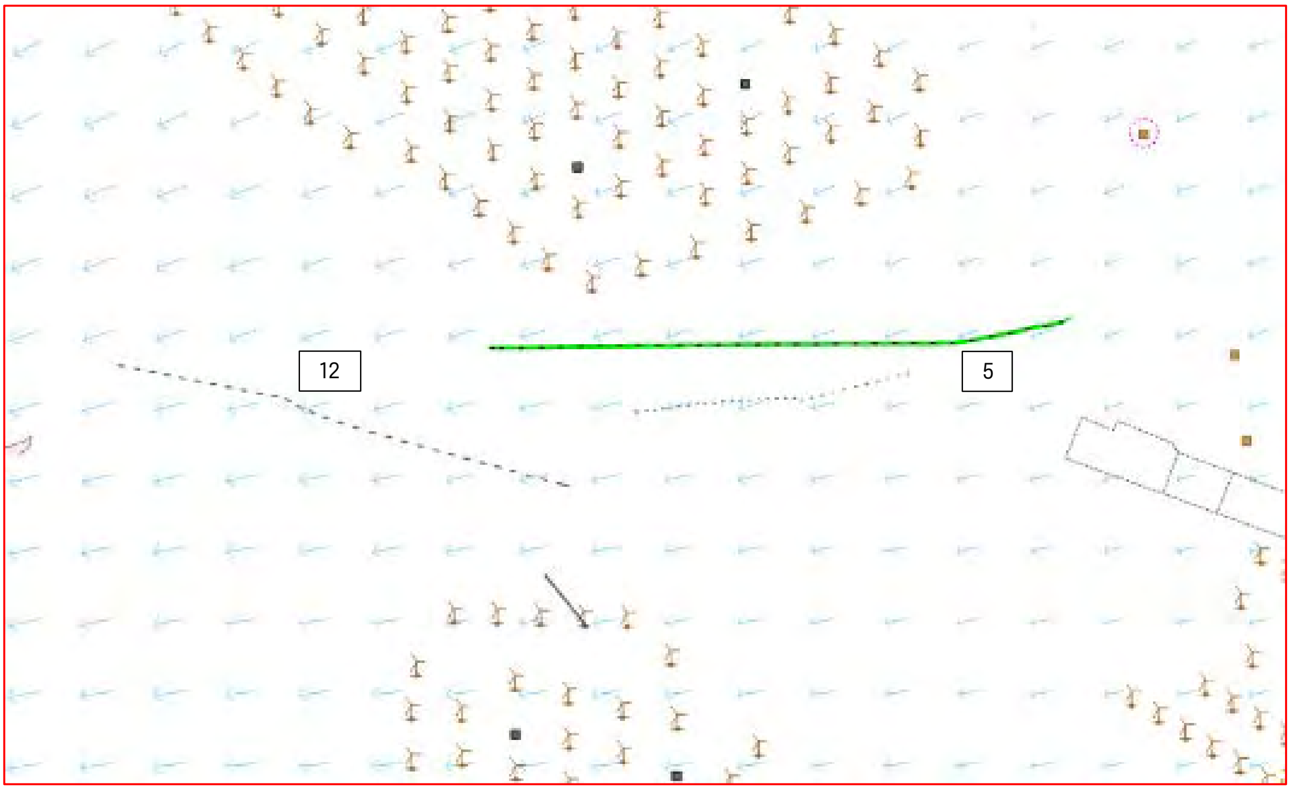
Scenario
Familiarisation run. To ensure that the operator is content with the simulator operation and setup. Make an initial assessment of the updated boundaries comparison base on RT 003 Run 2.



Actions of Vessels

Time	Seatruck Power	Target vessel	Comments
05	Alter course to 270	Adjust course to overtake slower moving product tanker	Able to overtake product tanker and maintain 1nm on CPA on OWF
12	-	Stena Transporter alters course to starboard by 25˚	East bound Stena transporter alters course to starboard to increase CPA 1NM with westbound product tanker .

Run commentary
Increased sea room provided by boundary changes make dealing with the situation very straight forward. 1nm CPA on Loya. 1nm CPA on Stena transporter. Able to identify traffic within wind farms visually and by radar.



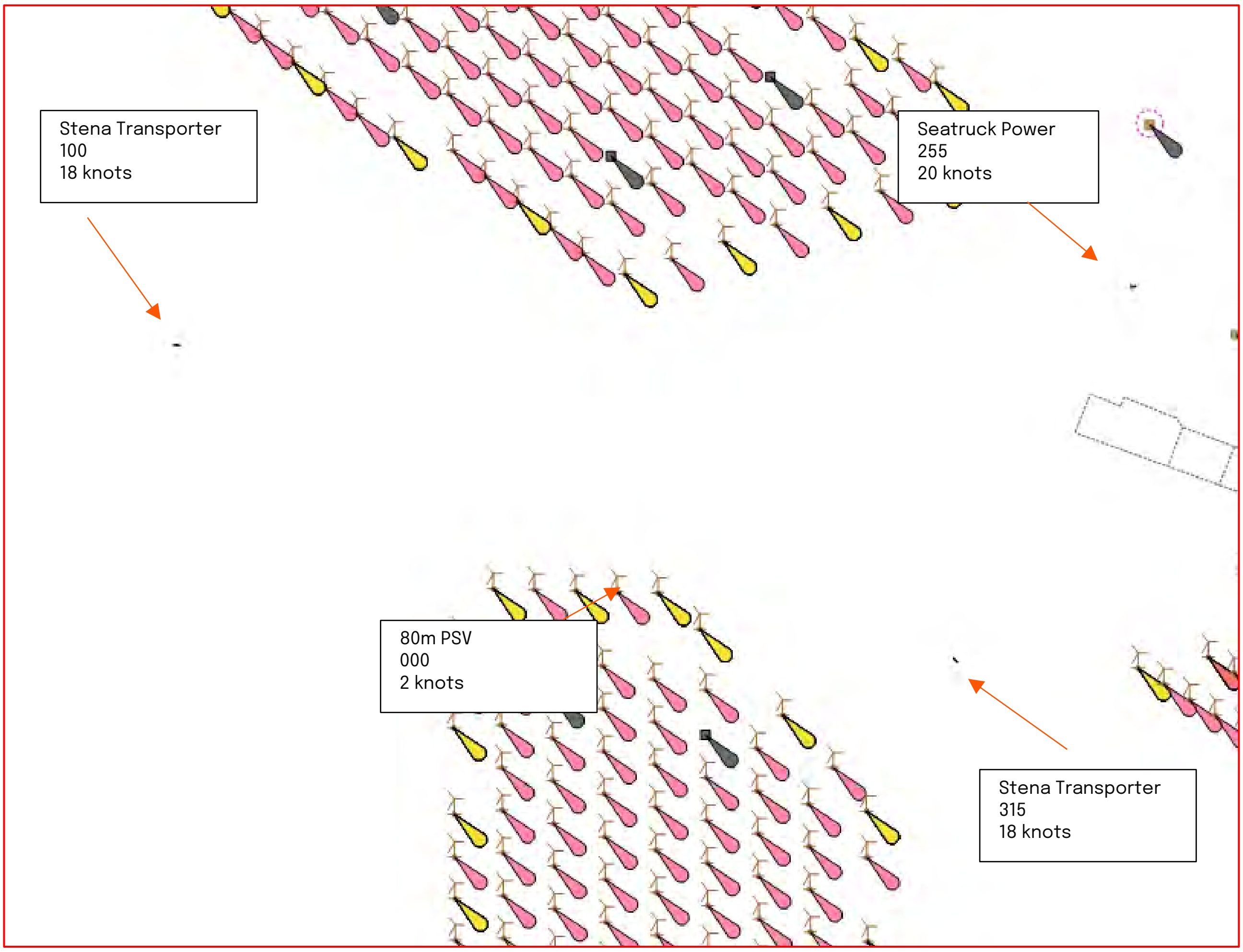
Criteria	Grading	Comment
Ship control	S	
Clearance - Fixed objects/boundaries	S	
Clearance - Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	S	
Impact on schedule	S	

