Appendix 13-1:
Navigation Risk Assessment

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

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ORIEL WIND FARM PROJECT

Environmental Impact Assessment Report
Appendix 13-1: Navigation Risk Assessment (NRA)

MDR1520B
EIAR – Appendix 13-1
A1 C01
March 2024

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Acronyms

Term	Meaning
ADCP	Acoustic Doppler Current Profiler
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
AtoN	Aids to Navigation
CAA	Civil Aviation Authority
CCTV	Closed Circuit Television
CHA	Competent Harbour Authority
CIL	Commissioner of Irish Lights
COLREGS	International Convention for the Prevention of Collision at Sea
CRBI	Community Inshore Rescue Ireland
CTV	Crew Transfer Vessel
DCCAE	Department of Communications, Climate Action and Environment
DTI	Department of Trade and Industry
DP	Dynamic Positioning
DSC	Digital Selective Calling
EBA	European Boating Association
EIAR	Environmental Impact Assessment Report
ERCoP	Emergency Response Cooperation Plan
GPS	Global Positioning System
HAT	Highest Astronomical Tide
HMCG	His Majesty's Coast Guard
HW	High Water
IAA	Irish Aviation Authority
IALA	International Association of Lighthouse Authorities
ICPC	International Cable Protection Committee
IMO	International Maritime Organisation
IMSRR	Irish Maritime Search and Rescue Region
IRCG	Irish Coast Guard
KISCA	Kingfisher Information Services Cable Awareness
LAT	Lowest Astronomical Tide
LOA	Length Overall
LPG	Liquified Petroleum Gas
MCA	Maritime and Coast Guard Agency
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MRCC	Maritime Rescue Co-ordination Centre
MRSC	Maritime Rescue Sub-Centre
MSI	Marine Safety Information
MSO	Marine Survey Office (Ireland)
NIFPO	Northern Ireland Fish Producers' Organisation
NRA	Navigation Risk Assessment
NSMS	Navigational Safety Management System
OREI	Offshore Renewable Energy Installation
OSS	Offshore Substation

Term	Meaning
PEXA	Practice and Exercise Areas
RACON	Radar Beacon
RAF	Royal Air Craft
RNLI	Royal Nautical Lifeboat Institute
ROV	Remotely Operated Vehicles
RYA	Royal Yachting Association
SAR	Search and Rescue
SHA	Statutory Harbour Authority
SOLAS	Safety of Life at Sea
SPS	Significant Peripheral Structure
SRR	Search and Rescue Region (UK)
UKC	Under Keel Clearance
UKHO	UK Hydrographic Office
VHF	Very High Frequency (radio communication)
VMS	Vessel Monitoring System
WFSVs	Wind Farm Service Vessels
WTG	Wind Turbine Generator

Units

Unit	Description
kt	Knot (unit of speed equal to nautical mile per hour, approximately 1.15 mph)
m	Metre
NM	Nautical Mile (1 NM= 1,852 m)

1 INTRODUCTION

1.1 Background

Nash Maritime has been commissioned by RPS to prepare a Navigation Risk Assessment (NRA) for the Oriel Wind Farm Project (hereafter referred to as "the Project"). The NRA will be used to inform the Project Environmental Impact Assessment Report (EIAR). This Technical Report presents the results of the NRA for the Project. The Project is located in the Irish Sea, off the coast of County Louth (approximately 22 km east of Dundalk town centre and 18 km east of Blackrock). The closest wind turbine will be approximately 6 km from the closest shore on the Cooley Peninsula. The offshore cable corridor extends approximately 11 km southwest from the wind farm area to the landfall south of Dunany Point.

This report has been prepared by NASH Maritime.

1.2 Scope and methodology

The scope and objectives of this NRA are as follows:

- Describe the Project;
- Provide a description of the existing environment and activities within 5 NM of the offshore wind farm area and offshore cable corridor; including but not limited to:
  - Local ports and harbours;
  - Metocean conditions;
  - Existing vessel management plans;
  - Other users of the area such as aggregates, oil and gas, anchorages, military, and renewable energy installations;
  - Existing vessel traffic patterns, including frequency and types; and
  - Existing risk profile for navigational incidents.
- Determine likely future traffic profile during the period when the Project would be operational;
- Identify and assess impacts of the development to shipping and navigation, including:
  - Traffic routeing;
  - Pilotage operations;
  - Collision risk;
  - Cable risk (i.e. snagging, anchors and fishing gear);
  - Communications, radar, and positioning systems;
  - Search and Rescue (SAR); and
  - Cumulative effects;
- Undertake an NRA that identifies the hazards during the construction, operational and maintenance and decommissioning phases of the Project. These hazards are then assessed, and risk controls identified to reduce the risk to As Low as Reasonably Practicable (ALARP); and
- Make recommendations as to the safety of the Project and identify mitigation measures.

1.3 Guidance

The Department of Communications, Climate Action and Environment (DCCAE) "Guidance on EIS and NIS Preparation for Offshore Renewable Energy Projects" (DCCAE, 2017) refers to the Department of Trade and Industry (DTI) "Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms" (DTI, 2013), which references the UK Maritime and Coastguard Agency (MCA) guidance – Marine Guidance Note (MGN) 543 (M+F) (MCA, 2016). Therefore, for the purposes of this NRA, MGN 543 has been followed, as also agreed with the Marine Survey Office (MSO) during consultation (see section 1.4). MGN 543 was superseded by MGN 654 in April 2021 (MCA, 2021) which updated the requirements for undertaking a NRA. This NRA has been validated against the requirements of MGN 654 to meet these requirements.

Table 1-1 outlines relevant policy/guidance documents and the relevant key provisions.

Table 1-1: Guidance documents.

Policy/guidance	Key provisions
MGN 654 Guidance on "UK Navigational Practice, Safety and Emergency Response Issues" (MCA, 2021)	This MGN highlights issues to be considered when assessing the impact on navigational safety and emergency response arising from Offshore Renewable Energy Installations (OREI). Including traffic surveys, consultation, structure layout, collision avoidance, impacts on communications/ radar/ positioning systems and hydrography.
"Methodology for Assessing Marine Navigational Safety Risks of Offshore Wind Farms" (DTI, 2013)	The DTI document provides a template for preparing NRAs for offshore wind farms. This template has been used throughout to define the methodology of assessment and is read in conjunction with MGN 654.
MGN 372 "Guidance to Mariners Operating in the Vicinity of UK OREIs" (MCA, 2008)	Issues to be considered when planning and undertaking voyages near OREI off the coast.
International Association of Marine Aids to Navigation and Lighthouse Authorities 0-139 the Marking of Man-Made Offshore Structures (IALA, 2013)	Guidance to national authorities on the marking of offshore structures including wind farms.
International Maritime Organisation (IMO) Guidelines for Formal Safety Assessment (IMO, 2018)	Process for undertaking marine navigation risk assessments.
Royal Yachting Association (RYA) Position on Offshore Energy Developments (RYA, 2019)	Outlines recreational boating concerns for offshore renewable energy developments.
European Boating Association (EBA) Position Statement, Offshore Wind Farms (EBA, 2019)	The EBA will: • Support its members in their dealings with their respective national governments regarding the development of offshore wind energy installations in order to secure navigational safety and to ensure that recreational boating interests are not adversely affected; • Object to the establishment of operational safety zones around individual turbines or entire wind farms unless it can be demonstrated that they are necessary and that their enforcement will increase the safety of mariners navigating within the vicinity of the development; • Support the guidance provided by the IALA in relation to marking and lighting and will support its members in their dealings with their respective national governments to identify site specific issues that may occur; and • Encourage publishers of media used by recreational boaters for passage planning to include details of any restrictions relating to wind farms.

The MGN 654 Compliance Table acts as an aid for developers when completing and submitting the NRA to ensure all guidance has been considered and addressed. This is presented in Table 1-2 below, with reference to where the provision has been addressed within this NRA.

Table 1-2: Marine Guidance Note 654 compliance table.

The following content is included:	Compliant (Yes/No)	Where addressed in this NRA
A risk claim is included supported by a reasoned argument and evidence	Yes	The risk assessment conducted in section 6: • Data analysis (section 3); • Consultation (section 1.4); and • Review and discussion of impacts (section 5).
Description of the marine environment	Yes	A description of the baseline marine environment is provided in section 3.
Description of the OREI development and how it changes the marine environment	Yes	A description of the OREI development is provided in section 2. Potential impacts are described in section 5.
Analysis of the Marine Traffic	Yes	A detailed analysis of the baseline vessel traffic is provided in section 4. Section 4.7 presents the future baseline traffic profile. The impacts of the OREIs on that traffic is contained within section 5.
Status of the hazard log	Yes	The navigational risk assessment is provided in section 6. The hazard log is provided in Appendix A.
Navigation Risk Assessment	Yes	The navigational risk assessment is provided in section 6.
Search and Rescue overview and assessment	Yes	Existing search and rescue provision is described in section 3.5. An assessment of impacts of the Project to search and rescue is provided in section 5.4.
Emergency Response Overview and Assessment	Yes	Existing search and rescue provision is described in section 3.5. An assessment of impacts of the Project to search and rescue is provided in section 5.4.
Status of Risk control log	Yes	Additional risk controls are provided in section 6.3.
Major Hazards Summary	Yes	A summary of the principal impacts of the Project are contained within section 5.
Statement of Limitation	Yes	Any limitations or assumptions of this assessment are reported in their relevant sections.
Through Life Safety Management	Yes	Additional risk controls are provided in section 6.3.

1.4 Consultation

Consultation with shipping and navigation stakeholders has been undertaken since September 2019. A summary of the consultation undertaken specific to shipping and navigation is outlined below in Table 1-3.

Concerns raised during the consultation undertaken have been addressed and are included within the assessment of navigation risk presented in the following sections.

Table 1-3: Summary of key consultation issues raised during consultation activities undertaken for the Project relevant to shipping and navigation.

Date	Consultee and type of response	Information provided/ Issue Raised	Response to issue raised and/or where considered in this report
September 2019	Irish Sailing Association (Email)	Advised that Irish Sailing supports the EBA position statement on wind farms. Advised on data sources for the risk assessment including shipping lanes, tonnage, frequency, speed etc. and advised to consider all likely activities in the area (windsurfing, motor boating/powerboating, sailing racing and cruising). Advocates anti-collision mitigation (sound, light, fluorescent paint etc). Advised that the Carlingford Sailing Club membership for 2019 stands at 216 members.	All forms of recreational activity relevant to this area were considered within this study and during the risk assessment scoring process. Overview of proposed navigation aids and marking in section 2.2.
September 2019	Warrenpoint Harbour (Meeting)	Identified that Warrenpoint Harbour is a Statutory Harbour Authority, with jurisdiction for navigation safety in the vicinity of Warrenpoint only. Most vessels transiting to/from Carlingford Lough are bound for Warrenpoint. Other commercial vessels (up to 200 m) also visit Greenore Port. There are typically 2,000 commercial movements per annum (in/out) of Warrenpoint and 7 to 8 ships per month, approximately 100 per year, to Greenore Port. Pilotage is compulsory for commercial vessels with pilots boarding/disembarking in the vicinity of the Hellyhunter Buoy. There are three yacht clubs in the Lough, with little recreational activity outside of the Lough and few yacht visitors. Discussion of potential impacts of the Project: considered that the Project would not have any navigation safety implications to Warrenpoint harbour; potential diversion of vessels around the offshore wind farm area was not considered significant; the offshore wind farm area was thought to have minimal if any effect on collision risk and grounding risk for commercial vessels; considered that commercial vessel contact with the Project would be minimal.	Impact on vessel deviation was considered in this study (see section 5.1).
September 2019	Clogher Head RNLI Station (Meeting)	Confirmed that the AIS fishing boat plots was a fair representation. Fishing activities included: Dublin prawns; razors; lobsters; and crab. The station has an average of 20-25 call outs per year. Several call outs have recently involved fishing boats suffering with mechanical issues. The general consensus was that the Project would not hamper existing lifesaving duties.	No action required.
September 2019	Dundalk Pilot (Meeting)	In 2018 Dundalk harbour handled 53 vessels (106 movements) up to a maximum length of 120 m and approximately 5 m draught. Cargoes include scrap, timber, fertilizer and bulk. There are no recreational or pleasure craft operating in or out of the harbour. Fishing is primarily cockle day boats operating inside port limits. There are three lobster boats operating out towards Imogene navigation buoy.	Local ports and harbours were reviewed (section 3.2.3). An overview of inshore and offshore fishing activities was undertaken as part of this study (section 3.6)

Date	Consultee and type of response	Information provided/ Issue Raised	Response to issue raised and/or where considered in this report
		Considered that the AIS vessel track plots are a fair representation of vessel traffic activity in Dundalk Bay. Confirmed that there is no vessel activity/anchoring in the Dunany Point area where the offshore cable corridor overlaps with the Dundalk CHA/SHA areas.	
September 2019	Dublin Port Company (Meeting)	Explained that the Dublin Harbour Master also has statutory responsibilities for Dundalk Harbour. Confirmed that the vessel traffic plots appeared to be representative of current commercial marine traffic in the Dundalk Bay area. Dundalk handles on average one vessel per week; however trade was currently declining. No navigational safety issues were raised regarding vessels entering and leaving Dundalk with the Project in place.	Local ports and harbours reviewed (section 3.2.3).
September 2019	Drogheda Port (Meeting)	Vessels arrive/depart the port at or around high water. The offshore wind farm area is outside of the port jurisdiction and as such no navigational concerns were raised. Raised potential for commercial impact arising from vessels diverting around the Project and possibly missing a tide at Drogheda. Advised consideration for a Traffic Separation Scheme adjacent to the offshore wind farm area. Discussed potential diversion of vessels around the offshore wind farm area. Accepted that the diversion and associated possible delays would be minor, as were the absolute number of vessels. Noted that Drogheda Port are proposing to develop a new harbour at Braymore Point (south of Drogheda).	Impact on vessel deviation was considered in this study (section 5.1).
September 2019	Irish Coast Guard (IRCG) (Meeting)	The role of the IRCG includes: SAR; pollution and ship casualty response and obligations under Safety of Life at Sea (SOLAS). The IRCG has three Rescue Coordination Centres: Malin; Valentia and Dublin as well as helicopter bases. A new SAR plan has recently been issued. The IRGC would be responsible for ensuring that adequate emergency plans were in place particularly for the use of helicopter involvement in SAR operations. Discussed provision of an Emergency Response Co-operation Plan (ERCoP) for the Project. Explained that the NRA is being undertaken following the Maritime Coastguard Agency Marine Guidance Note 543. The risk assessment process was described including hazard identification and several risk control measures. IRCG explained that Warrenpoint was anticipating an upturn of vessel movements following the UK's departure from the European Union.	SAR in Irish coastal waters and their approaches was considered (section 3.5). Impact on SAR considered in section 5.4.

Date	Consultee and type of response	Information provided/ Issue Raised	Response to issue raised and/or where considered in this report
		Guidance was sought on lines of orientation of the WTGs. IRCG considered that although a linear layout would be preferable, they were unaware of any regulatory requirement.	
September 2019	Marine Survey Office (MSO) and Commissioners of Irish Lights (CIL) (Telecon)	The MSO will consider the impact of the Project on: the safety of navigation; restriction of navigation rights; vessel traffic displacement; and limiting room of vessel manoeuvrability. The CIL will be responsible for approving the Project navigational aids and lighting plans and would promulgate this information to the UK Hydrographic Office (UKHO) for updating navigation charts. The Applicant explained that the NRA considered a 5 NM Study Area around the offshore wind farm area and offshore cable corridor, and generally followed MGN 543. MSO confirmed agreement with this approach. The Applicant summarised the Formal Safety Assessment approach to undertaking the NRA, including AIS data analysis for 2 x 30-day periods (January and July 2019) supplemented by published data and extensive consultation. The MSO agreed that AIS data supplemented with adequate consultation should provide sufficient information. The MSO highlighted that future traffic trends may be influenced by the UK's departure from the European Union and other future port developments. The Applicant presented several vessel track plots and discussion took place on potential deviations around the Project. It was agreed that the AIS traffic analysis presents a relatively light traffic profile. The Applicant identified the potential for temporary safety zones during construction. CIL has no statutory function regarding safety zones, which are a matter for the Coastal State under UNCLOS Paragraph 60(4) and IMO Resolution A.671(16). There are 2 x navigation buoys to the west of the offshore wind farm area namely, Imogene and Dunany red buoys. It was noted that the distance between the offshore wind farm area and the Imogene buoy is 1 NM. CIL noted that both buoys mark shoal areas for larger commercial vessels in the vicinity of Dundalk Bay. Fishing and leisure users may safely navigate inside these marks in practice. CIL guidance on the layout from a navigational perspective is that the Project should seek to avoid choke points, especially to the north side in the vicinity of Imogene lateral mark. It was noted that vessels bound for Greenore anchor off Carlingford Lough in the Imogene buoy region, although there is no charted anchorage.	This NRA was undertaken following current UK guidance (section 1.3).
March 2021	Northern Ireland Fish Producers' Organisation (NIFPO) (telecon)	The 20 members fish all year round, daytime only, single-handed in boats up to 12 m with heaviest effort between May to September and between mid-November to mid-December. Potting main activity with some trawling for	No action required.