Run: 02

Location: Morgan and Mona corridor (HEY-WAR)

Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp
Seatruck Power	255	IS	SW (225)	30 knots	3.0m	7.0s

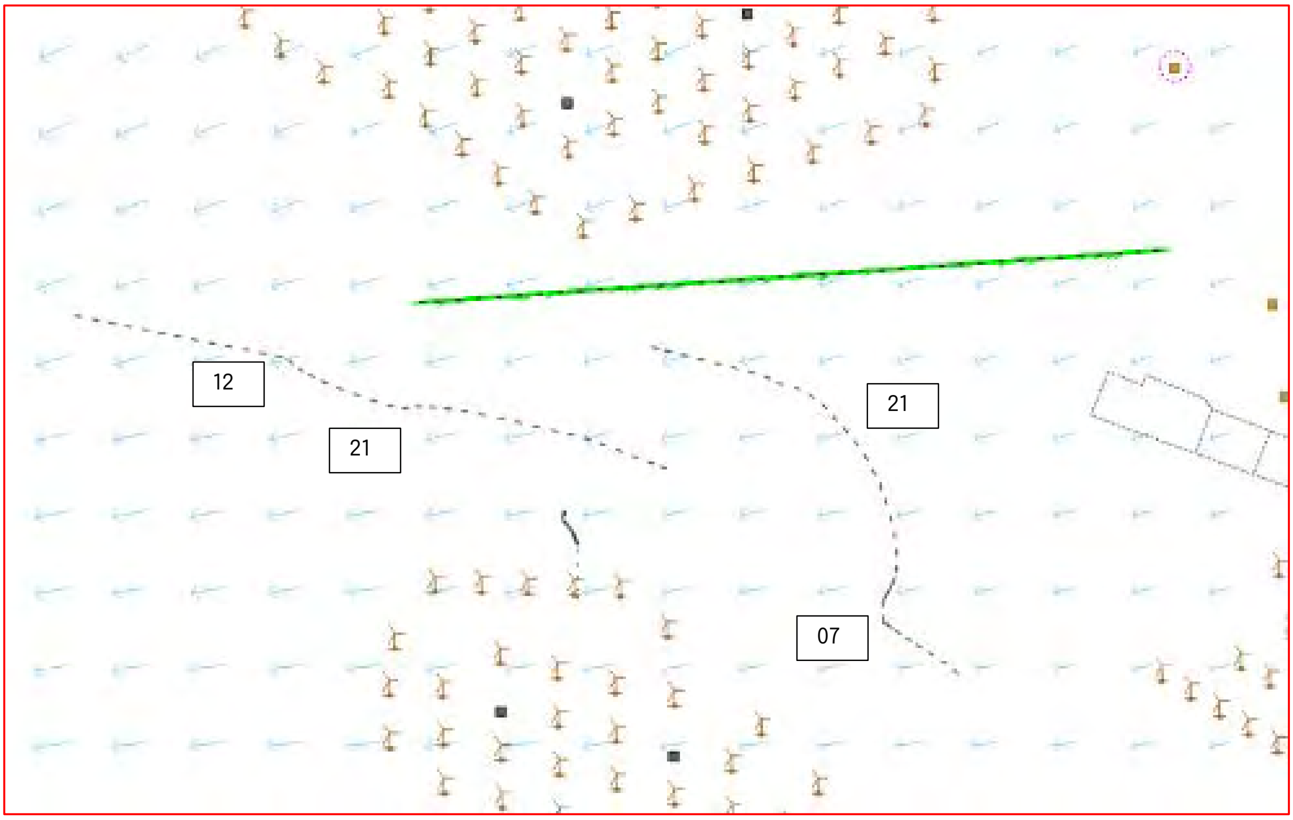
Scenario
To make a further assessment of the updated boundaries Morgan Mona OWF. Considering basic traffic levels. To make a direct comparison with challenging situation identified in RT003 Run 12.



Actions of Vessels

Time	Seatruck Power	Target vessel	Comments
7		Stena Transporter make bold alteration to starboard	Northbound Stena Transporter required to give way to Seatruck Power

Time	Seatruck Power	Target vessel	Comments
12	-	As give way vessel, Stena Transporter eastbound (EB) makes a bold alteration of course 35˚ to starboard.	
21	-	Stena Transporter EB follows astern of Seatruck until able to rejoin original course. Stena Transporter WB alters course to maintain 1nm CPA from PSV	



Run commentary
Sufficient room for 3 vessels to navigate simultaneously through the Morgan Mona corridor. The northbound ferry is required to make a bold alteration of course to give way to Seatruck Power, resumes navigation track with a delay of less than 5 minutes. All vessels operating within the OWF can be identified visually and by radar.

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Objective Assessment

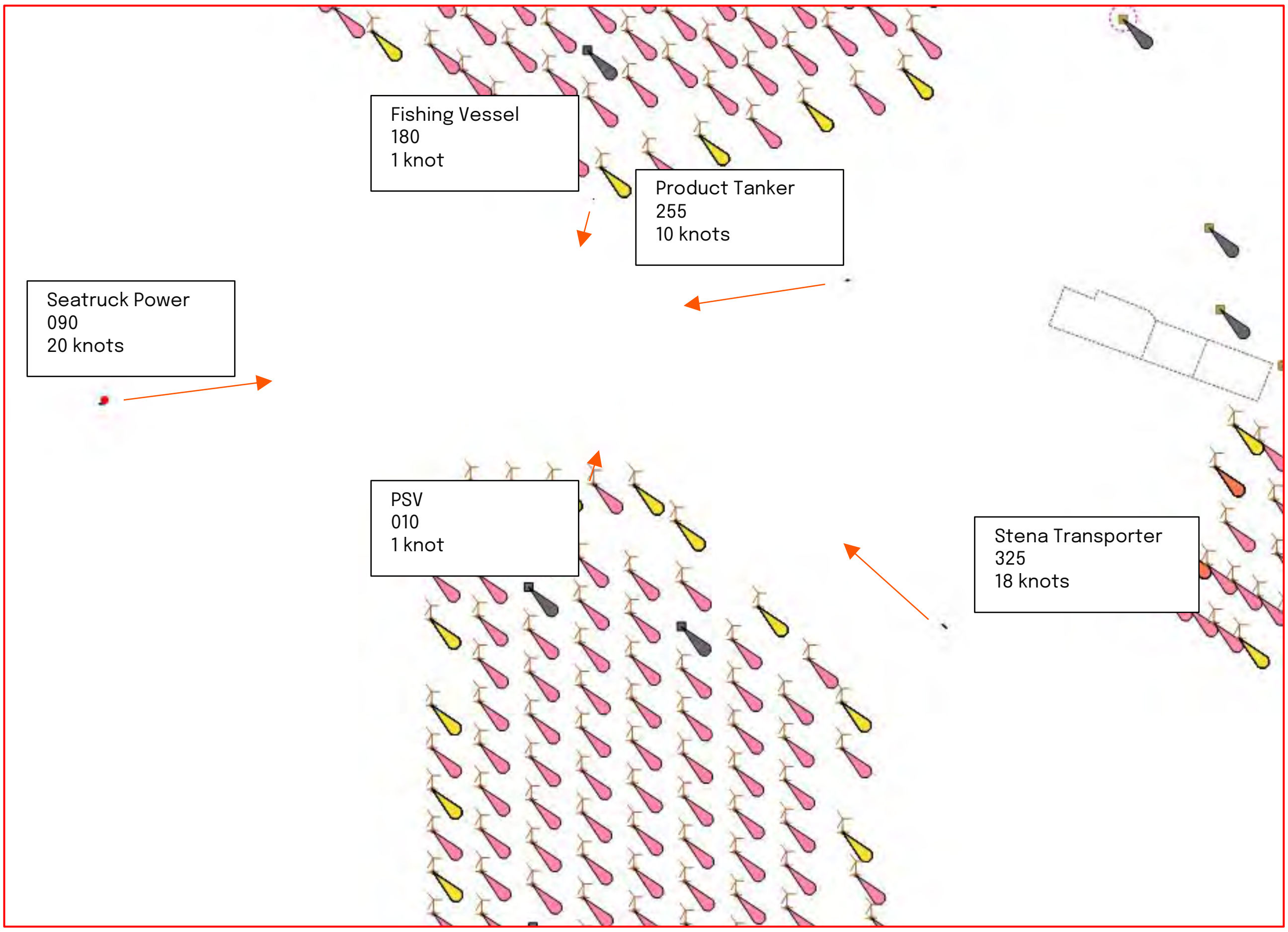
Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	S	
Impact on schedule	S	