Date	Consultee and type of response	Information provided/ Issue Raised	Response to issue raised and/or where considered in this report
		Nephrops. Pots are deployed within the offshore cable corridor. Some boats may carry AIS. Vessels operate out of Kilkeel and Ardglass. No concerns were raised relating to shipping and navigation only impacts relating to electromagnetic fields from cables during operation and noise and vibration during construction	
March 2021	Dunany Point Lobster and Crab (telecon)	Operate throughout the year in Dundalk bay in the vicinity of the wind farm and cable corridor. 14 potting and kreel boats up to 10 m with 2-man crews operating during daylight hours only and do not have AIS fitted. Land in Clogherhead, Dundalk, Greenore, Donegal. Concerns include: Restrictions to vessels during construction, piling and drilling activities. Fishing numbers on all species down after surveys. Concerns with ongoing operation and maintenance activities Concerns with shipping route over fishing grounds as result of deviation. Small deviation of vessels due to array.	Impact on vessel deviation was considered in this study (section 5.1). As part of the risk mitigation 500 m safety zones will be applied for during construction and significant maintenance activities only (section 6.3).
During March and April 2021 following updates to the project specification additional consultation was undertaken with the following consultees:			
March 2021	Irish Coast Guard (letter and email)	The Irish Coast Guard responded that they had no further observations or comments to make at this point.	No action required.
March 2021	Marine Survey Office (letter and email)	The Marine Survey Office had no further comment. Confirmed that the additional information provided will be forwarded to the relevant officer in the Department of Housing.	No action required.
March 2021	Commissioners of Irish Lights (letter, email and online meeting)	An update on current project status was provided. CIL noted that the turbine layout has increased the distance to the Imogene buoy from 1 NM to 1.57 NM. CIL noted there is still a risk with vessels having to navigate northwest towards shallower waters. The Project may lead to diverting some commercial vessels into shallower water if they elect to transit the inshore route. Concerns were raised by CIL regarding vessels transiting the inshore route which may encounter vessels at anchor to the north of the offshore wind farm, near the approaches to Carlingford Lough.	Vessel traffic would remain southeast of the buoy rather than travel via shallower water to the northwest. Furthermore, there very few commercial vessels transiting in a coastwise direction (approximately 1 per week). Adjust the inshore route (Figure 5-1) to show vessels transiting outside 10 m contour line. An acoustic Doppler current profiler (ADCP) buoy was deployed in the study

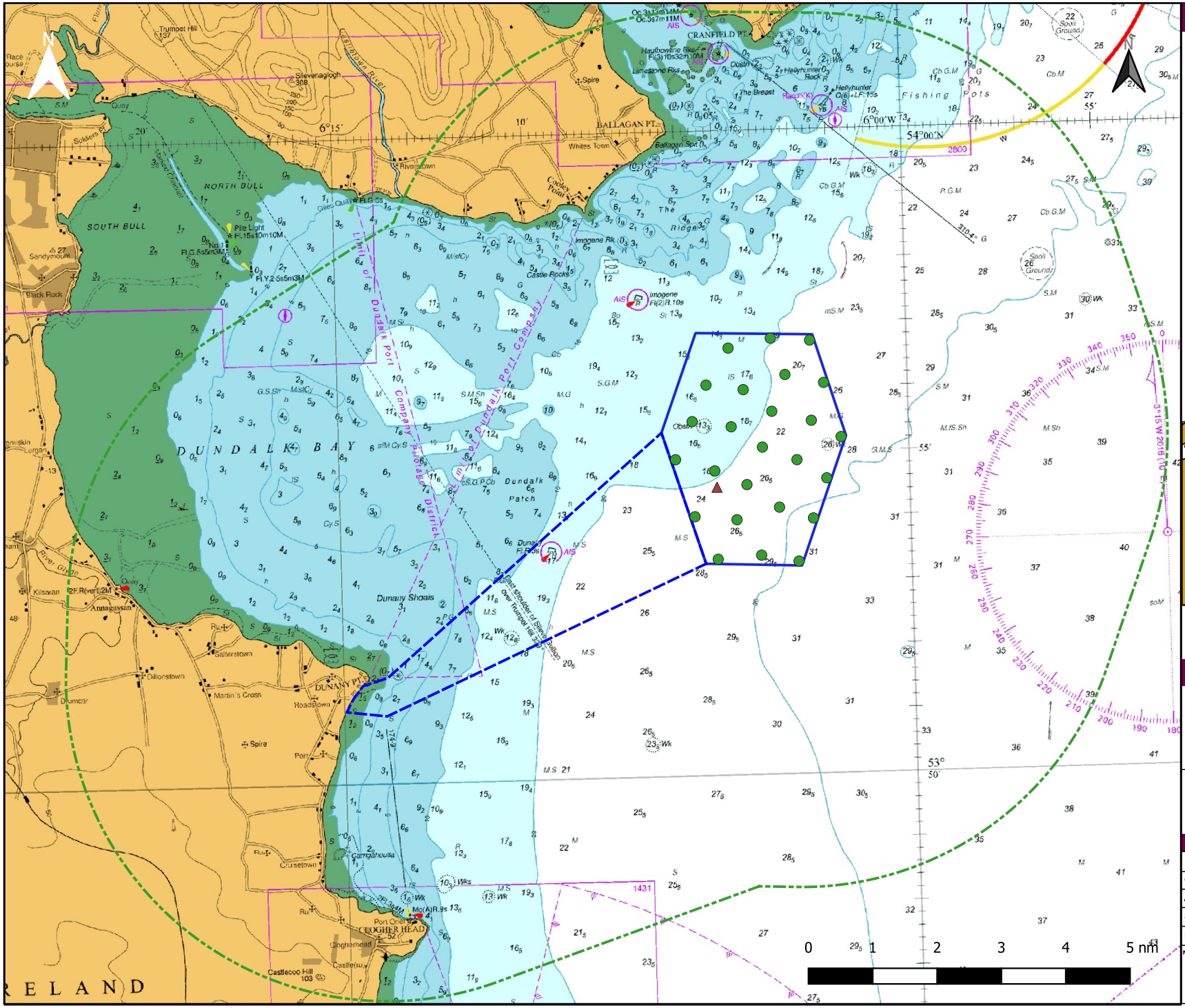
Date	Consultee and type of response	Information provided/ Issue Raised	Response to issue raised and/or where considered in this report
		CIL confirmed though that the offshore route would be more attractive to commercial vessels on coastwise transit, however it was also noted there needs to be consideration for vessels using the inner route. CIL as Lighthouse Authority responsible for Aids to Navigation (AtoN), would undertake an assessment on the need to relocate/change the location of the Imogene Buoy, if the Project went ahead, based on the "Volume of Traffic" and "Degree of Risk" of vessels using the inshore passage. CIL advised that consideration of cumulative impacts needs to be undertaken particularly with other offshore wind farm projects to the northeast and southeast. Noted that whilst other offshore wind farms were known to be considered in the area, there are currently no other details available on their design geometry, and only licenses for foreshore development have been issued (which had little impact on the Project). As such any cumulative issues associated with constructed offshore wind farms would have to be addressed by the other projects once site geometry was known and understood. Tidal effects were identified as minimal within the NRA study area. It was explained that source data is from some distance away as depicted on the Admiralty Chart. CIL: with regards to the conclusions to overriding issues, may disagree with absolute use of this wording. Consider as much mitigation as possible to reduce risk further.	area to measure movement in the water, both as waves and currents. reference to this data is included in section 3.3. The frequency of vessel transit in the area is low and most vessels would likely transit to the west of the offshore wind farm area.
March 2021	Dundalk Port Company and Pilot (online meeting)	Overview of project update explaining EIA Report and NRA was being updated based on the new layout. No significant concerns raised by HM or pilot. Dundalk Harbour was in the process of being handed to Louth County Council for ownership and future operation. HM and pilot noted that the wind farm layout has moved away from northwest corner and Imogene buoy. This gives more space for vessels transiting from north into Dundalk Harbour and was seen as positive. It was confirmed stated that there is and would be continued engagement with CIL and MSO on navigation marking requirements but expect navigation lighting at corners of wind farm area. Concerns raised: Vessel emergency anchoring within wind farm or cable corridor and potential drag and damage cable	Navigation marking requirements considered in section 2.2. Emergency anchoring and dragging, damage to cable considered in sections 5.7 and 5.8.

Date	Consultee and type of response	Information provided/ Issue Raised	Response to issue raised and/or where considered in this report
March 2021	Irish Sailing (letter and email)	Irish Sailing had no further comments to make. Carlingford Sailing Club also confirmed that they were content and that all aspects of the Project with regards to navigation safety had been covered.	No action required.
March 2021	Irish Cruising Club (letter and email)	No response received.	No action required.
March 2021	Skerries Sailing Club	Meeting held with Commodore and club committee members. Extent and location of development was explained in detail. Club has occasional cruises both organised and informal along the coast up to Carlingford. Issues raised included: Exclusion zones for wind farm. It was explained that 500 m safety zones would only be sought during construction and maintenance at other times no exclusion zone would apply. Risk for anchoring in area. It was explained that all cables would be buried or protected by rock armour. Navigation markings. It was explained that the project would be guided by the requirements of CIL and IALA. Air draft. It was confirmed that a minimum air draft of 22 m above MHWS would be in place. Vessel displacement. Concern was raised that larger cargo vessels transiting into Ports could be diverted by the wind farm into more coastal routes with an increased risk of collision with recreational vessels. The relatively low number of cargo vessel movements and the space for transiting into Dundalk Harbour or Warrenpoint was highlighted by the Applicant.	Impacts on vessel traffic routeing are considered in section 5.1. Collision hazards have been considered for the construction/decommissioning phases in section 6.4.1 and for the operational phase in section 6.4.2
March 2021	Irish Cruising Association (letter and email)	No response received.	No action required.
November 2022	Irish Coast Guard (meeting)	Meeting held to provide an update to the Project and results of NRA and to agree requirements for Navigational Safety Management System. An emergency response plan should be developed following the requirements of the UK's Emergency Response Co-operation Plan (ERCoP). Guidance is being developed for the emergency response requirements and is due to be published in 2023.	An outline emergency response plan has been provided in volume 2A, appendix 5-8: Emergency Response Co-operation Plan
November 2022; February 2024	Commissioners of Irish Lights (meetings)	Meeting held to provide an update to the Project and results of NRA and to agree requirements for marine lighting and marking and Navigational Safety Management System.	A lighting and marking plan has been prepared and is provided in volume 2A, appendix 5-9: Lighting and Marking Plan.

Date	Consultee and type of response	Information provided/ Issue Raised	Response to issue raised and/or where considered in this report
		Meeting held to discuss the SAR corridors, the ERCoP and the draft guidance on Navigation Risk Assessment and emergency response.	The Department of Transport have prepared guidance on navigation risk and emergency response assessments and is currently in draft and undergoing consultation with the relevant stakeholders (as of February 2024). The Applicant will consider the final guidance once published and ensure that the Emergency Response Co-operation Plan (appendix 5-7 in volume 2A) complies with the guidance.
February 2023	Marine Survey Office (meeting)	Meeting held to confirm the results of the vessel traffic data validation exercise and provide an update on the status of the Project. It was agreed that there were no significant differences to vessel traffic quantity or patterns which would affect the results of the NRA.	No issues raised.

1.5 NRA study area

The NRA Study Area considers vessel traffic within 5 NM of the offshore wind farm area and the offshore cable corridor as shown below in Figure 1-1. A 5 NM study area was considered representative in capturing all commercial fishing and recreational vessel traffic transiting to and from the principal ports in the area (i.e. Drogheda, Carlingford Lough (Warrenpoint and Greenore) and Dundalk) as well as vessels transiting on a north / south course line to the east of the offshore wind farm area. Where necessary and appropriate, reference is made to navigation routes in the wider context.



Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Offshore Sub Station
- Wind Turbine

Client: ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 1-1 NRA Study Area

RPS Ireland
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Issue Details

Drawn:	AF	**Project:**	MDR1520B
Checked:	AF	**File Ref:**	
Approved:	EJR		MDR1520QG0000D01
Scale:	1:150,000@ A4	**Projection:**	
Date:	25/1/2024		IRENET95 / ITM

Notes

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2 DESCRIPTION OF THE PROJECT

2.1 Project parameters

The Project will consist of 25 WTGs installed on monopile foundations, one OSS installed on a monopile foundation and a series of inter-array cables within an offshore wind farm area of 27.7 km^2. Electricity will be transferred from the OSS to shore through one export cable located in the offshore cable corridor between the offshore wind farm area and the landfall south of Dunany Point. The Project parameters considered for this NRA are presented below. Full details of the Project are presented in volume 2A, chapter 5: Project Description.

Wind turbine generators (WTGs)

The Project will include 25 WTGs with an upper blade tip height of 270 m above Lowest Astronomical Tide (LAT). WTGs located around the UK are required to have the lowest point (air draught) of the rotor sweep at least 22 m above Mean High Water Springs (MHWS) (ref: MGN 372 section 2.10.1). The lowest point of the rotor sweep for the Project is 27 m above Lowest Astronomical Tide (LAT), which is approximately 22 m above Mean High Water Springs (MHWS) in this location.

Offshore substation (OSS)

The Project will include one OSS, which will be 40 m in height above LAT, 40 m in length and max 30 m in width.

Foundations

The foundations for the WTGs and OSS will be monopile foundations with associated scour protection.

Inter-array and export cables

There will be 41 km of inter-array cables installed within the offshore wind farm area, with a minimum burial depth of 0.5 m, and associated cable protection along 50% of the route. There will be one offshore cable 16 km in length between the OSS and the landfall, with a minimum burial depth of 0.5 m, and associated cable protection along 50% of the route.

Cable protection may consist of rock placement or concrete mattresses and will be 10 m in width and 2 m in height above the seabed.

Layout

The IRCG, the Irish Aviation Authority (IAA) and the CIL have been consulted on the Project layout as well as the marking, lighting and fog-horn specifications.

The Project layout adheres to the following layout principles relevant to shipping and navigation:

1. All surface offshore infrastructure shall be confined within the offshore wind farm area;
2. A minimum spacing of 4 x maximum rotor diameter (i.e. 944 m) will be maintained between the centre points of all WTGs;
3. The layout will meet the requirements of MGN 654 to facilitate SAR access; and
4. The offshore export cable will be located within a defined offshore cable corridor from the southwestern side of the offshore wind farm area to the landfall south of Dunany Point.

Vessel movements

Project vessel types may include jack-up barges/DP vessels, tug/anchor handlers, cable installation vessels, scour/cable protection installation vessels, guard vessels, survey vessels, and crew transfer vessels (CTVs). There will be 475 vessel round trips during the construction phase, 352 vessel round trips per year during the operational and maintenance phase and 475 vessel round trips during the decommissioning phase.

Ports

Construction port facilities will be required for assembly of Project components before delivery to the offshore wind farm area for installation. Different ports may be selected depending on specific requirements for the Project such as offshore substation construction, turbine pre-assembly, heavy lift or other facilities. Ports under consideration include those within the Irish Sea such as Belfast or Mostyn or other Irish, UK and European ports. Port facilities will be finalised and contracted prior to construction commencement.

Operational and maintenance activities will be planned, controlled and monitored from an onshore operations and maintenance base, which will be located at an existing port in County Louth or County Down.

Construction timelines

Construction of the offshore infrastructure for the Project will take place over a period of 15 months. The Project will be operational for a maximum period of 40 years. Decommissioning durations are assumed to be similar to those for construction.

Decommissioning

At the end of the operational lifetime of the Project it is anticipated that all structures above the seabed level will be completely removed. The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels and equipment.

Monopile foundations would likely be cut approximately 2 m below the seabed and removed. It is anticipated that any scour/cable protection would be left in situ.

Any exposed cables are likely to be removed to ensure they do not become hazards to other users of the seabed. The removal of buried cables is not an operation for which there is much precedent. However, it is expected that equipment similar to that used for cable installation could be used to reverse the burial process and expose them. Therefore, the area of seabed impacted during the removal could be the same as the area impacted during the installation of the cables. Divers and Remotely Operated Vehicles (ROVs) may be used to support the cable removal vessels. Once the cables are exposed, grapples would be used to pull the cables onto the deck of the decommissioning vessel, cut into manageable lengths and taken to shore. To minimise the environmental disturbance in the intertidal area the preferred option is to leave cables buried in place with the cable ends cut, sealed and securely buried as a precautionary measure. Alternatively, partial removal of the cable may be achieved by pulling the cables back out of the ducts. This may be preferred to recover and to recycle the copper and/or aluminium and steel within them.

2.2 Navigation aids and marking

2.2.1 Overview

The following sections set out the likely navigation and aviation lighting requirements for the Project, based on industry standards.

2.2.2 Aids to navigation

The Project layout, lighting and marking arrangements, during the construction and operational and maintenance phases, will be submitted to the IRCG, MSO and CIL for agreement.

Cardinal marks

Perimeter navigational buoys (i.e. cardinal marks) may be put in place before construction commences, to exclude non-project navigation. Following construction, consideration shall be given to retaining the buoys which may assist in ensuring that commercial vessels navigating in the vicinity maintain an acceptable distance from the offshore wind farm area, thereby minimising the risk of an undetected craft exiting from the offshore wind farm area into the path of an oncoming vessel.