Run: 03

Location: Morgan – Mona corridor (DUB-HEY)

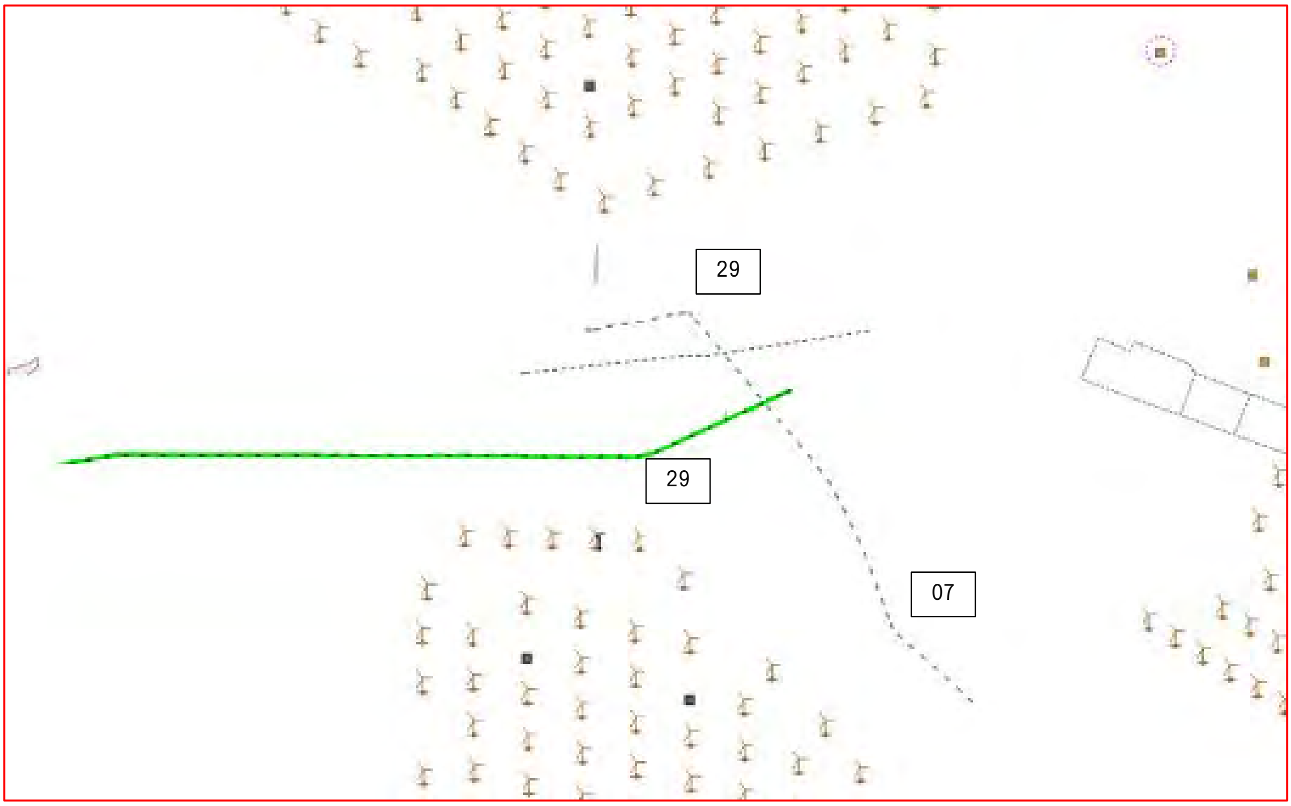
Model	Passage direction	Pilot	Wind direction	Wind speed	Wave Hs	Wave Tp
Seatruck Power	090	AK	SW (225)	30 knots	3.0m	7.0s

Scenario
To consider the ability of the vessel to detect and make safe adjustments in response a busy shipping situation including fast moving craft emerging from the OWF. To make a direct comparison with challenging situation identified in Summer 2022, RT003-Run 3. 1 x 212m RoRo (Stena Transporter). 1 x PSV. 1 x Product Tanker. 1 x Fishing Vessel.



Actions of vessels

Time	Seatruck Power	Target vessel	Comments
07	-	RoRo eastbound alters course by 30˚ to pass stern of the product tanker	
29	Alter course to 050 to continue planned passage to Heysham	RoRo returns to planned passage once astern of the product tanker and to maintain 1nm CPA of fishing vessel	



Run commentary
No issue identified.
With the increased boundaries, there is sufficient space for concurrent safe transit of 3 vessels.
The increased boundary provides sufficient space that a suitably qualified and experienced OOW would be able to manage this type of situation without requiring support from the master.

Objective assessment

Criteria	Grading	Comment
Ship control	S	
Clearance - Fixed objects/boundaries	S	
Clearance - Ships	S	
UKC	S	
Respond to emergency	N/A	

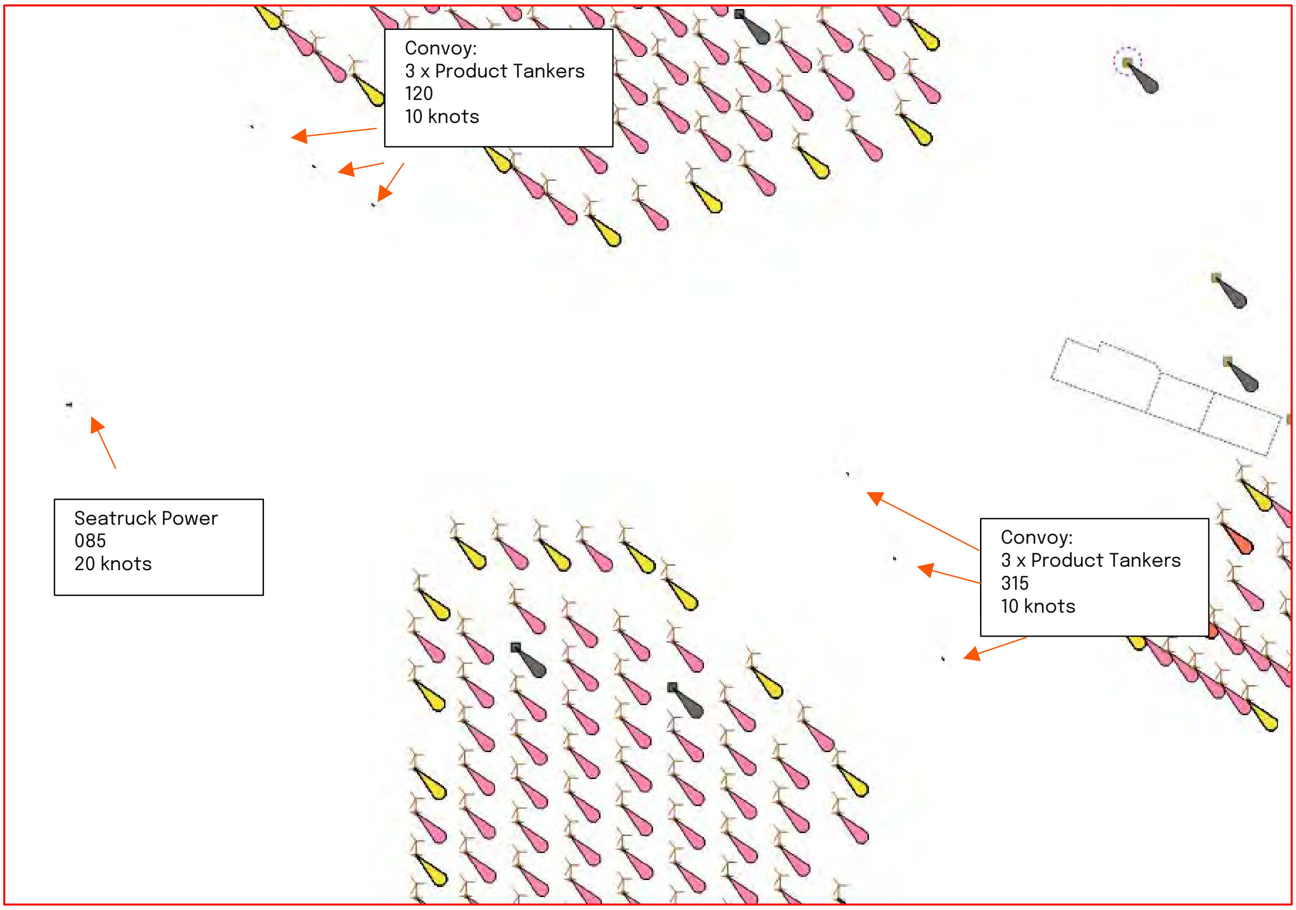
Criteria	Grading	Comment
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	S	
Impact on schedule	S	

Run: 04

Location: Morgan and Mona corridor (DUB - HEY)

Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp	Current
Seatruck Power	085	Seatruck	SW (225)	30-40 knots	3.0m	7.0s	Grid

Scenario
To consider the ability of the vessel to detect and make safe adjustments in response to developing situations. Traffic set to reasonable worst credible level in accordance with scoping document. 2 x Convoy (northbound & southbound). Convoys : 3 x 147m product tankers. Both convoys set to arrive at mid-point of Morgan Mona corridor concurrently.



Actions of vessels

Time	Seatruck Power	Target vessel	Comments
01	Alter course to 110 to pass ahead of southbound convoy and astern of northbound convoy	-	

Time	Seatruck Power	Target vessel	Comments
10	–	Northbound convoy adjusts course to pass through corridor and maintain 1nm CPA of OWF	
34	Alter course to 085 to return to original passage plan	Northbound convoy has crossed the bow	

Run commentary
No issues identified in passage.
Sea room with revised boundaries is adequate to take normal avoiding manoeuvres.
Careful consideration, the situation found in, able to maintain a heading and suitable control of vessel.

Objective assessment

Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	

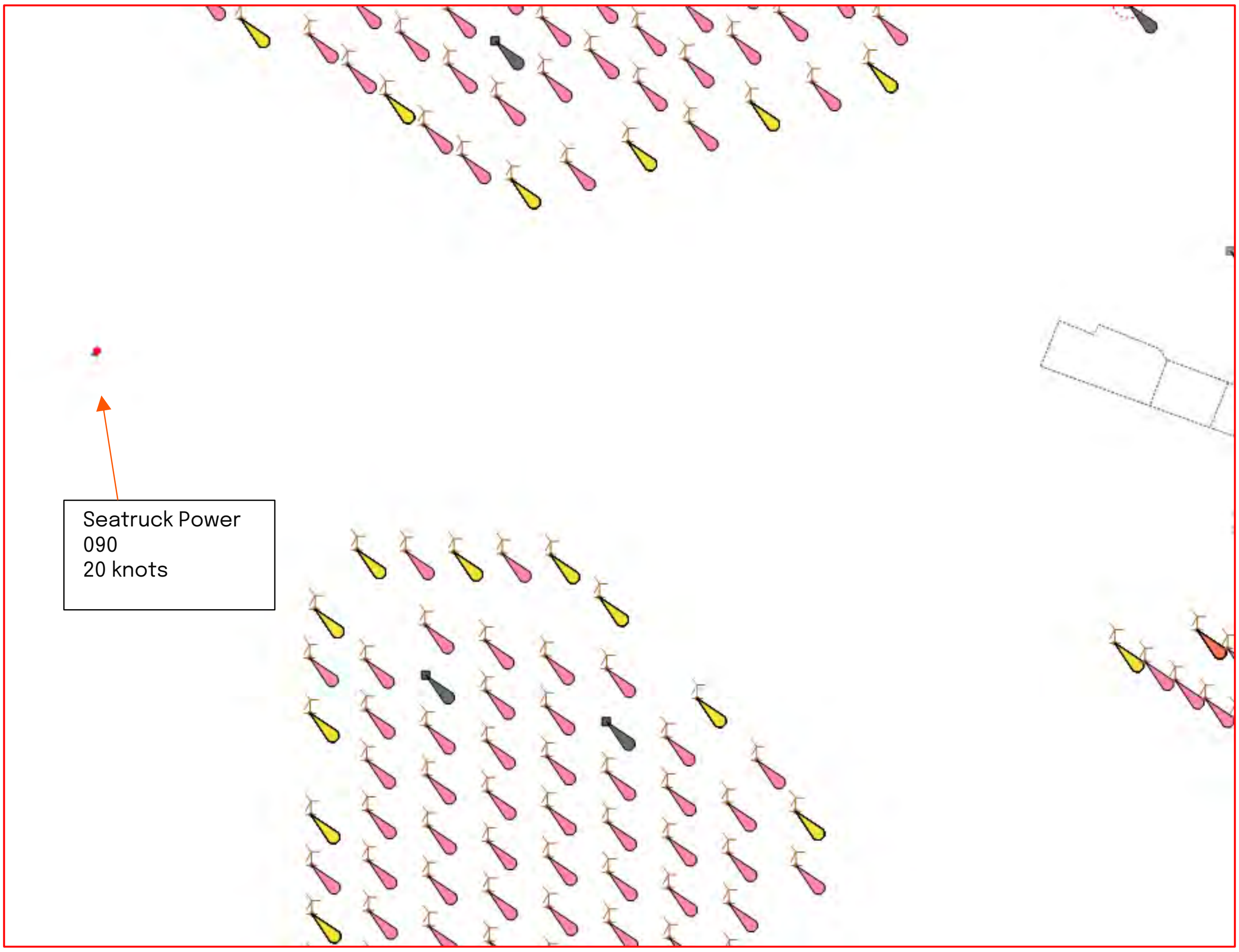
Criteria	Grading	Comment
Maintain passenger comfort	S	
Impact on schedule	S	

Run: 05

Location: Morgan & Mona (DUB-HEY)