Structure marking

The WTGs shall be painted, marked and fitted with navigation lights in accordance with International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) standards and more specifically as required by the CIL.

When in operation, all the WTGs will be marked with clearly visible and unique identification characters, which will be visible from all sides of the WTGs and comply with applicable international and local rules guidance and requirements as follows:

- MCA MGN 372 (M+F) "OREI Guidance to Mariners Operating in the Vicinity of UK OREIs";
- IALA Recommendation O-139, "Marking of Man-Made Offshore Structures"; and
- The widely accepted procedures for the fitting of aviation warning lights (see section 2.2.3).

Namely each structure will be:

- Painted yellow all-round from the level of Highest Astronomical Tide (HAT) to 15 m, or the height of any Aid to Navigation if fitted, whichever is greater;
- Marked with a unique alphanumeric identifier ("ID Boards");
- Fitted with red aviation navigation lights, on the turbine nacelle;
- Fitted with Significant Peripheral Structures (SPS) lighting, as described below; and
- Fitted with RACON[1] transponders, fog signals and possible AIS on selected turbines as appropriate.

An SPS is the "corner" or other significant point on the periphery of a wind farm. Each individual SPS should be fitted with lights visible from all directions in the horizontal plane. The lights should be synchronised and display an IALA "special mark" characteristic (i.e. flashing yellow), with a range of not less than 5 NM. The lateral distance between such lit structures or the nearest SPS should not exceed 2 NM.

[1] RACON - Radar Beacon: A transmitter-receiver associated with a fixed navigational mark which, when triggered by a radar, automatically returns a distinctive signal which can appear on the display of the triggering radar, providing range, bearing and identification information.

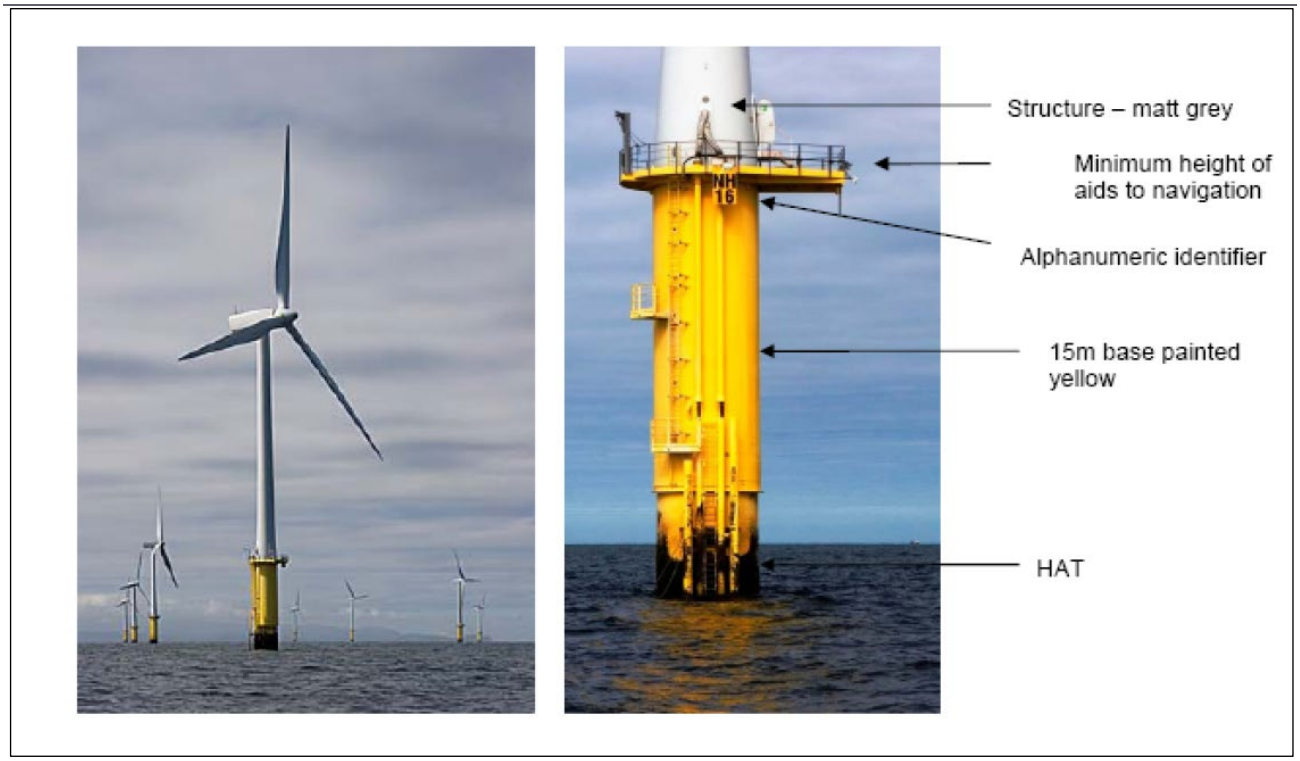


Figure 2-1: Example of marking a turbine structure (extract MGN 372).

2.2.3 Aviation lighting

Aviation lighting requirements are addressed within volume 2A, appendix 5-8: Lighting and Marking Plan. The following sections provide information specific to SAR requirements.

Wind turbine blade hover-reference marking

With regards to blade and nacelle markings it is recommended that reference is made to the MCA consultation document: "Offshore Renewable Energy Installations Search and Rescue and Emergency Response Guidance, Advice and Requirements" December 2016, the relevant extract of which is shown below in italics.

"WTG blades need to be marked to provide a Search and Rescue (SAR) helicopter pilot with a hover reference point when hovering over a nacelle during a rescue. This is necessary because SAR helicopters are large aircraft and the pilot (sitting on the right of the aircraft) may not be able to use objects or markings on the nacelle for reference because these are too far behind the pilot's location to be easily seen. The WTG blades are in the pilot's normal vision-arc and so are the best place for such markings.

Three marks are required on each blade - one each at the 10, 20 and 30 m interval (starting from the hub end of the blade) and placed near the trailing edge of the blades so that, when they are feathered, and the blades are parked in the "bunny ears" ("Y" position) or offset "Y" (one blade angled forward into the wind), the marks lie upwards in view of the helicopter pilot. The blade tip should also be marked in red (the amount of tip paint is dependent on the size of blade, but approximately 2% of the blade length should suffice).

The marks should be painted in a contrasting shade to the turbines overall colour - red is considered to be most suitable. The diameter of the marks (which can either be dots or stripes) should be at least 600 mm but may need to be larger according to the overall size and shape of the turbine and blades. The location of the dots/stripes to be confirmed with MCA Search and Rescue Operations branch to be as shown in Figure 2-2"

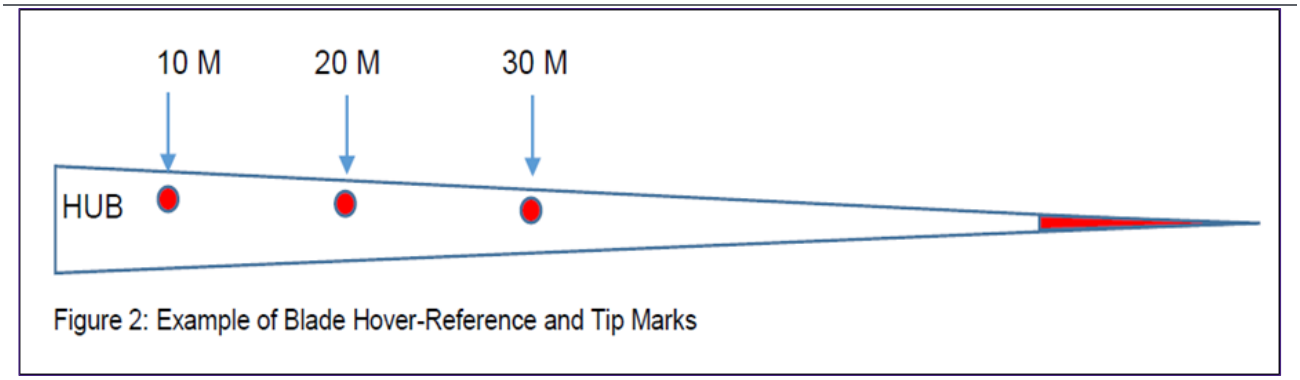


Figure 2-2: Example of blade hover reference and tip marks.

Wind turbine tower and nacelle-roof id numbers

The requirement for the nacelle marking can be found in the same document as described above, and therefore it is recommended that guidance is followed as described below in the relevant extract:

"Individual wind turbines are marked for safety of navigation and SAR situational awareness purposes with ID number plates, set at 120-degree intervals around the tower base usually somewhere above the entrance door area. These ID numbers must be clearly readable by an observer stationed 3 m above sea level at a distance of at least 150 m from the turbine. Each ID number plate shall be illuminated by a low intensity light visible from a vessel thus enabling the structure to be detected at a suitable distance to avoid a collision. It is recommended that lighting for this purpose be hooded or baffled to avoid unnecessary light pollution or confusion with navigation marks. Individual ID numbers are also to be painted on the nacelle roof so that SAR helicopters and/or other low flying aircraft (Search and Rescue, Counter Pollution, Fisheries patrol or Military) can locate and/or reference a turbine visually. These ID numbers should be recognisable from an aircraft flying 500 feet (152 m) above the highest part of the structure, which for wind farms would be the blades at their vertical point. Advice from the CAA (October 2013), following discussion with the MCA, is that such numbers should be as large as practicable but not less than 1.5 m in height and of proportionate width. This implies that ID numbers should be more than 1.5 m in height where there is space to achieve this. It is expected that developers will make ID numbers as large as can be sensibly fitted on a nacelle roof"."

2.2.4 Charting

All wind farms off the UK and Irish coast will be charted by the UKHO either by a group of black WTG chart symbols, or an outer limit with an encircled black WTG symbol. The outer limit will be in a black dashed line, or a magenta T-shaped dashed line if there are navigational or other restrictions in the area; see Admiralty Chart 5011(INT1) – "Symbols and Abbreviations" used in Admiralty Charts. Whether all submarine cables associated with the wind farm will be charted depends upon the scale of the chart.

3 OVERVIEW OF THE BASELINE ENVIRONMENT

3.1 Data sources

The data sources used to establish the baseline environment in relation to shipping and navigation are presented in Table 3-1.

Table 3-1: Summary of key desktop data.

Title	Source	Year
No: 44 Nose of Howth to Ballyquintin Point	UKHO	1978 (corrected to 5902/2019)
No 1411: Irish Sea Western Part	UKHO	2017 (corrected to 0748/2021)
Q6043 Practice and Exercise Area (PEXA)	UKHO	2020
NP 40 Sailing Directions Irish Coast Pilot	UKHO	2019
AIS data	Marine Traffic	January/July 2019, January/July 2022
NP 256 Irish Sea/Bristol Channel Tidal Stream Atlas	UKHO	1992
RYA Coastal Atlas of Recreational Boating	RYA	September 2019
A Coastal Atlas of Recreational Boating for Ireland	Irish Sailing	ND
Information collected through consultation	-	2019
Historical incident data	RNLI	2008-16

The following sections present the baseline environment within the NRA Study Area in relation to coastal features, Metocean conditions, existing vessel management, SAR and other offshore activities.

3.2 Coastal features

Between Dublin Bay and the entrance to Strangford Lough the hinterland is generally low-lying or of moderate elevation, except for a stretch of 20 NM between Dundalk Bay and Dundrum Bay where the coast is backed by the mountains of the Cooley Peninsula and the Mourne Mountains.

Bathymetry, principal bays and loughs, with associated ports and harbours, in the vicinity of the NRA Study Area are briefly described in the following sub-sections.

3.2.1 Bathymetry

As shown on the Admiralty Chart the minimum charted water depth is 15 m and the maximum water depth is 31 m at Lowest Astronomical Tide (LAT) within the offshore wind farm area. The offshore cable corridor has decreasing charted water depths ranging from approximately 25 m at the offshore wind farm area southwestern boundary to drying out close to Dunany Point.

3.2.2 Bays and loughs

Dundalk Bay

The eastern boundary of Dundalk Bay is entered between Dunany Point and Cooley Point, with an irregular seabed. Several rocks lie off Cooley Point including a pinnacle with a depth of 0.3 m, which is marked by a lit buoy moored 1.7 NM southeast of the point. The land to the south and west sides of the bay is flat, but to the north side rises to heights of over 600 m close inland.

Carlingford Lough

Carlingford Lough is located approximately 5 NM north of Dundalk Bay and extends inland for about 8 NM. It is entered between Ballagan Point (54˚ 00'.01N 6˚ 06'.19W) and Cranfield Point, 2 NM northeast. In clear weather, the lough can be easily identified by its low entrance framed between mountains on each side. The entrance is almost entirely blocked by rocks and shoals extending across the mouth of the lough.

The limits of the Carlingford Lough Commissioners Statutory Harbour Authority (SHA) lies within a line drawn from Cranfield Point (54˚ 01'.37N 6˚ 03'.75W) to Hellyhunter Rock (54˚ 00'.90N 6˚ 01'.93W) thence to Ballagan Point (54˚ 0'.01N 6˚ 06'.19W).

Pilotage is compulsory for all vessels entering the Lough and Carlingford Lough Pilots Ltd serve the ports of Greenore and Warrenpoint. Pilots board at Hellyhunter Buoy (see section3.4).

Dundrum Bay

Dundrum Bay lies about 6 NM northeast of Annalong. The west side of the bay is bordered by steep slopes which rise to a height of over 800 m within 1.5 NM of the coast. Slieve Croob (531 m in elevation) is prominent from all parts of the bay.

3.2.3 Local ports and harbours

The commercial harbours at Drogheda, Dundalk and Greenore in Ireland and Warrenpoint at the head of Carlingford Lough in Northern Ireland are the main ports in the vicinity of the NRA Study Area. There are, however, several fishing harbours and inlets which are visited by coasting vessels and are suitable for small craft. Strangford Lough, well to the north of the NRA Study Area, with its extensive landlocked waters, is also a popular area for yachts.

A brief synopsis of the principal ports situated in the vicinity of the NRA Study Area are described in this section.

Port of Warrenpoint

Warrenpoint (54˚ 06'.03N 6˚ 15'.76W) is a port situated at the mouth of the Newry River at the head of Carlingford Lough. The entrance channel is marked by lights and is dredged to a depth of 5.4 m. The port has seven berths with a total quay length of 750 m. Principal trades are as follows:

- Seatruck Ferries operate a regular Ro-Ro (Roll on – Roll off) service from Warrenpoint to Heysham (Lancashire). There are 11 weekly departures and the crossing time is approximately eight hours;
- Cardiff Container Line provide a regular container service from Warrenpoint to Cardiff and Dublin; and
- Dry cargoes, including timber and general building materials.

Port of Dundalk

Dundalk (54˚ 00'.47N 6˚ 23'.20W) is a port lying on the Castletown River at the head of Dundalk Bay. The quays are situated on the south bank of the river. It is ideally located as a gateway between Northern Ireland and the Republic of Ireland. Ships of up to 3,500 deadweight tonnes (dwt) and 120 m in length overall (LOA) can be handled. The main cargo imports are plasterboard, feedstuff, oil, coal, timber and steel. The main exports are scrap metal and turf.

At their closest point the Dundalk Port Company statutory harbour limits are approximately 2.5 NM from the western boundary of the offshore wind farm area (see Figure 1-1).

The offshore cable corridor overlaps the Dundalk Port Company Pilotage District limits, near Dunany Point.

Greenore Port

Greenore Port (54˚ 02'.07N 6˚ 08'.02W) is a privately-owned port located at the eastern end of the Carlingford Peninsula (County Louth) next to the Dublin-Belfast Economic Corridor. It has three berths and can handle vessels of up to 40,000 gross tons. Greenore Port completed a project to extend quay infrastructure for Lo-Lo (Load on – Load off) facilities in 2022 and has further plans to develop the port for use in the offshore renewables industry.

Kilkeel Harbour

Kilkeel Harbour (54˚ 03'.47N 5˚ 59'.30W) is a fishing port lying 3.2 NM northeast of Cranfield Point. The harbour is protected by breakwaters which form an entrance about 400 m wide, with a dredged depth of 1.0 m. Tides rise about 5.3 m at Mean High Water Springs (MHWS). The harbour has facilities for fishing vessels and affords shelter for small craft but is liable to silt.

An inshore lifeboat is maintained at Kilkeel.

Port of Drogheda

Drogheda (53˚ 43'.23N 6˚ 18'.32W) lies about 4.5 NM upstream from the mouth of the River Boyne. The port is divided between two sites, the deep-water terminal at Tom Roes Point (53˚ 43'.25N 6˚ 18'.32W) and the inner and shallower quays at Drogheda, 1 NM farther upstream.

Drogheda Port Company is a commercial state port which handles over 1 million tonnes of cargo annually in addition to over 700 vessel calls. The port has a wide product base and a balance of trade at approximately 75% import and 25% export. Imports include containers, paper, steel, timber, fertiliser, grains, petroleum and liquefied petroleum gas. Exports include containers, magnesite, zinc concentrate and timber.

The Drogheda Port Company has two facilities for the loading/discharging of cargoes (i.e. the inner north quays port and the deep-water facility at Tom Roes Point Terminal). In addition, there are two private facilities. The approach and estuarial channels are maintained to a depth of 2.2 m at chart datum[2] to the deep-water facility at Tom Roes Point, 5 km from the sea, and at 0.8 m at chart datum to the inner port 7 km from the sea. The port can currently accommodate vessels up to 130 m LOA.

The deep-water facility at Tom Roes Point is the primary container/paper and timber handling facility. The berth is 160 m in length with an always-afloat dredged pocket of 6 m at chart datum over a length of 210 m.

A private hydrocarbons facility can accommodate vessels of up to 80 m LOA, in a dredged pocket of 2.2 m at chart datum. The oil terminal has a current capacity of 10,000 m^3 of Class 1, 2 and 3 products, plus, 1,500 m^3 capacity at the liquefied petroleum gas (LPG) terminal. A private bulk cement/magnesite/coal facility can accommodate two vessels on a 160 m berth.

3.3 Metocean conditions

The climate on the east coast of Ireland and in the Irish Sea is mild, equable and humid. The summers are usually cloudy and wet, and the winters are windy with frequent rain. Snow is quite rare. The annual rainfall is generally heavy and well-distributed.

Wind

Although winds from any direction may be expected in any month, the winds are usually from the southwest and west, and occasionally from the northwest. From March to May however, northeast winds become frequent and north winds are not uncommon. Gales may occur in any month and are common from October to March.

Visibility

Coastal fog is most frequent on autumn and winter mornings.

Tide streams and current

There is little, if any, current in the Irish Sea, however, there is the possibility of a west-going surface current which is believed to set across the Irish Sea from Liverpool Bay during strong and persistent east winds.

Tidal streams off the coast are generally weak and there is an area of permanently slack water between the latitudes of Drogheda (53˚ 43'.00N) and Carlingford Lough (54˚ 00'.00N). The tidal rate and direction for a

[2] A chart datum is the water level that depths displayed on a nautical chart are measured from.

position off Killard Point (54°18.51'N 5°27.37W) are detailed below. Tidal rates during spring tides for Killard Point show rates of less than 1.0 knot and therefore tidal rates are not considered significant.

Table 3-2: Tidal rate and direction off Killard Point.

Time	Direction	Spring rate (kts)	Neap rate (kts)
06h	238°	0.3	0.2
05h	201°	0.8	0.5
04h	206°	0.9	0.6
03h	214°	0.6	0.4
02h	232°	0.4	0.2
01h	278°	0.2	0.1
HW	353°	0.2	0.1
+01h	024°	0.4	0.2
+02h	039°	0.6	0.3
+03h	055°	0.7	0.4
+04h	070°	0.8	0.5
+05h	023°	0.7	0.4
+06h	265°	0.4	0.3

An acoustic Doppler current profiler (ADCP), used to measure movement in the water, both as waves and currents) was deployed in the study area between October 2019 and July 2020. The data confirms currents are mostly 0.5 knot and maximum is 1 knot (rare), and the direction is mostly north / south – confirming that the Admiralty Chart-diamond is representative of the offshore wind farm area. (Reference: offshore wind farm – Floating LiDAR Buoy, 12- month Measurement Campaign Report, December 2020).

3.4 Existing vessel management

The following section outlines the existing vessel management measures within or close to the NRA Study Area for the ports and harbours described above in section 3.2.3.

Pilotage

The principal ports considered in this report employ their own licensed pilots. At minor ports where no official pilotage organisation exits, local fishermen or boatmen are usually available to act as pilots.

The closest pilot station to the NRA Study Area is situated at the entrance to Carlingford Lough close to the Hellyhunter buoy (54˚ 02'N 6 05'W). Pilotage is compulsory for all vessels entering the Lough and Carlingford Lough Pilots Ltd. serve the ports of Warrenpoint and Greenore.

Dundalk pilotage district lies to the west of a line from Giles Quay Light (53˚ 59.05'N 6 14.41'W) to a position 1.75 NM east of Dunany Point (53˚ 51.63'N 6 14.35'W) thence to Dunany Point. Pilots board about 1.5 NM south southeast of Pile Light (53˚ 58.56'N 6 17.72'W). If the Dundalk pilot boat is not operational then the pilot will utilise Carlingford Lough pilot boat and generally board and land vessels bound to and from Dundalk close to Hellyhunter buoy.

Vessel Traffic Services

There are no local port Vessel Traffic Service facilities close to the NRA Study Area. The primary form of communication between local ports and vessels is generally VHF radio and the use of AIS.

IMO Routeing Measures

There are no International Maritime Organisation (IMO) routeing measures[3], within or near the NRA Study Area.

Radio navigational warnings

The waters described in this report lie within NAVAREA[4] 1 which is coordinated by the United Kingdom. NAVAREA warnings are concerned with information which ocean-going mariners require for safe navigation including failures of important aids to navigation (AtoN) as well as information which may necessitate changes to planned navigational routes.

Aids to navigation

The CIL is the responsible authority for the principal lights and buoys on or around the coasts of Ireland. Some of the minor lights and buoys are the responsibility of local authorities.

The IALA Maritime Buoyage System Region A (red to port) is in use on the coasts and in the harbours covered in this report. A description of navigation aids near the NRA Study Area is as follows (see Figure 1-1):

- At the entrance to Carlingford Lough is Haulbowline Light; a grey granite tower, 34 m in height (54˚ 01'.20N 6˚ 04".74W) stands on the east rock of Haulbowline Rocks;
- Hellyhunter Light Buoy (54˚ 00'.35N 6˚ 02'.05W) is a south Cardinal mark with characteristics Q(6) + long flash 15 secs. with a Racon and AIS;
- A light 8 m above MHWS at the entrance to Kilkeel harbour (54˚ 03'.46N 5˚ 59'.0530W) with a Flash white/red every 2 secs with AIS characteristics;
- Imogene Light Buoy (53˚ 57'.41N 6˚ 07'.03W) a red can buoy with Flash (2) red every 10 secs with AIS characteristics; and
- Dunany Light Buoy (53˚ 53'.53N 6˚ 09'.50W) is a red can buoy with Flash red every 3 secs and AIS characteristics.

3.5 Search and rescue

In Irish coastal waters and their approaches, SAR operations are carried out by ships, aircraft, including helicopters, and by lifeboats.

SAR is coordinated between the relevant responsible authorities and organisations in Ireland and Northern Ireland.

SAR in Ireland

SAR in Ireland is the responsibility of the Department of Transport, Tourism and Sport and is controlled by the Irish Maritime Search and Rescue Region (IMSRR) by the IRCG, a division of the Department. There are three divisions within the IMSRR each with its own coordination centre as follows:

- Dublin Maritime Rescue Coordination Centre (MRCC) which also acts as the overall coordinator of IMSRR;
- Valentia Maritime Rescue Sub-Centre (MRSC); and

[3] An international predetermined path for ships to navigate in order to avoid navigational hazards such as collisions and subsequent damages to ships, crew members, and the marine environment.

[4] The maritime geographic areas in which various governments are responsible for navigation and weather warnings.

- Malin Head MRSC.

IRCG has at its disposal a range of resources including; a marine communication network, helicopters and fixed wing aircraft, Royal National Lifeboat Institution (RNLI) lifeboats (see below), Community Inshore Rescue Boats (see below) as well as equipment belonging to other public and private organisations.

As well as its own medium load carrying helicopters based at Shannon, Dublin, Waterford and Sligo airports, the IRCG can call upon Air Corps fixed wing aircraft available in Dublin and similarly Royal Air Force (RAF) aircraft can be used.

The RNLI is a voluntary organisation incorporated by Royal Charter for the purpose of saving lives, promoting safety and providing relief from disaster, primarily at sea and secondly on the inland waters of the UK, Channel Islands, Isle of Man and Republic of Ireland. The closest RNLI stations to the offshore wind farm area are at:

- Kilkeel (inshore B class Atlantic 85 lifeboat);
- Clogher Head (all-weather Shannon class lifeboat); and
- Newcastle (all-weather Mersey class lifeboat and an inshore D class lifeboat).

There is an IRCG station at Greenore.

Community Inshore Rescue Boat Ireland (CRBI) is a locally funded rescue service manned by volunteers. The service patrols the coastline as well as reacting to emergencies. There are no CRBI stations within the vicinity of the NRA Study Area.

SAR in Northern Ireland

HM Coast Guard (HMCG) is the authority responsible for initiating and coordinating all civil maritime SAR operations in the UK Search and Rescue Region (SRR). This includes the mobilisation, organisation, and tasking of adequate resources to respond to people either in distress at sea, or at risk of injury or death on the cliffs or shoreline of the United Kingdom.

The Ministry of Defence provides units to assist casualties on request from HMCG. Royal Navy provides Explosive Ordnance Disposal Teams to deal with unexploded or suspect ordnance.

The Aeronautical Rescue Coordination Centre at Kinloss, Scotland controls the operation of all military SAR air resources within the UK SRR.

As stated above the RNLI provides all-weather and inshore lifeboats around the coast for saving life at sea.

3.6 Fishing

The offshore wind farm area and offshore cable corridor overlap with areas for netting, dredging and potting (see appendix 12-1: Commercial Fisheries Technical Report). Netting grounds for mixed demersal species extend from Carlingford Lough to the north of the offshore wind farm area, south along the east coast of Ireland to Skerries and beyond to Howth. Dredging for scallops take place from the offshore wind farm area south towards Skerries. Dredging for razor clams takes place from the landfall section of the offshore cable corridor south towards Howth. Potting for shrimp, lobster and crab extends from Carlingford Lough to the north of the offshore wind farm area, south along the east coast of Ireland to Skerries. Consultation has also indicated that hand lining for mackerel and pollack also takes place during the summer months.

Offshore fishing grounds located outside the NRA study area include the Irish Sea prawn grounds and areas fished by mobile bottom, mobile seine, mobile other and passive gear types. It is important to note that the Vessel Monitoring System (VMS) data does not delineate between whether a vessel is fishing, steaming or inactive, however AIS data for 2019, suggest that vessels are steaming to and from offshore grounds, through the offshore wind farm area (see section 4.3).

3.6.1 Republic of Ireland - ports and fishing fleets

In 2020, the Republic of Ireland (RoI) fishing fleet registered 1,998 vessels. The fleet comprises of:

- 1,486 vessels under 10 m LOA;
- 234 vessels between 10 m and 12 m LOA;
- 66 vessels between 10 m and 15 m LOA;
- 99 vessels between 15 m and 24 m LOA; and
- 113 vessels equal to or over 24 m LOA.

Clogherhead represents the closest fishing port to the offshore wind farm area and offshore cable corridor within the Commercial Fisheries Study Area.

Consultation with the Dundalk Pilot advised that cockle day boats operate inside port limits, likely to be within Dundalk Bay, with up to three lobster boats operating out of the port. Furthermore, consultation with Clogher Head RNLI indicated that fishing activities within the Commercial Fisheries Study Area are likely to target Nephrops, razor clams, lobsters, and crabs.

3.6.2 Northern Ireland – ports and fishing fleets

There are an estimated 854 fishermen working 332 vessels in Northern Ireland, operating out of Belfast, Kilkeel, Ardglass and Portavogie (MMO, 2019).

Key species landed by Northern Ireland vessels within the Commercial Fisheries Study Area (see volume 2B, chapter 12: Commercial Fisheries) include Nephrops and queen scallops, targeted by bottom trawls; mussels, cockles, razor clams and scallops targeted by dredgers; and lobsters, brown crabs, and velvet crabs by potters.

Fishing ports in proximity to the Commercial Fisheries Study Area include Kilkeel, Ardglass and Portavogie. Kilkeel is the closest port to the offshore wind farm area and offshore cable corridor, however no Northern Ireland ports are located within the Commercial Fisheries Study Area, although vessels from these ports will travel into the Commercial Fisheries Study Area to fish.

Consultation with the Northern Ireland Fish Producers' Organisation (NIFPO) and Dunany Lobster and Crab indicated that fishing activities within the Commercial Fisheries Study Area are likely to target *Nephrops,* razor clams, prawns, lobsters, and crabs with some mackerel and pollack fishing using handlines at certain times of the year (mainly summer).

3.7 Other offshore activities

For development consent decisions the guidance in MGN 654 requires consideration of any impact the wind farm may have, regarding navigation safety, on existing marine offshore activities.

3.7.1 Marine aggregates

There are no marine aggregate extraction sites near the offshore wind farm area or offshore cable corridor.

3.7.2 Oil and gas

A gas pipeline from Scotland comes ashore 1.25 NM northwest of Braymore Point (53˚37'.79N 6˚11"41W) and passes about 8 NM to the southeast of the offshore wind farm area, at its closest point.

A natural gas pipeline from Scotland comes ashore in the vicinity of Loughshinny (53˚32'.64N 6 04'.82W) which is approximately 20.8 NM to the south of the offshore wind farm area.

3.7.3 Subsea cables

There are no charted sub-sea cables in or close to the NRA Study Area.

3.7.4 Spoil ground

There are two “spoil ground” areas charted in the vicinity of the NRA Study Area, centred in the following positions:

- 54˚01’.20N 5˚.55.50W (approximately 5 NM northeast of the offshore wind farm area); and
- 53˚57’.80N 05˚ 56.50W (approximately 3.4 NM east-northeast of the offshore wind farm area.

3.7.5 Offshore renewable energy installations

There are no existing OREI in or close to the NRA Study Area.

3.7.6 Charted anchorages

Other than anchorages for emergency situations there are no charted anchorages within the offshore wind farm area or the offshore cable corridor, although vessels may on occasion anchor in the bays and inlets along the respective coastal region.

3.7.7 Military exercise areas

Practice and Exercise Area (PEXA) chart Q6403 gives details of exercise areas in the vicinity of the NRA Study Area. Submarines exercise frequently in the area both dived and, on the surface, 8 NM to the northeast of the offshore wind farm area, as marked on Admiralty Chart No 44. A good lookout is required when passing through these waters.

3.7.8 Firing practice area

There is a firing practice area in Dundrum Bay, approximately 20 NM northeast of the NRA Study Area. The firing practice areas are operated using a clear range procedure; exercises and firing only take place when the areas are clear of shipping.

Gormanston Military Firing Range operates from the site of the Gormanston aerodrome, which is located 16 NM southwest of the offshore wind farm area (IAA, 2015). Gormanston is used for air-ground firing training, air-defence training and general military training.

4 EXISTING VESSEL TRAFFIC AND RISK PROFILE

4.1 Data sources

To provide an accurate baseline of vessel traffic in the NRA Study Area, AIS information was utilised for January and July 2019 representative of winter and summer periods respectively and January/July 2022 (see section 4.2 and 4.3 respectively). AIS data has been supplemented by information provided during consultation for the purposes of the NRA.

In 2000, IMO adopted a new requirement (as part of a revised Chapter V of SOLAS) for ships to be fitted with AIS. AIS was developed primarily as an aid for collision avoidance between vessels. Vessels that carry an AIS transponder broadcast at regular intervals to all AIS receivers within VHF range key information such as identity, name, type, speed, course, etc. AIS exists in two forms, Class A and Class B: the former in all those vessels mandated by IMO to carry AIS; the latter on a voluntary basis by non-SOLAS vessels such as recreational craft.

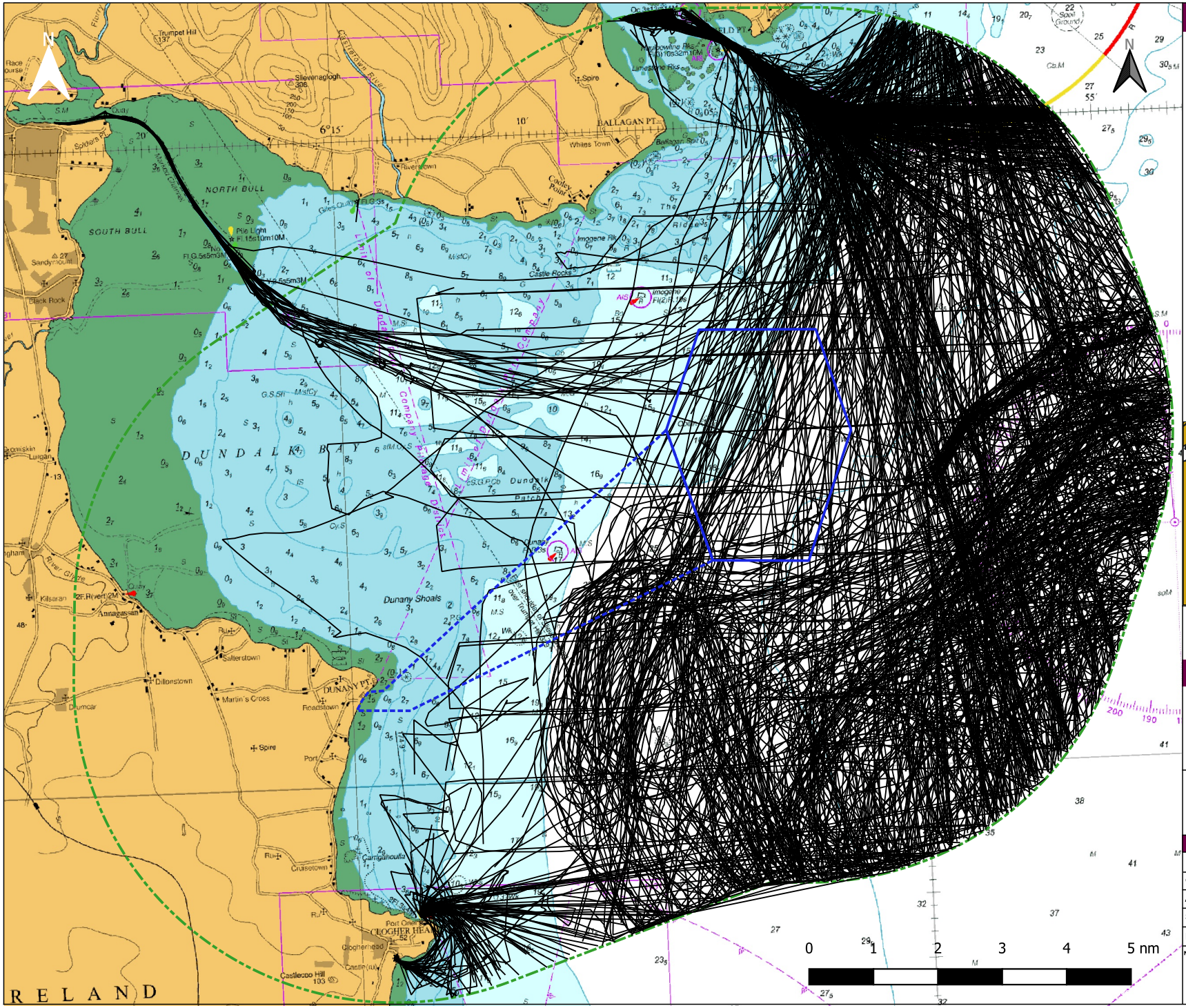
Regulation 19 of SOLAS Chapter V sets out the navigational equipment to be carried on board ships according to ship type. AIS is required to be carried on:

- All ships of 300 gross tonnage and upwards related to international voyages;
- Cargo ships of 500 gross tonnage and upwards not engaged on international voyages; and
- All passenger vessels irrespective of size.