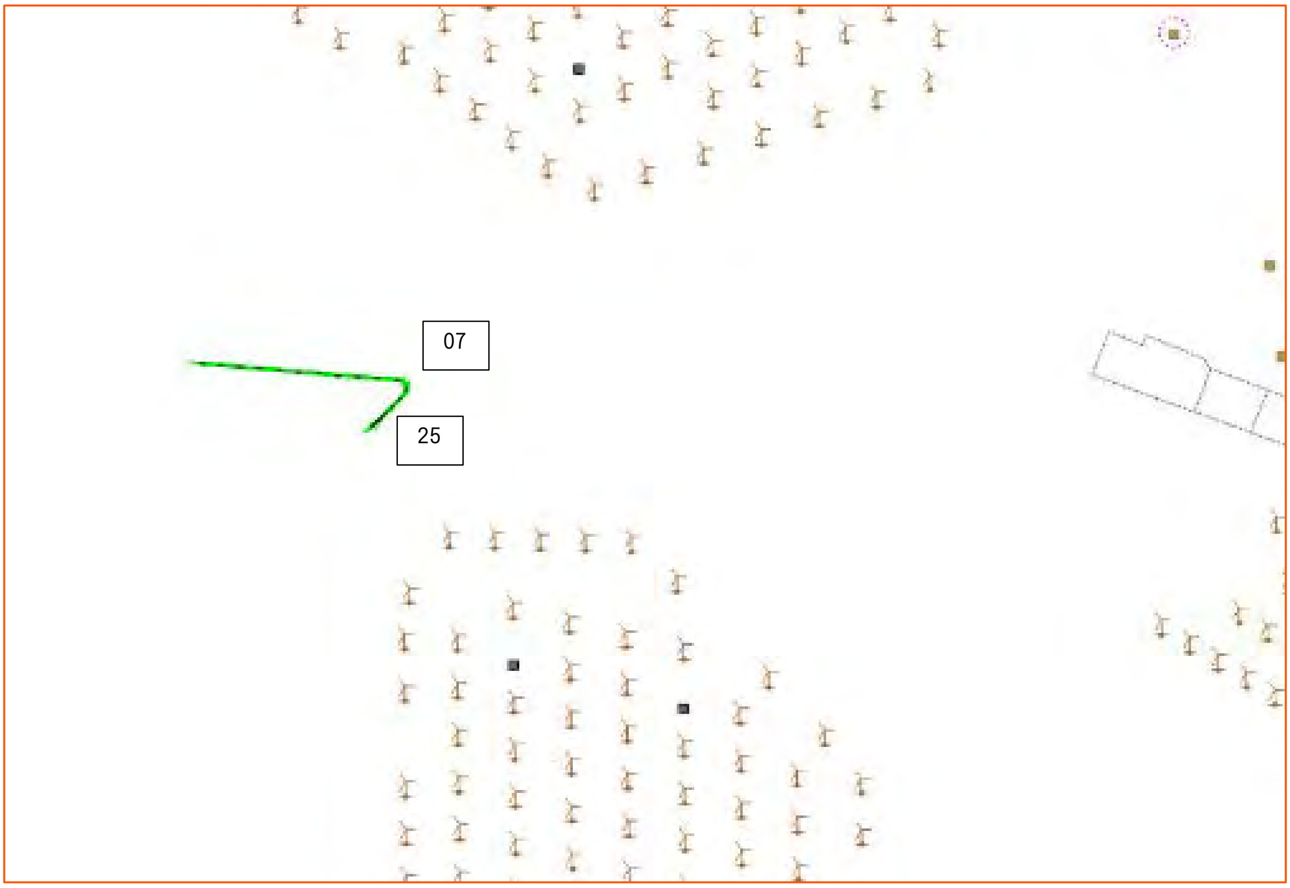
Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp	Current
Seatruck Power	090	IS	SW (225)	30 knots	3.0m	7.0s	Grid

Scenario
Determine heave to speed and drift and the relationship that has with mean passage plan and the adopted 1nm safety on fixed structures. Traffic: Nil.



Actions of vessels

Time	Seatruck Power	Target vessel	Comments
07	Altercourse to head into wind (change of course by 135 to starboard)	N/A	
25	Speed reduced to 1.5 knots SOG	N/A	



Run commentary
In the simulator the ship was able to maintain heading heave to at 1.5 knots. Due to the limitations of the simulator in the sea state simulated it was agreed that the sea truck master experience that a minimum of 3 knot head way will be required to maintain control of the vessel. It may not be necessary to head directly into the wind to deal with a fire. It was agreed that the master would need to make a decision on the safest course of action in the event of a fire in heavy seas and strong winds. It might not always be possible to take the optimum action due to the proximity of the OWF.

Objective assessment

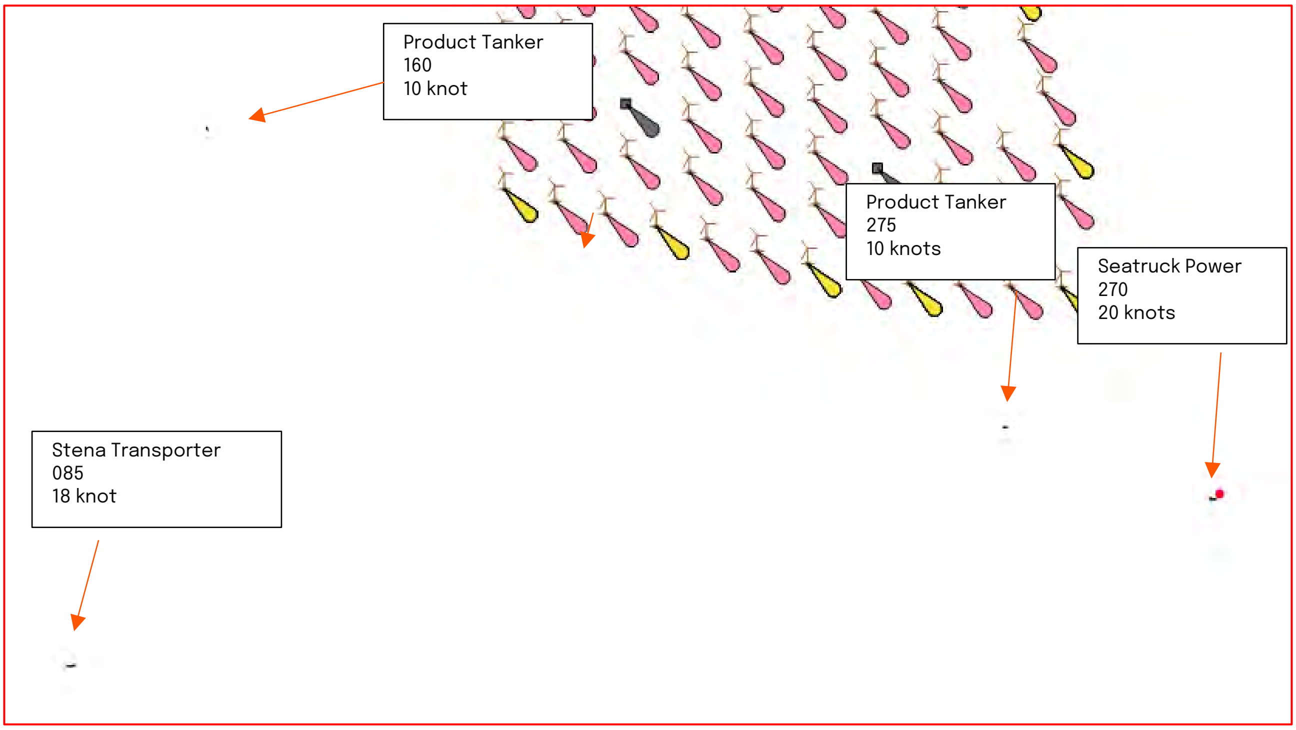
Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	
UKC	S	
Respond to emergency	S	
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	NA	The alteration of course was required to deal with the emergency
Impact on schedule	NA	Any delay is due to the emergency not the OWF

Run: 06

Location: South of Mona, LIV-DUB

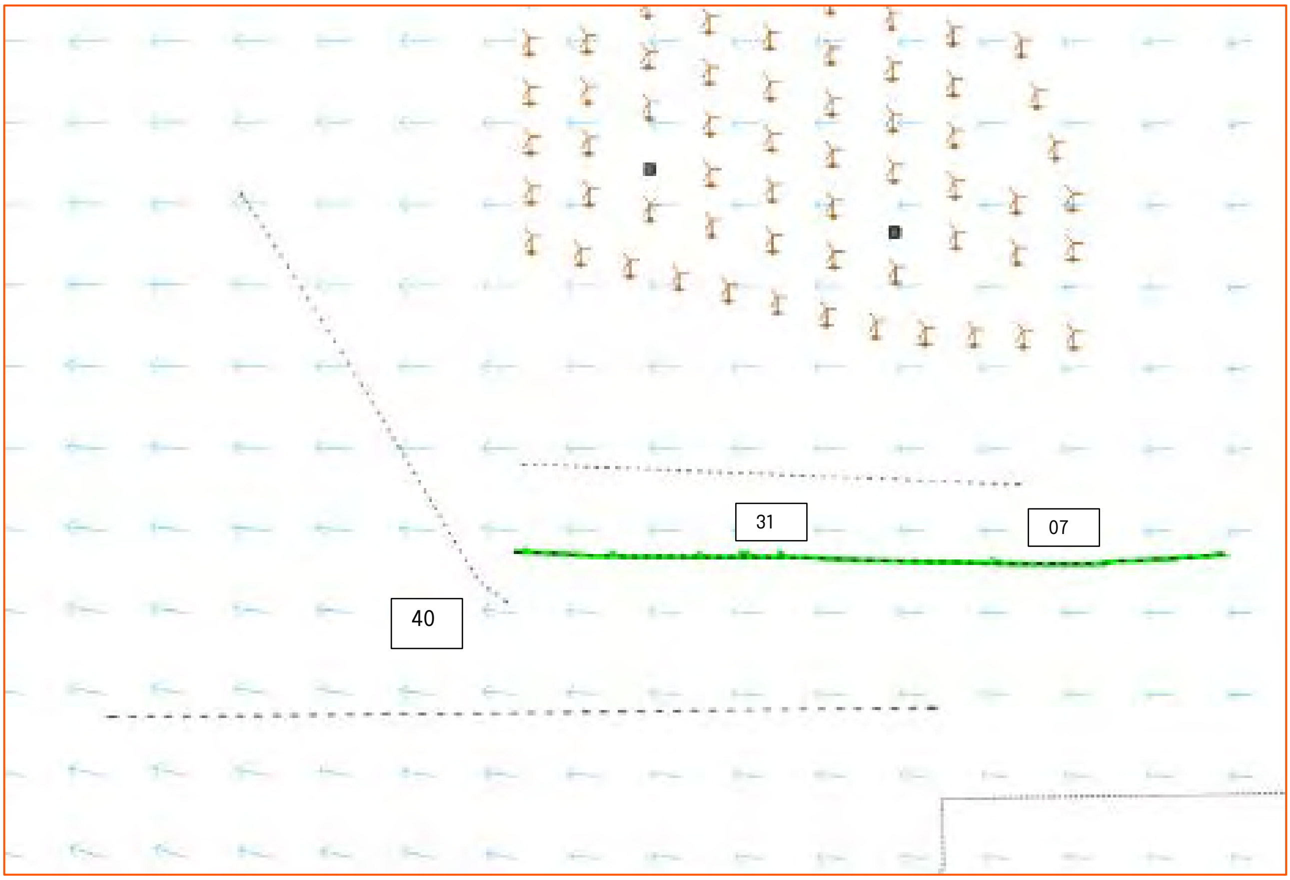
Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp	Current
Seatruck Power	270	All	WNW (292.5)	40 knots	2.9m	8.3s	Grid

Scenario
Consider the effect of revised boundaries at Mona and how the additional sea room effects traffic heading to Dublin via the TSS.



Actions of vessels

Time	Seatruck Power	Target vessel	Comments
7	After developing initial situational awareness decision is made to Seatruck overtake Product tanker to the south	-	
31	Reduced speed to 13 knots to increase CPA on southbound product tanker to more than 1NM	Product tanker southbound maintains course and speed stand-on vessel	
40	Return to passage speed 20 knots	Southbound product tanker alter course to join TSS	



Run commentary

Pilot concerned that overhauling the product tanker to the north would compromise the intended safe distance from the OWF.

The geometry of the OWF in relationship to the TSS increases the potential for westbound traffic to be required to give way to south bound traffic from Douglas joining the TSS. This will result in minor additional delays.

Objective assessment

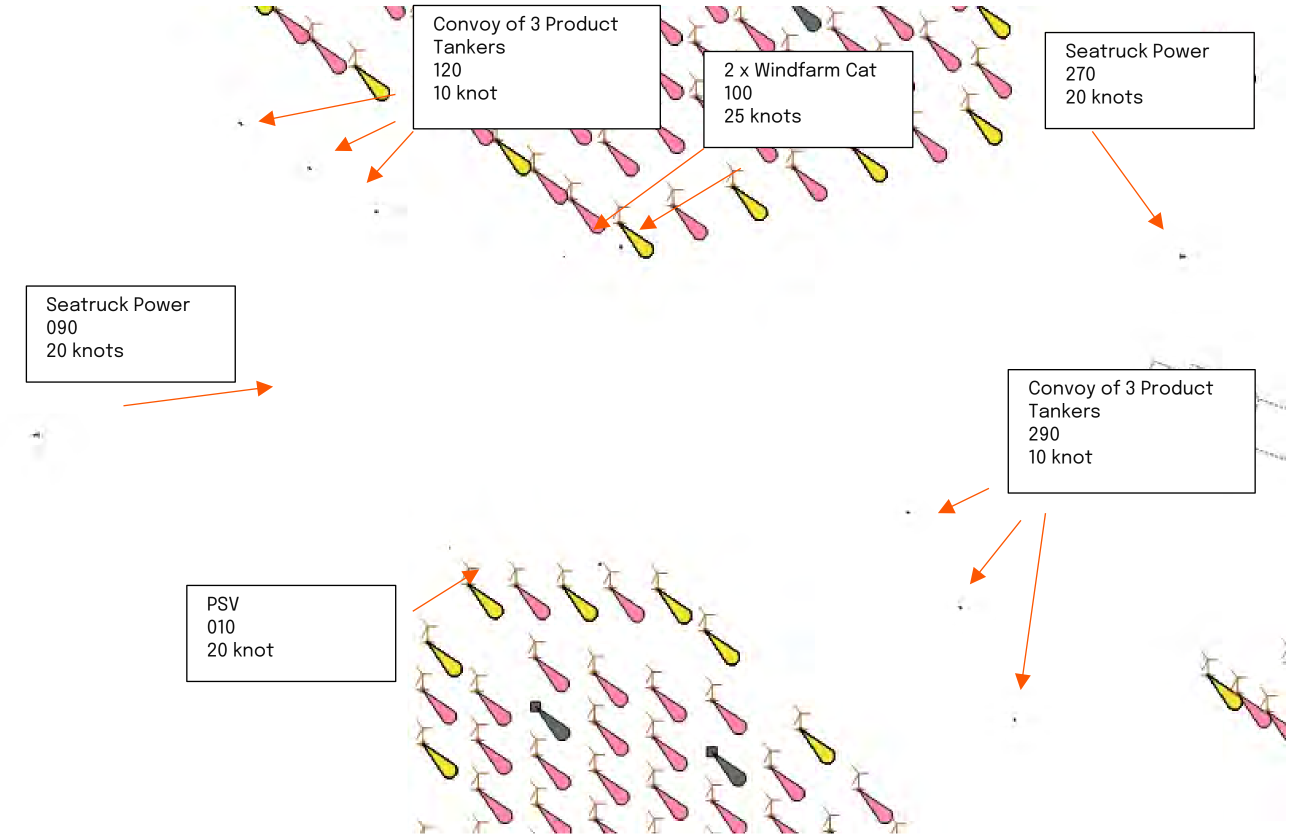
Criteria	Grading	Comment
Ship control	S	
Clearance - Fixed objects/boundaries	S	
Clearance - Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	S	
Impact on schedule	M	Minor due to reducing speed as required by the give way vessel

Run: 07

Location: Morgan-Mona Gap, DUB-HEY,

Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp	Current
Seatruck Power	270	IS	NW (315)	30-40 knots	3.0m	7.0s	Grid

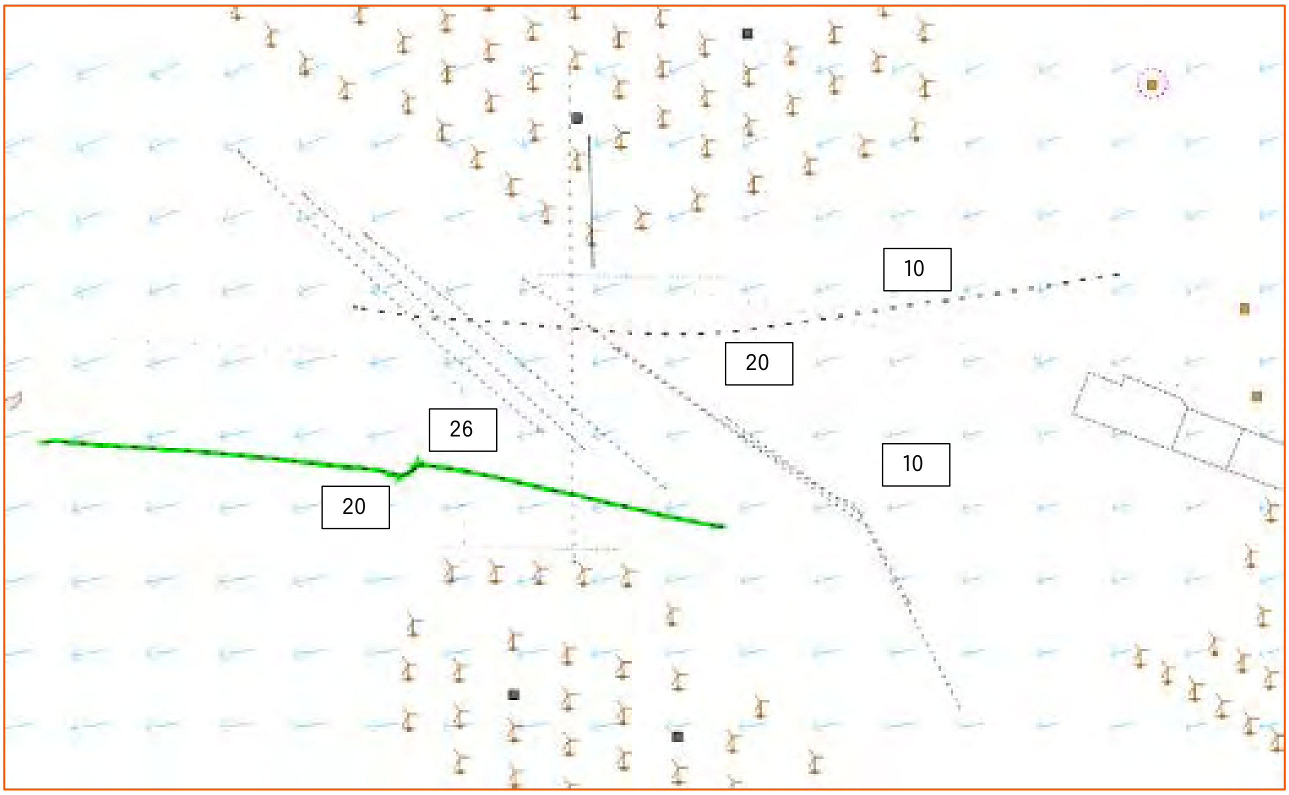
Scenario
To consider high traffic levels in Morgan Mona corridor and the ability to identify transiting vessel in the vicinity of the OWF at night.



Actions of vessels

Time	Seatruck Eastbound	Seatruck Westbound	Target vessel	Comments
10		Observes fast moving traffic departing OWF – No action required	Windfarm cat leaving Morgan clearly passing astern of vessel Northbound convoy alters course to pass through corridor and maintain 1nm CPA from OWF	North bound convoy should have given way to westbound sea truck ferry
20		Alters course to starboard passing clearly ahead of northbound convoy		

Time	Seatruck Eastbound	Seatruck Westbound	Target vessel	Comments
20	Alter course and reduce speed to avoid windfarm cat exiting Mona		-	Wind farm vessel detected visually and by radar as it departed the OWF – CPA > 1nm maintained
26	Resume passage	-	-	



Run commentary

Seatruck Eastbound

Morgan-Mona OWF's are less dense than Walney and therefore easier to identify vessels leaving wind farm. Once within visual range of OWF and vessel lights then the vessel aspect was easy to identify and discriminate against planned OWF lighting.

Seatruck Eastbound

Once within visual range of OWF and vessel lights then the vessel aspect was easy to identify and discriminate against planned OWF lighting.

Delay of 3 minutes to allow windfarm cat to pass.

The level of traffic and the vessel not complying with collision regulations would have required the master to provide support to the OOW.

In a situation with a vessel which is not compliant with col regs, master must attend bridge.

Even with vessel not complying, still able to maintain 1NM CPA from OWF structure.

Objective assessment

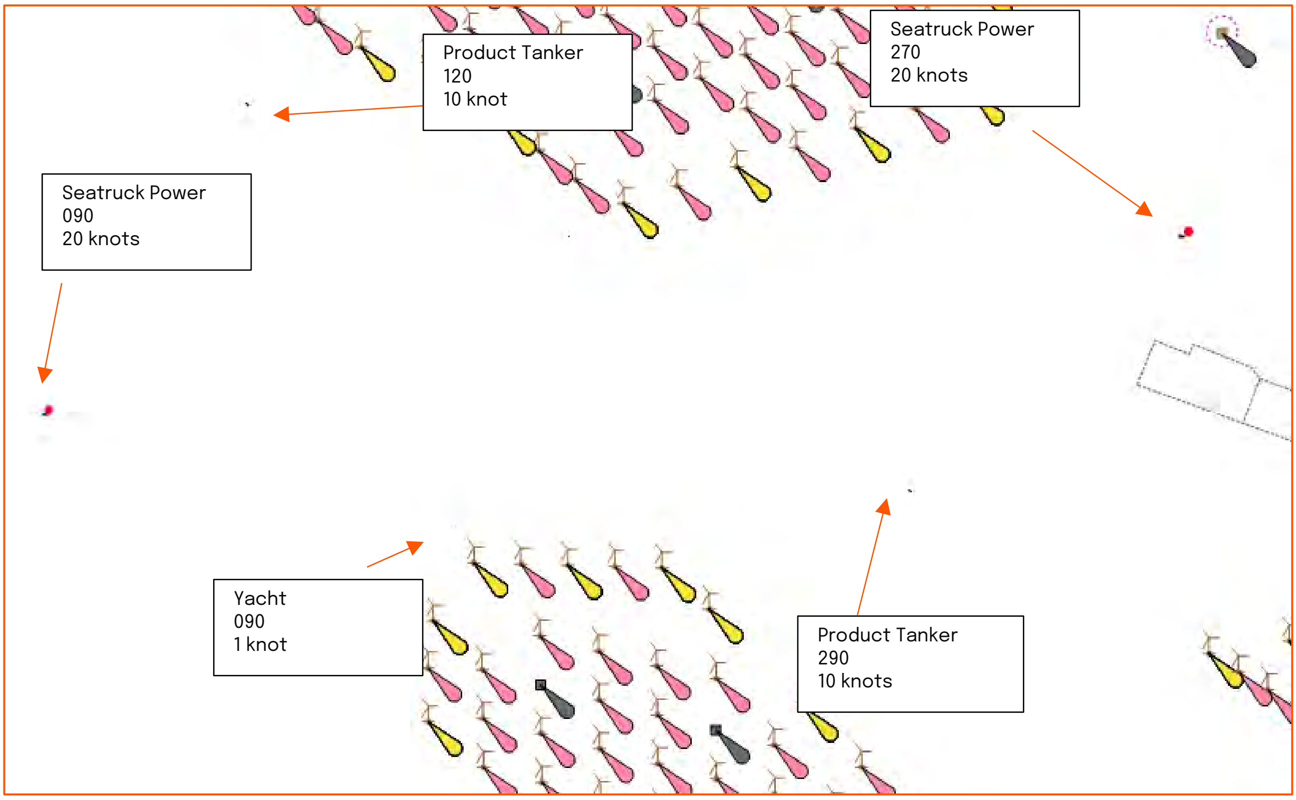
Criteria	Grading	Comment
Ship control	S	
Clearance – Fixed objects/boundaries	S	
Clearance – Ships	S	1 mile CPA was maintained, even with Col. Regs ignored
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	
Maintain passenger comfort	S	
Impact on schedule	S	

Run: 08

Location: Morgan-Mona Gap

Model	Passage direction	Pilot	Wind Direction	Wind Speed	Wave Hs	Wave Tp	Current
2 x Seatruck (Power & Progress)	260/090	IS	NW (315)	30-40 knots	3.0m	7.0s	Grid

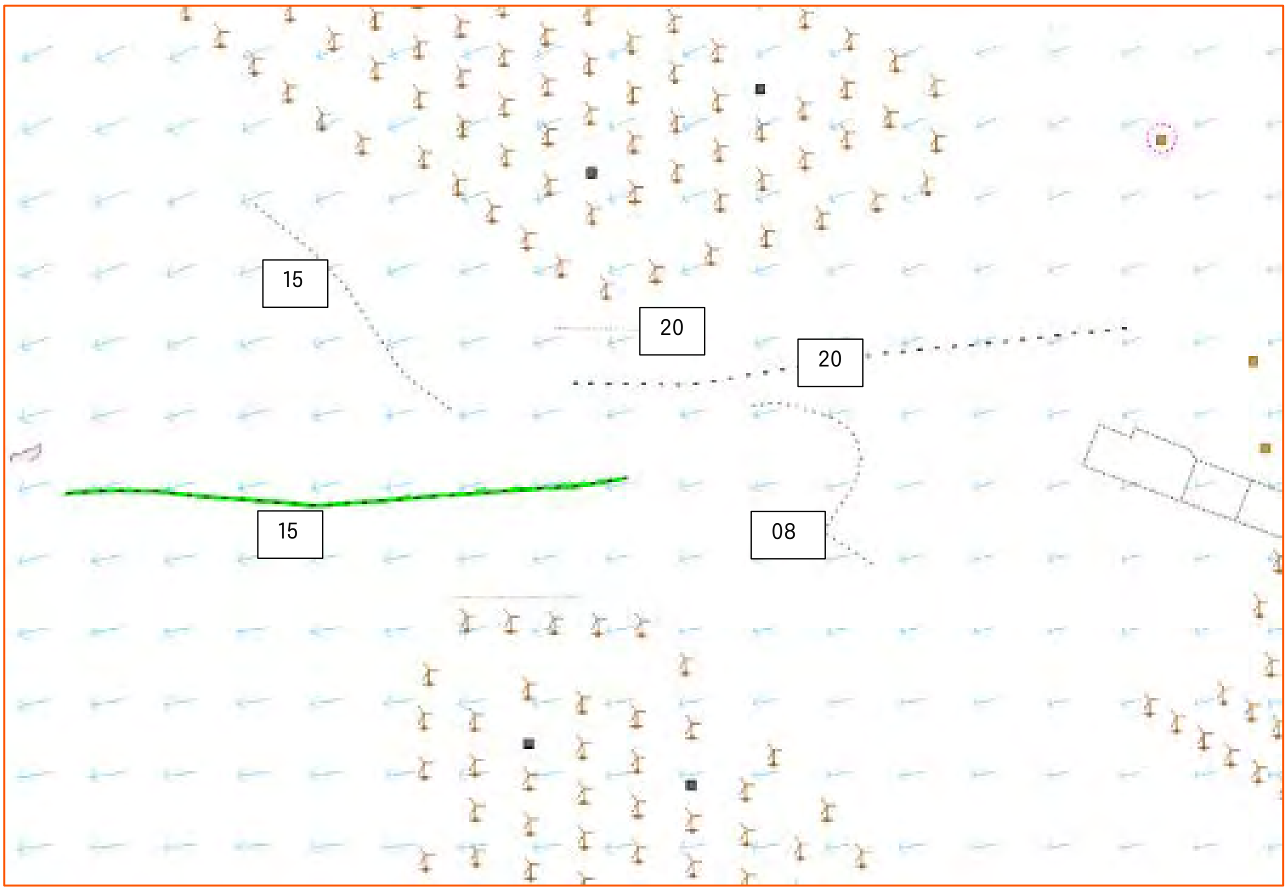
Scenario
To consider moderate traffic levels in Morgan Mona corridor and the ability to identify transiting vessel in the vicinity of the OWF at night. Revisit the situation from Run 7 with north bound convoy complying with colregs.



Actions of vessels

Time	Seatruck Eastbound	Seatruck Westbound	Target vessel	Comments
08	-	Maintain course and speed	North bound product tanker alters course to pass atern of the stand-on Seatruck vessel (westbound)	
10	-	-	Windfarm cat leaving Morgan clearly passing astern of vessel	

Time	Seatruck Eastbound	Seatruck Westbound	Target vessel	Comments
15	Alters course by 10° to port to increase CPA on yacht		Southbound product tanker alters course as give way vessel to increase CPA on east bound sea truck ferry	
20	-	Seatruck passes ahead of Product tanker westbound at 2nm	Product Tanker returns to original passage heading	



Run commentary

Reduced traffic: CPA was broken, no intervention (10% scenario) required from master.

Objective assessment

Criteria	Grading	Comment
Ship control	S	
Clearance - Fixed objects/boundaries	S	
Clearance - Ships	S	
UKC	S	
Respond to emergency	N/A	
Avoid cargo shift	S	
Avoid dangerous seas	S	

Criteria	Grading	Comment
Maintain passenger comfort	S	
Impact on schedule	S	

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