There is currently no requirement for small commercial vessels or cruising yachts to carry AIS, however, should they choose to do so they should be fitted with an AIS B transponder or receiver. In 2007, the new Class B AIS standard was introduced which enabled a new generation of economical AIS transceivers. As required under EU Directive 2009/17/EC the entire EU fishing fleet over 15 m was required to be equipped with AIS, Class A, by 2014. The Directive was put into effect to improve the navigation and anti-collision mechanisms on board fishing vessels.

4.2 Traffic profile 2019

The tracks of all vessels recorded by AIS during the winter and summer periods are shown in Figure 4-1. Vessel tracks are also broken down by winter (January 2019) and summer (July 2019) in Figure 4-2 and Figure 4-3 respectively, which show that winter is significantly quieter in terms of vessel traffic compared with the summer.



Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Vessel Tracks

Client: ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-1 AIS Vessel Tracks (January and July 2019)

RPS Ireland
A TETRA TECH COMPANY

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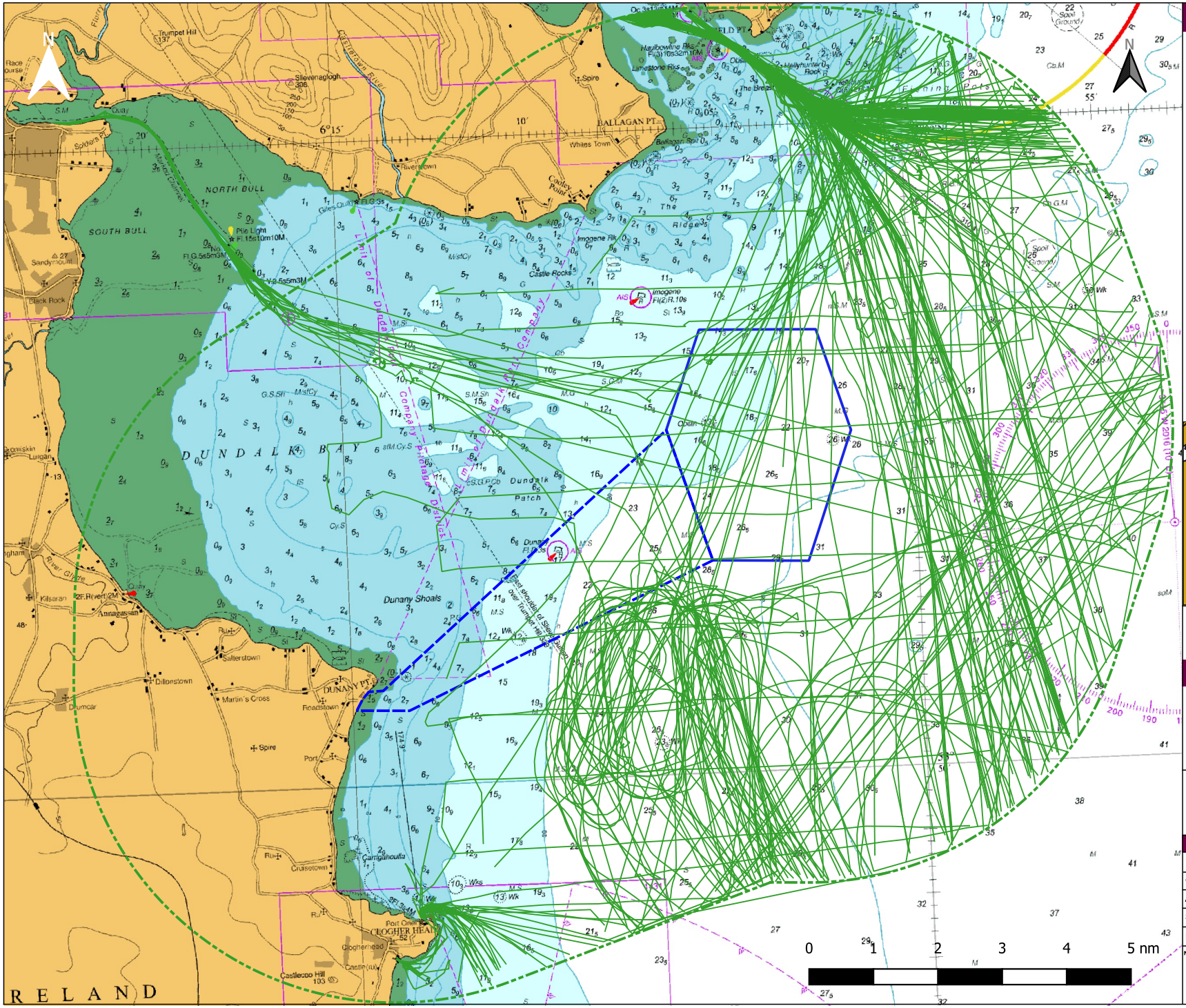
Scale:	1:150,000@ A4	**Projection:**	
Date:	25/1/2024		IRENET95 / ITM



Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Jan 2019 Vessel Tracks

Client: ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-2 AIS Vessel Tracks (January 2019)

RPS Ireland
A TETRA TECH COMPANY

Issue Details

Drawn:	AF	**Project:**	MDR1520B
Checked:	AF	**File Ref:**	
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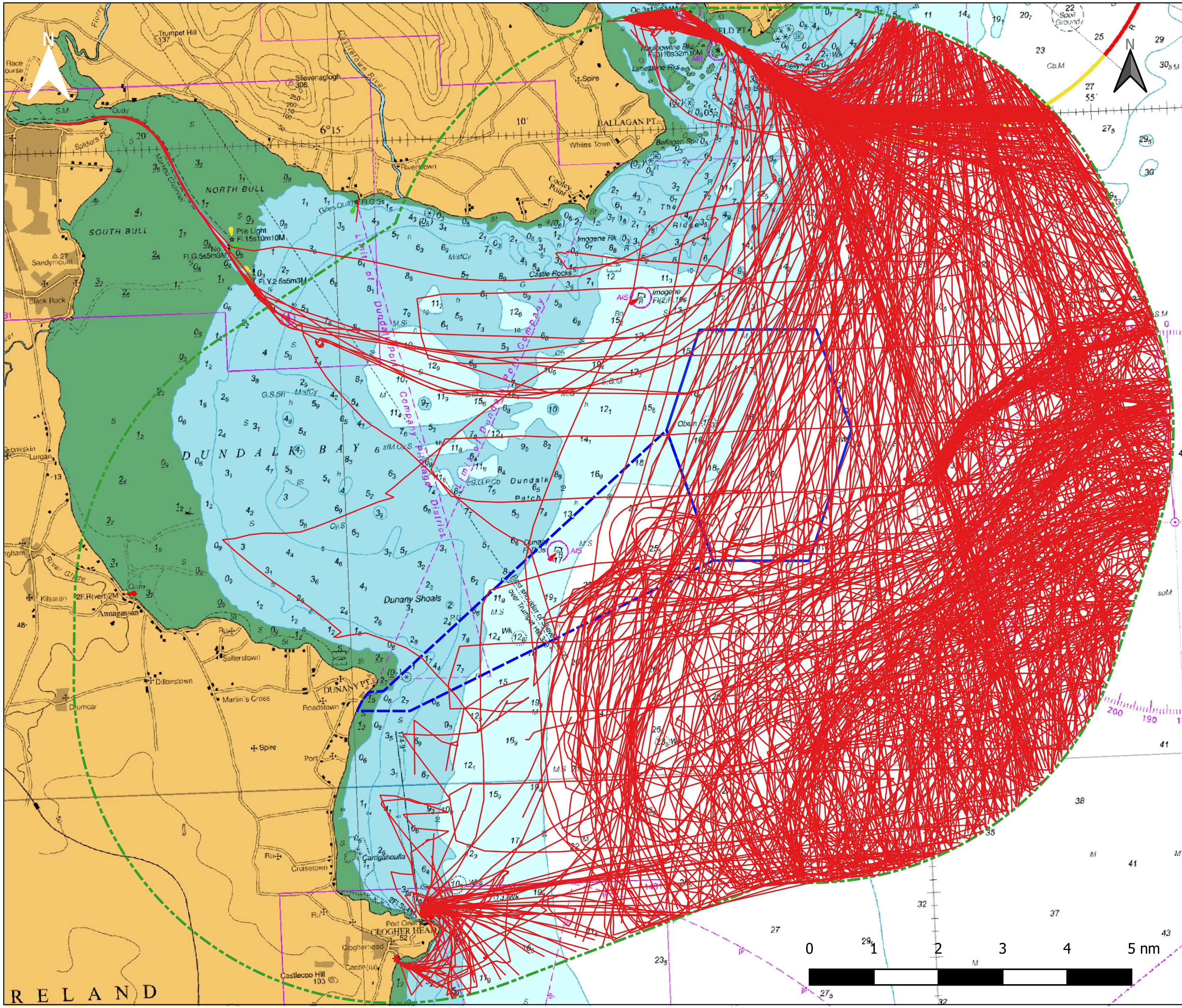

Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- July 2019 Vessel Tracks

Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-3 AIS Vessel Tracks (July 2019)

Ireland

A TETRA TECH COMPANY

Issue Details

Drawn:	AF	**Project:**	MDR1520B
Checked:	AF	**File Ref:**	MDR1520QG0000D01
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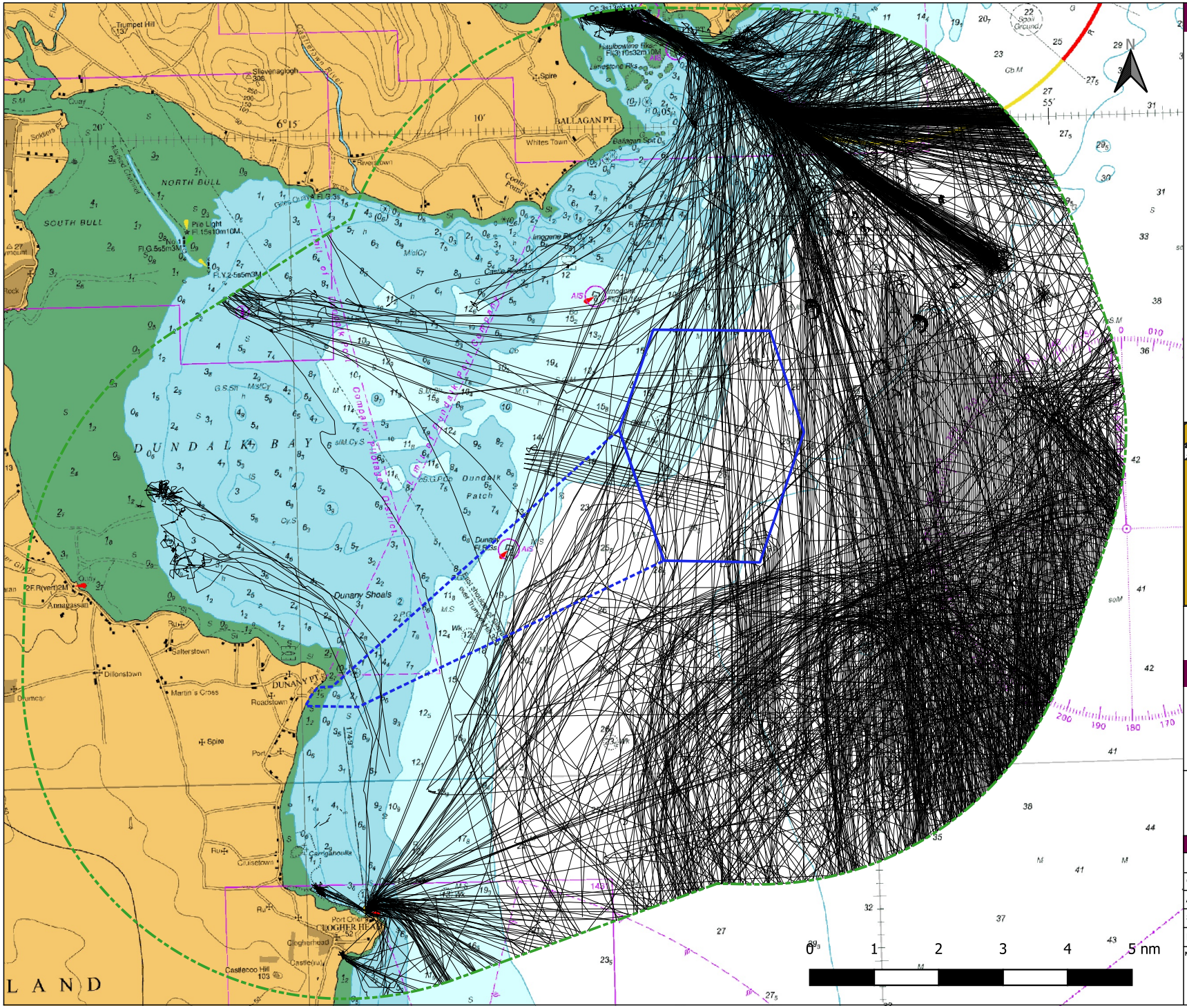
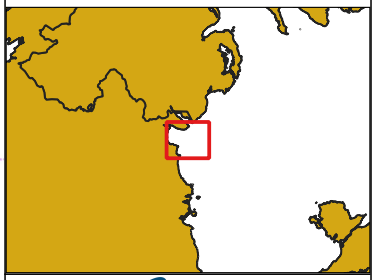
4.3 Traffic profile 2022

The tracks of all vessels recorded by AIS during the winter and summer periods are shown in Figure 4-4 for 2022. Vessel tracks are also broken down by winter (January 2022) and summer (July 2022) in Figure 4-5 and Figure 4-6 respectively.



Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Vessel Track



Client: ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-4 AIS Vessel Tracks (January and July 2022)

RPS Ireland
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Issue Details

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Scale:	1:150,000@ A4	**Projection:**
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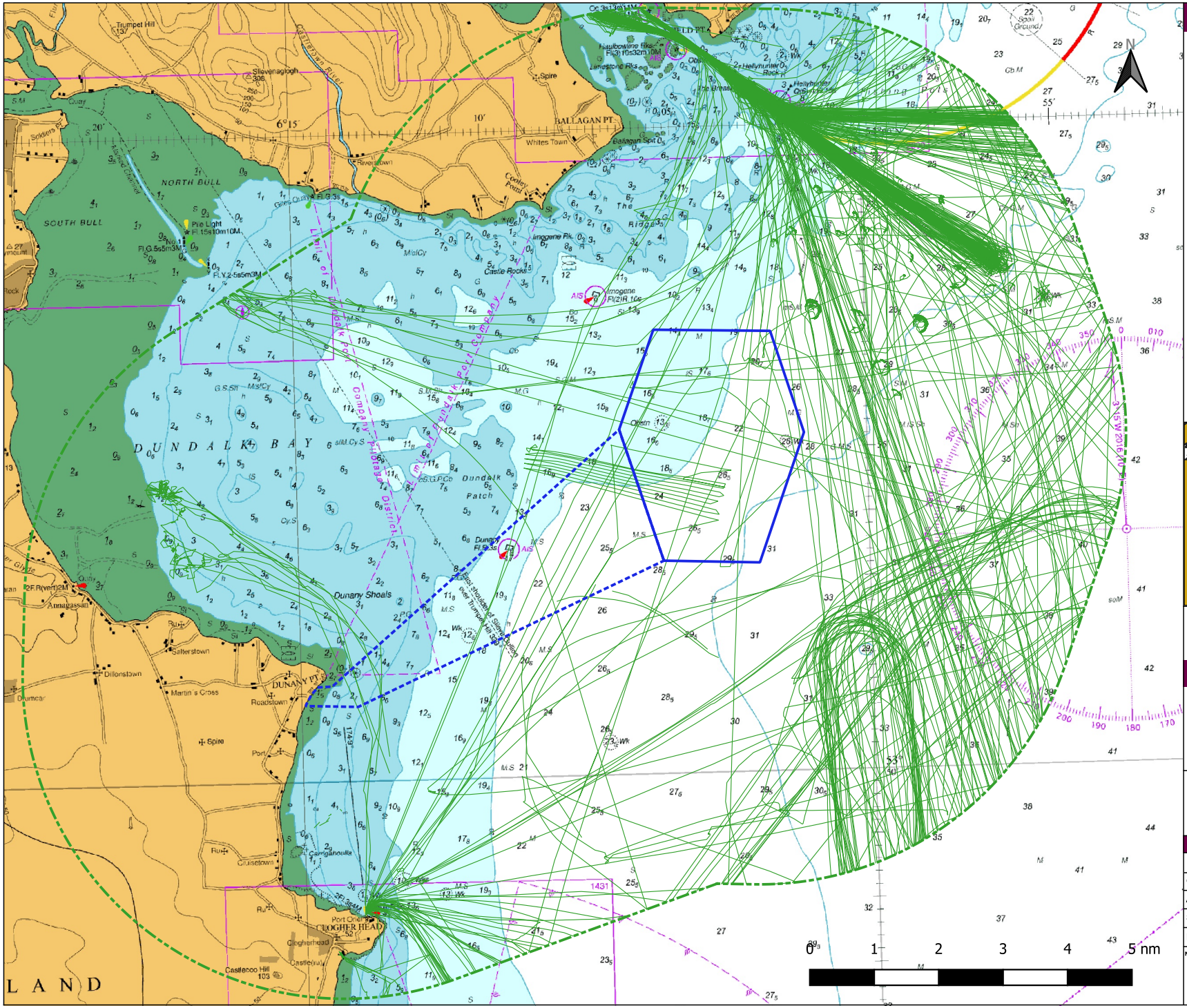
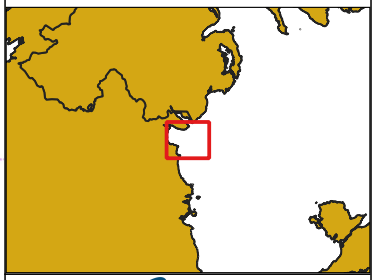


Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- January 2022 Vessel Track



Client: ORIEL WINDFARM OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-5 AIS Vessel Tracks (January 2022)

RPS Ireland
A TETRA TECH COMPANY

Issue Details

Drawn:	RM	**Project:** MDR1520B
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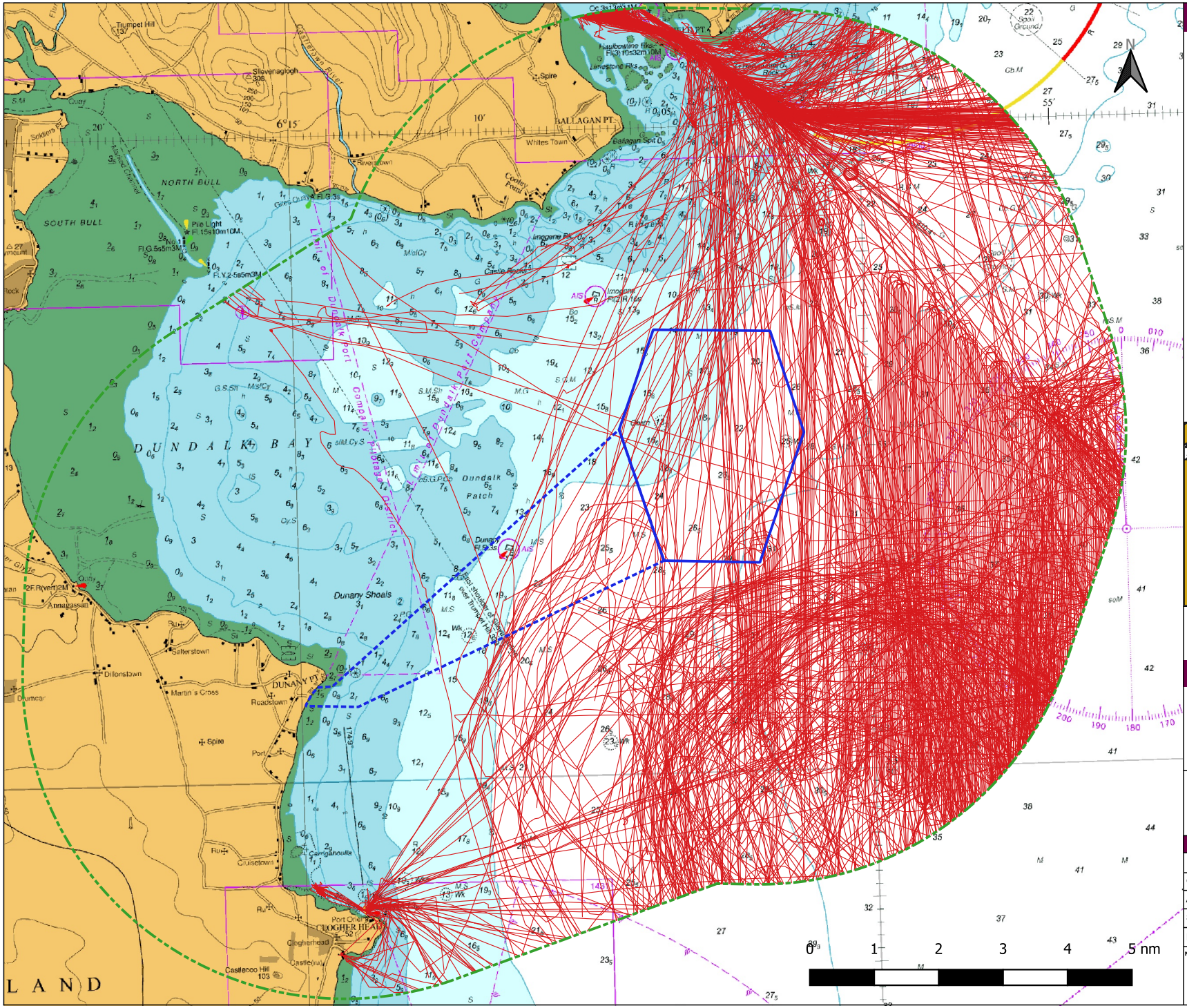
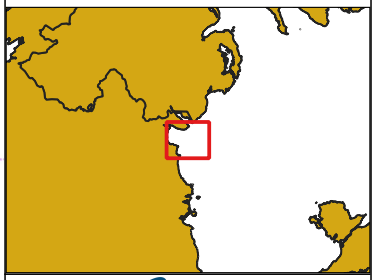
Scale:	1:150,000@ A4	**Projection:**
Date:	25/01/2024	IRENET95 / ITM



Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- July 2022 Vessel Track



Client: ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-6 AIS Vessel Tracks (July 2022)

RPS Ireland
A TETRA TECH COMPANY

Issue Details

Drawn:	RM	**Project:**	MDR1520B
Checked:	AF	**File Ref:**	MDR1520QG0000D01
Approved:	ER		
Scale:	1:150,000@ A4	**Projection:**	IRENET95 / ITM
Date:	25/01/2024		

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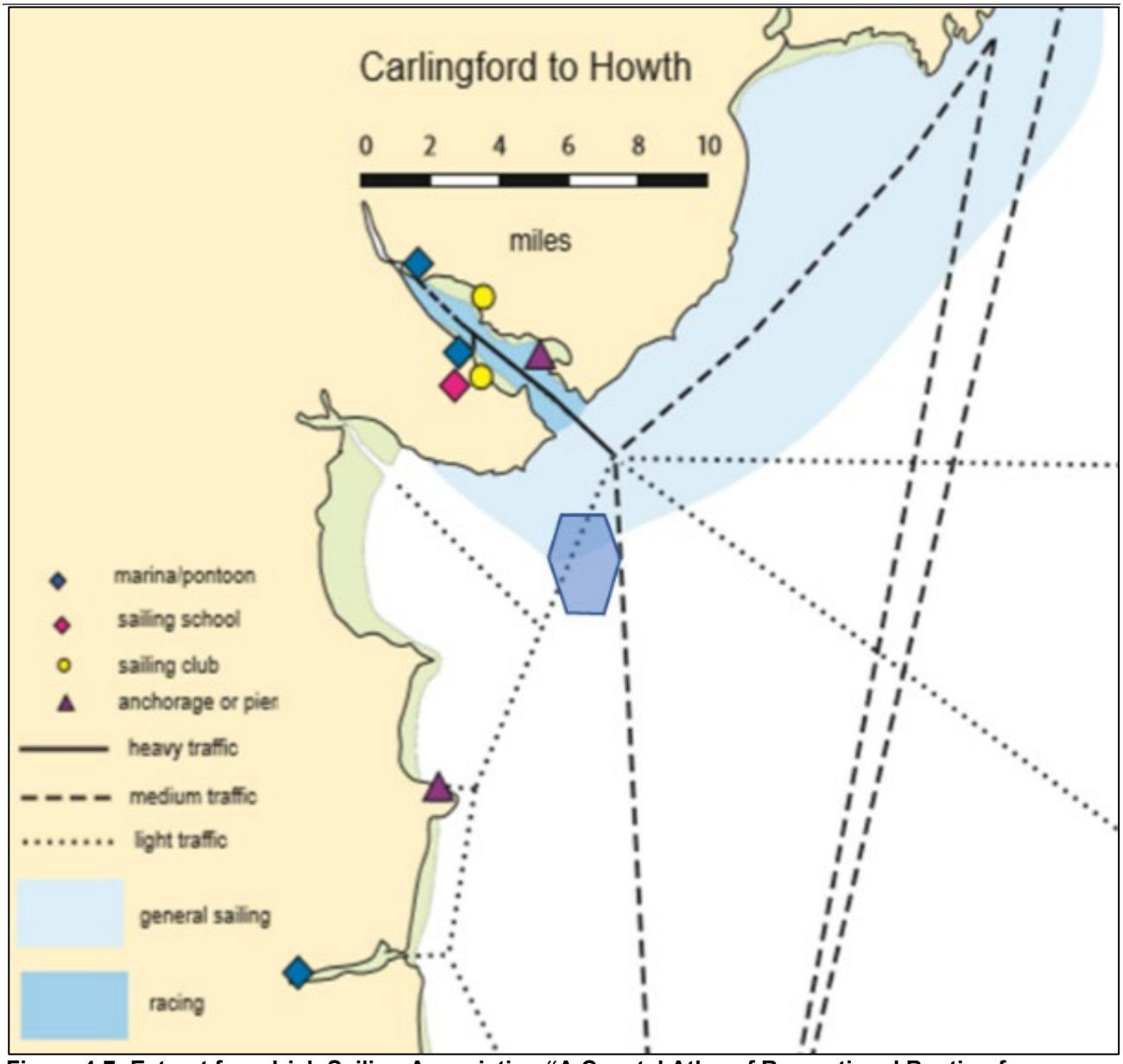


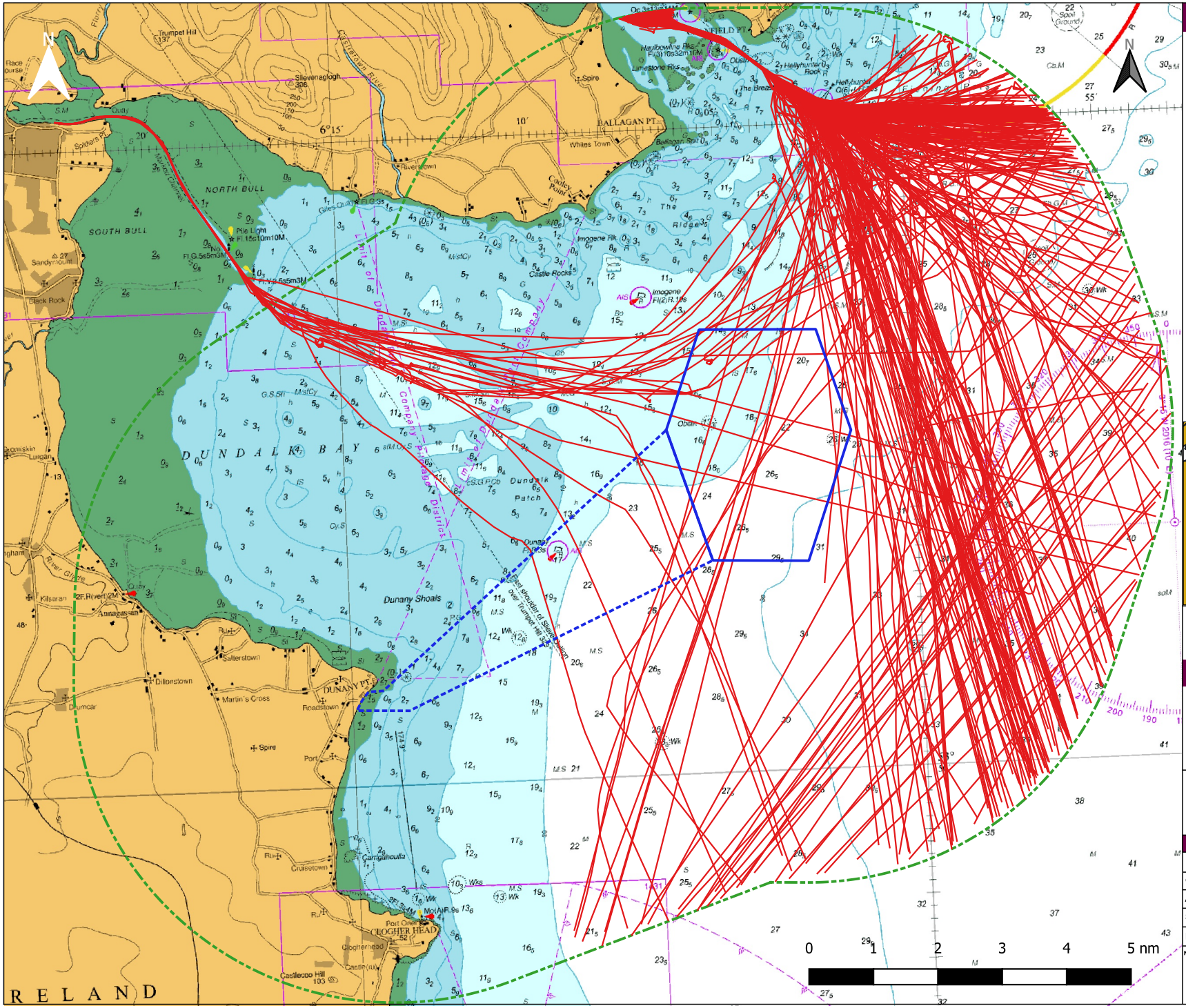
Figure 4-7: Extract from Irish Sailing Association "A Coastal Atlas of Recreational Boating for Ireland" (Offshore Wind Farm area indicated by blue hexagon).

Service craft

Figure 4-13 shows combined winter and summer service vessel tracks within the NRA Study Area. Service craft primarily represents the Carlingford Lough and Dundalk Harbour respective pilot vessel movements. The other movements are attributed to general service vessels.

Other vessels

Figure 4-14 shows combined winter and summer tracks for other vessels within the NRA Study Area. The tracks in this plot are primarily associated with the survey vessel engaged in survey work for this Project.



Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Cargo Vessel Tracks

Client: ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-8 Cargo Vessel Tracks (Jan/July 2019)

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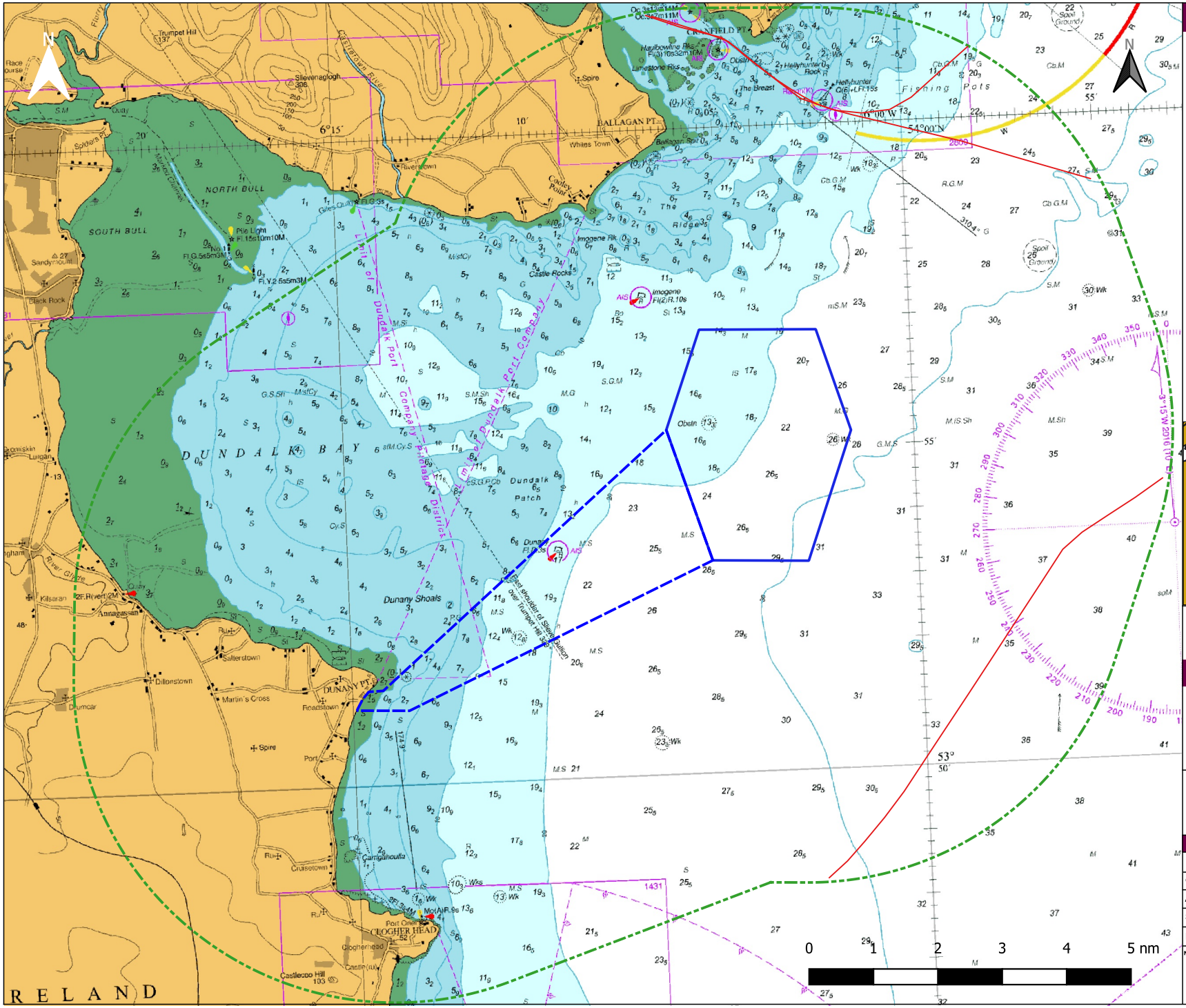

Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Tanker Tracks

Client: ORIEL WINDFARM OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-9 Tanker Tracks (Jan/July 2019)

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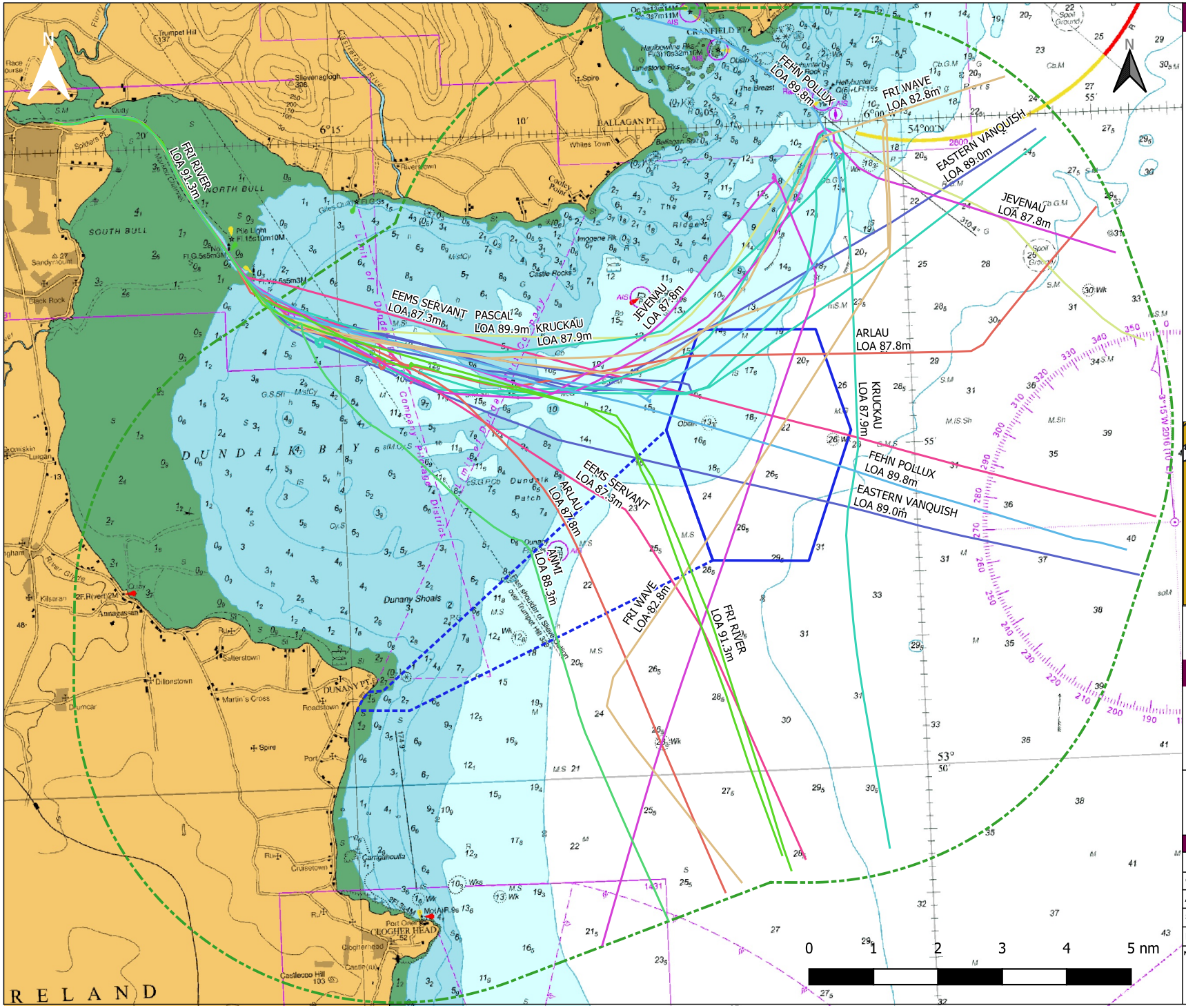

Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area

Dundalk Cargo Vessels

- ANMI
- ARLAU
- EASTERN VANQUISH
- EEMS SERVANT
- FEHN POLLUX
- FRI RIVER
- FRI WAVE
- JEVENAU
- KRUCKAU
- PASCAL

Client: ORIEL WINDFARM OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-10 Dundalk Vessel Tracks (Jan/July 2019)

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Scale:	1:150,000@ A4	**Projection:**
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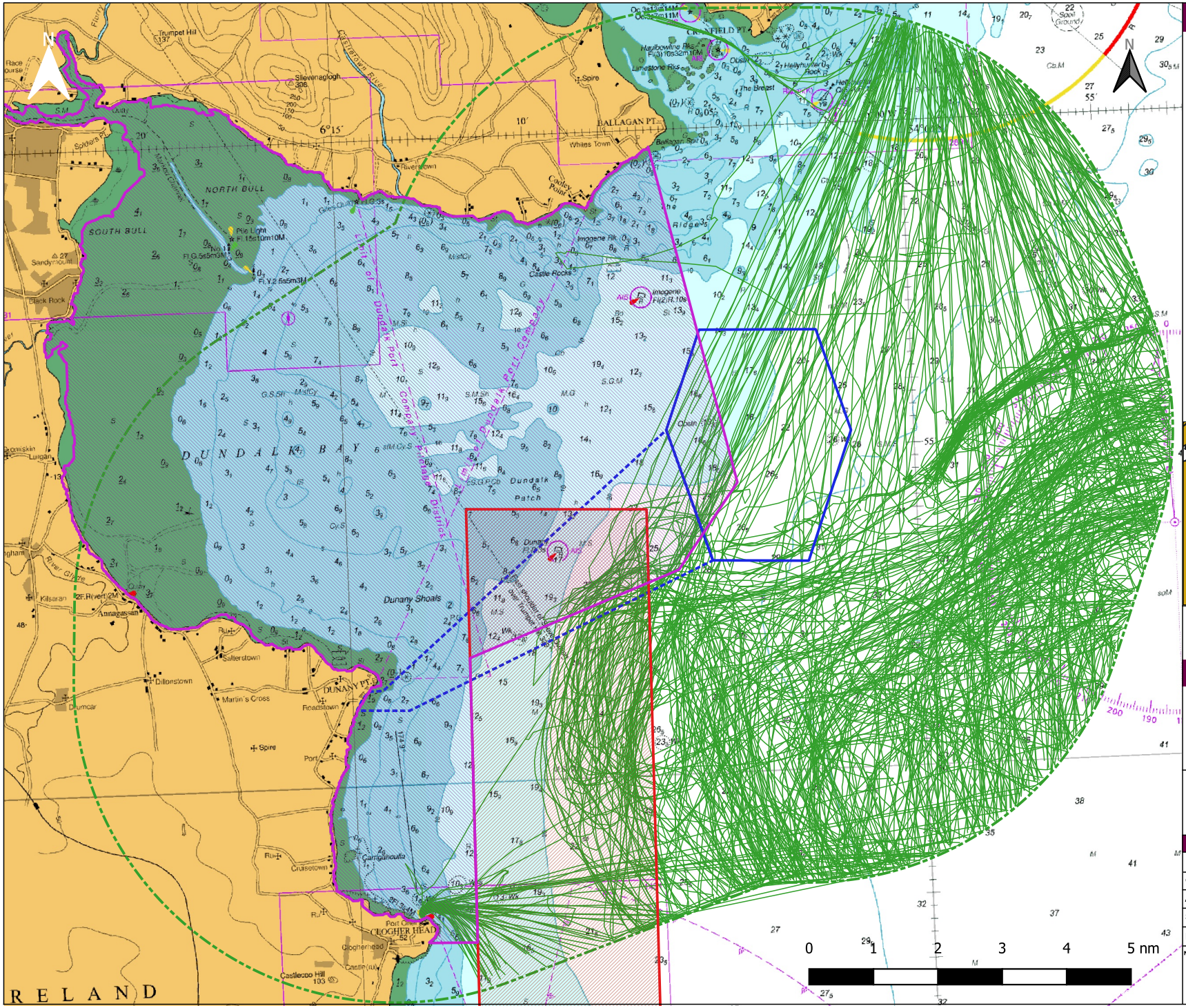

Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Fishing Vessel Tracks

Dunany Pt Lobster & Crab

- Shrimp Fishery
- Lobster and Crab Fishery

Client: ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-11: Fishing Vessel Tracks (Jan/July 2019)

RPS Ireland
A TETRA TECH COMPANY

Issue Details

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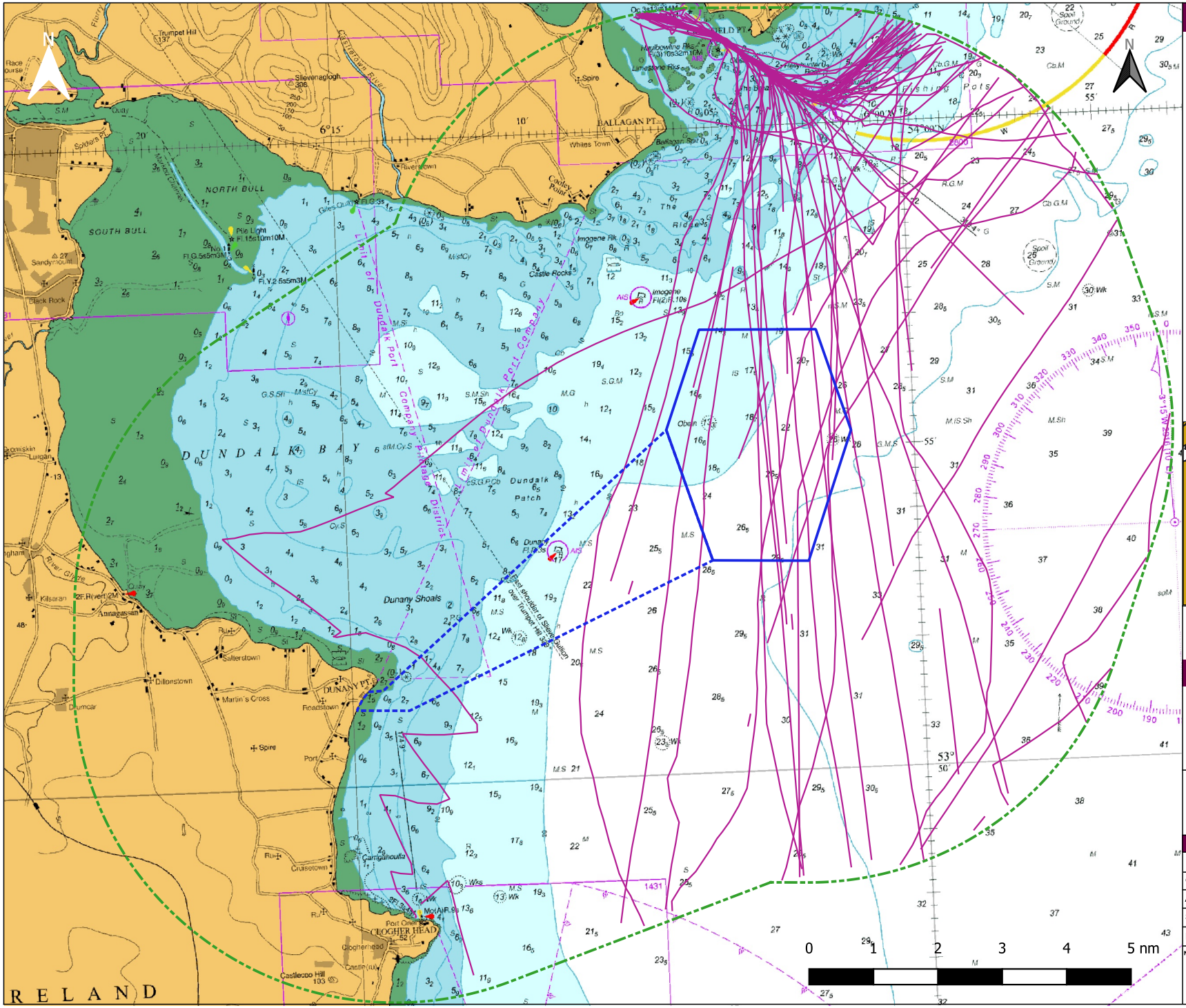

Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Recreational Vessel Tracks

Client: ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-12 Recreational Vessel Tracks (Jan/July 2019)

RPS Ireland
A TETRA TECH COMPANY

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Scale:	1:150,000@ A4	**Projection:**
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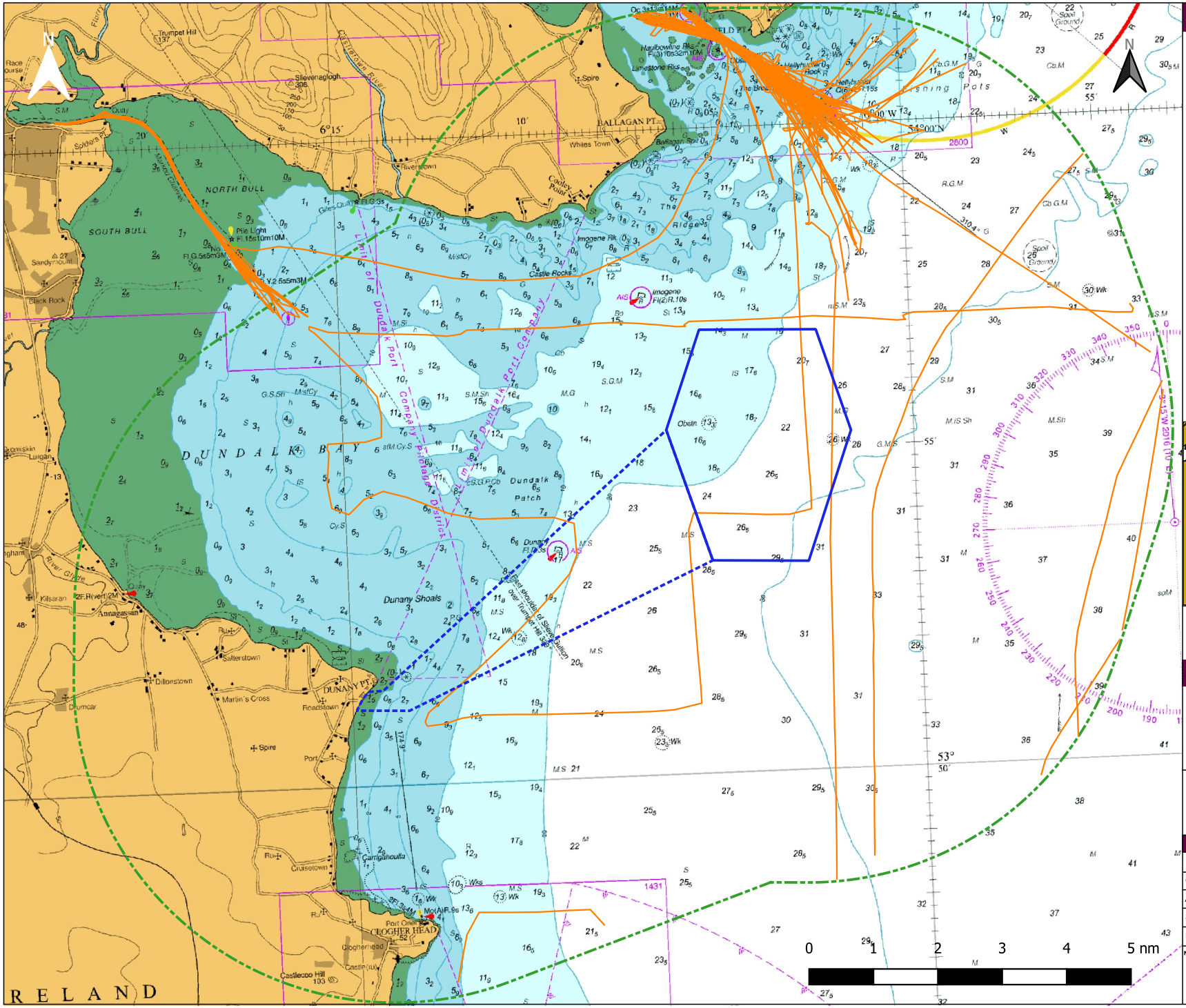

Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Service Vessel Tracks

Client: ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-13 Service Vessel Tracks (Jan/July 2019)

RPS Ireland
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Issue Details

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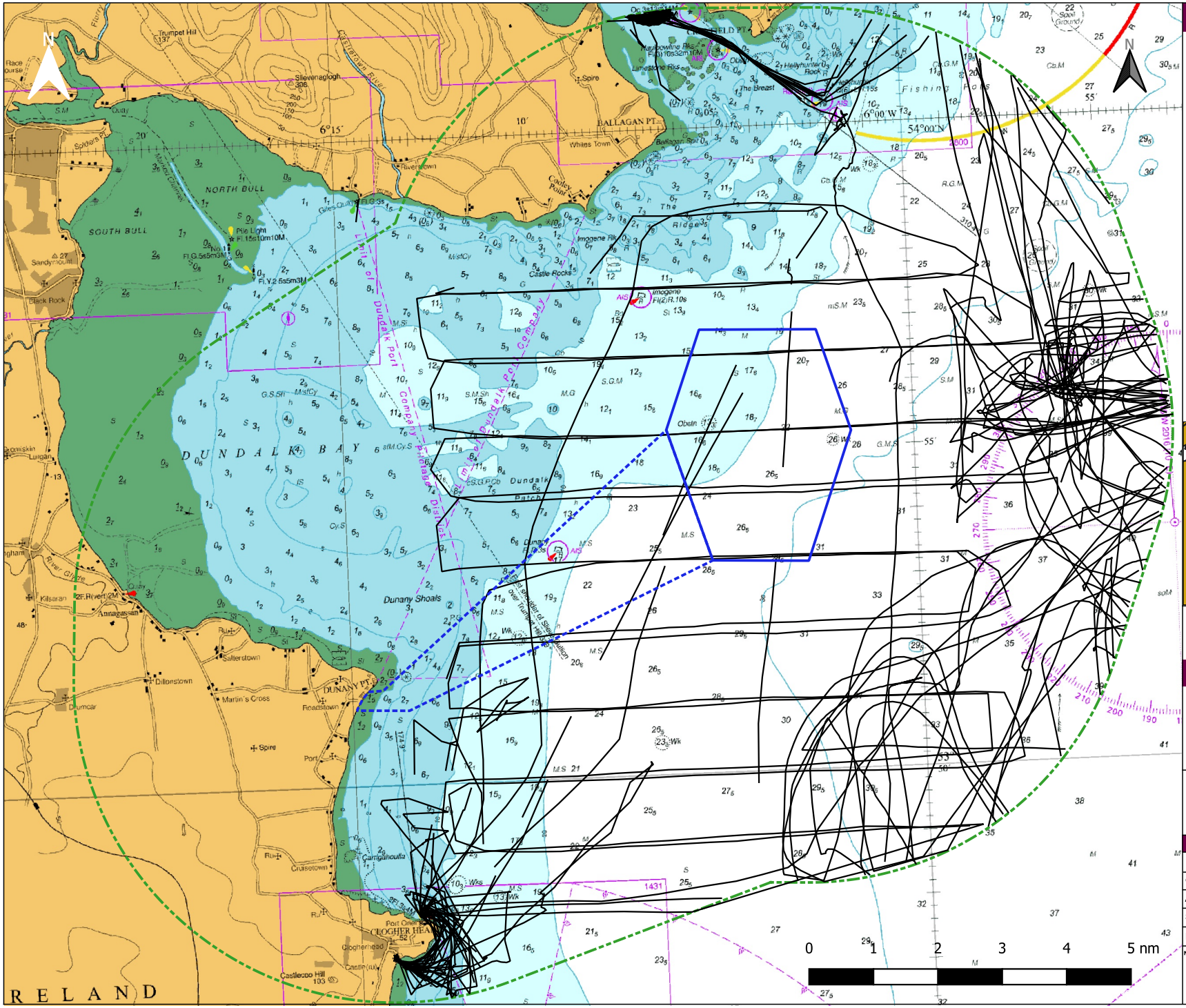

Client
ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project **Oriel Wind Farm Project**

Title

Figure 4-14 Other Vessel Tracks (Jan/July 2019)

RPS Ireland
A TETRA TECH COMPANY

Issue Details

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Scale:	1:150,000@ A4	**Projection:**	
Date:	25/1/2024		IRENET95 / ITM

4.4.2 Vessel traffic by type 2022

The following section compares plots of vessel tracks by vessel type within the NRA Study Area for the 2022 AIS data, including:

- Cargo vessels;
- Tankers;
- Vessels bound to and from Dundalk;
- Fishing vessels;
- Recreational craft; and
- Service vessels.

Cargo vessels

Figure 4-15 shows cargo vessel tracks within the NRA Study Area for 2022. There were 13 individual vessel tracks crossing the offshore wind farm area in 2022 with seven of these being associated with vessels proceeding to/from Dundalk and six transiting in a north/south orientation for Warrenpoint or coastal routes. Three of the tracks through the offshore wind farm area show significant alterations of course which indicate the potential for loitering in the area whilst waiting for berth availability or orders. Northeast of the offshore wind farm area, there is indication of vessels anchoring close to the approaches for Carlingford Lough.

Tankers

Figure 4-16 shows tanker tracks from the 2022 AIS data which shows that most of the tanker is located in the northeast of the study area and is associated with tankers bound to and from Warrenpoint Harbour. This tanker traffic typically transits approximately 3 NM from the offshore wind farm area, however there are two transits which divert closer to the offshore wind farm area. The transit to the south of the offshore wind farm area is likely associated with a vessel loitering prior to arrival into a harbour. The other transit may be due to weather conditions or to loiter before proceeding to berth.

Vessels bound to and from Dundalk

Figure 4-17 shows all vessel tracks entering and leaving Dundalk Harbour for January and July 2022 which identifies 12 cargo vessel tracks, 10 tug or service vessel tracks and five fishing tracks during the period. The cargo vessel tracks either cross the offshore windfarm area (seven tracks), turn south and pass to the east of the Dunany buoy (one track) or turn north after passing south of the Imogene buoy (4 tracks). The fishing vessel tracks all remain within Dundalk Bay and the 10 tug or service vessel tracks are all associated with the pilot vessel Flurry.

Fishing vessels

Figure 4-18 shows fishing vessel tracks within the NRA Study Area for the 2022 AIS data which show 21 tracks through the offshore wind farm area, with most proceeding to/from Port Oriel. The most significant fishing vessel activity is to the south and east of the offshore wind farm area in the deeper water at approximately 30 m. There is also inshore activity shown with vessels transiting to/from Carlingford Lough.

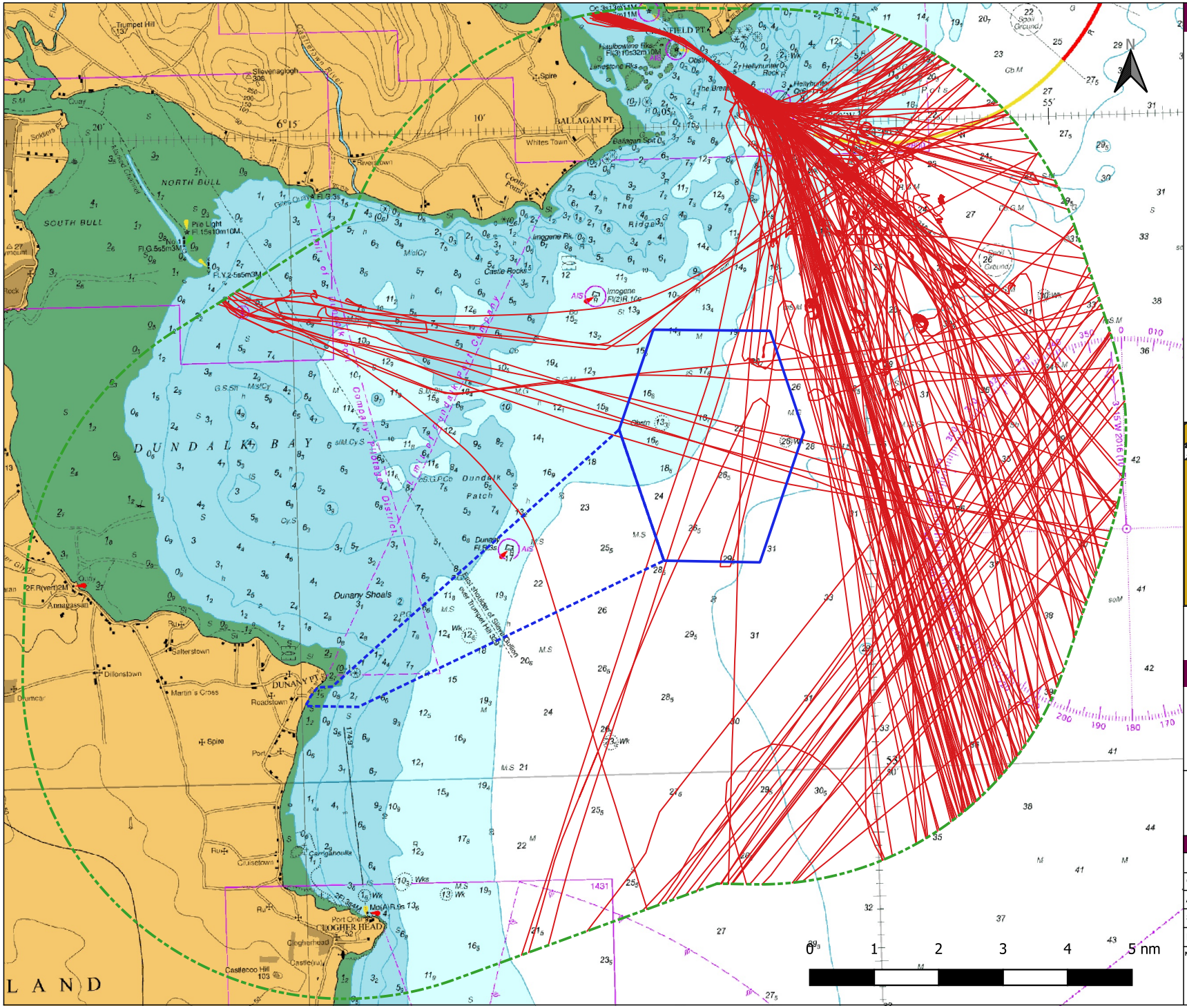
Recreational craft

Figure 4-19 shows combined winter and summer recreational vessel tracks within the NRA Study Area for 2022. There were 43 individual tracks through the offshore wind farm area, the majority of which were by vessels transiting to/from Carlingford Lough. There are two tracks which may be proceeding to anchor in Dundalk Bay approximately 5.5 NM west of the offshore wind farm area.

Service craft

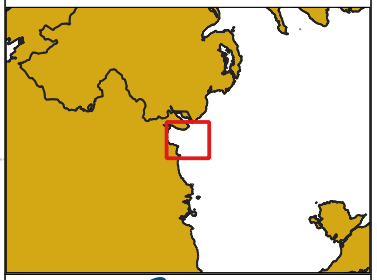
Figure 4-20 shows service vessel AIS tracks within the NRA Study Area for the 2022 period. The main features shown in the offshore wind farm area and to the east are related to survey activities, meaning that

they are for limited periods and are unlikely to be a feature that will commonly occur. The main survey shown in 2022 is related to the proposed Clogherhead offshore wind farm to the east of the offshore wind farm area. There has also been an increase in the number of transits in the approaches to Carlingford Lough which is due to maintenance dredging activities for Warrenpoint Harbour.



Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Cargo Vessel Track



Client: ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-15 Cargo Vessel Tracks (January/July 2022)

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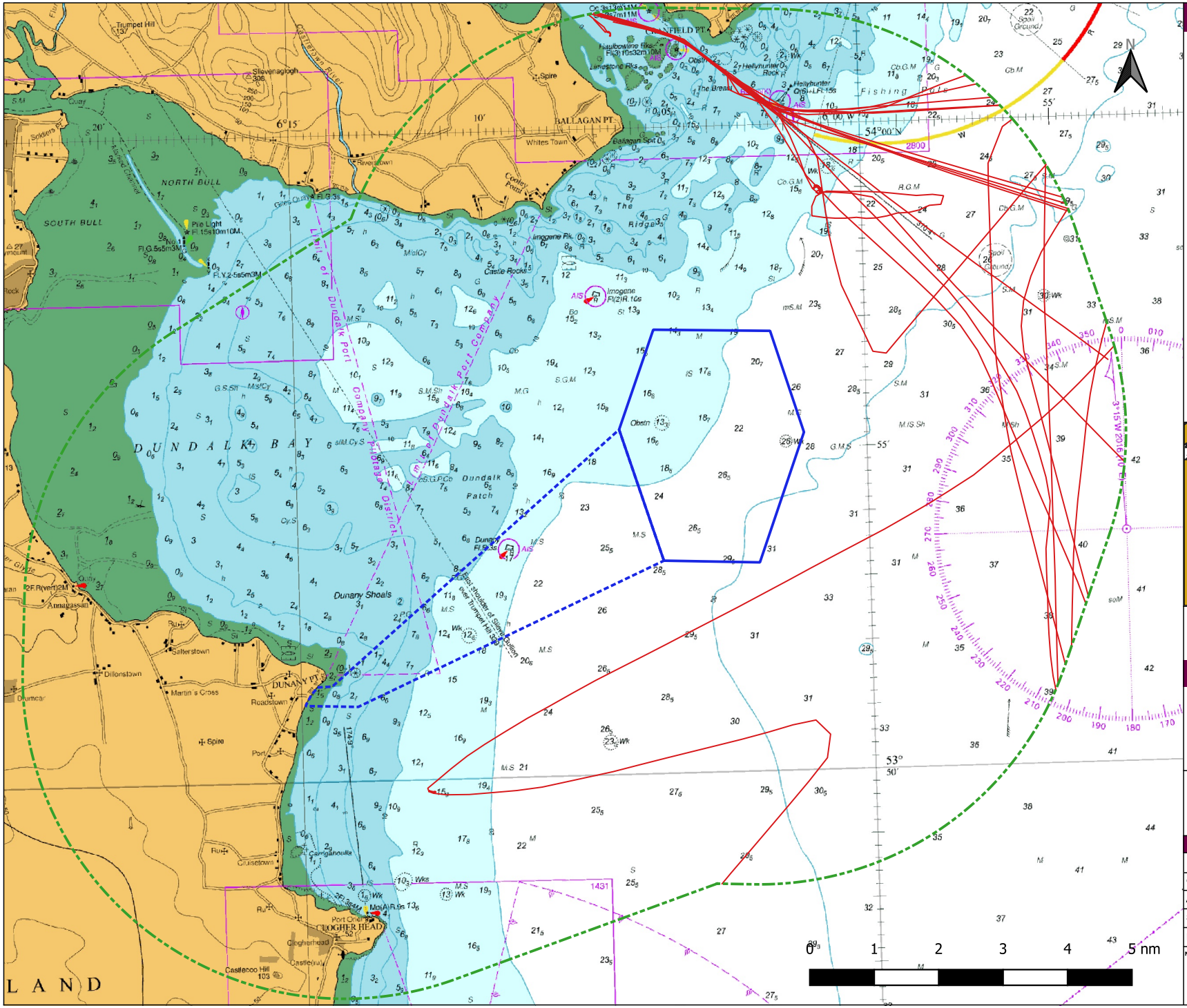
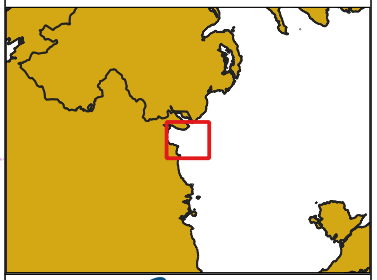
Scale:	1:150,000@ A4	**Projection:**
Date:	25/01/2024	IRENET95 / ITM



Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Tanker



Client: ORIEL WINDFARM OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-16 Tanker Tracks (January/July 2022)

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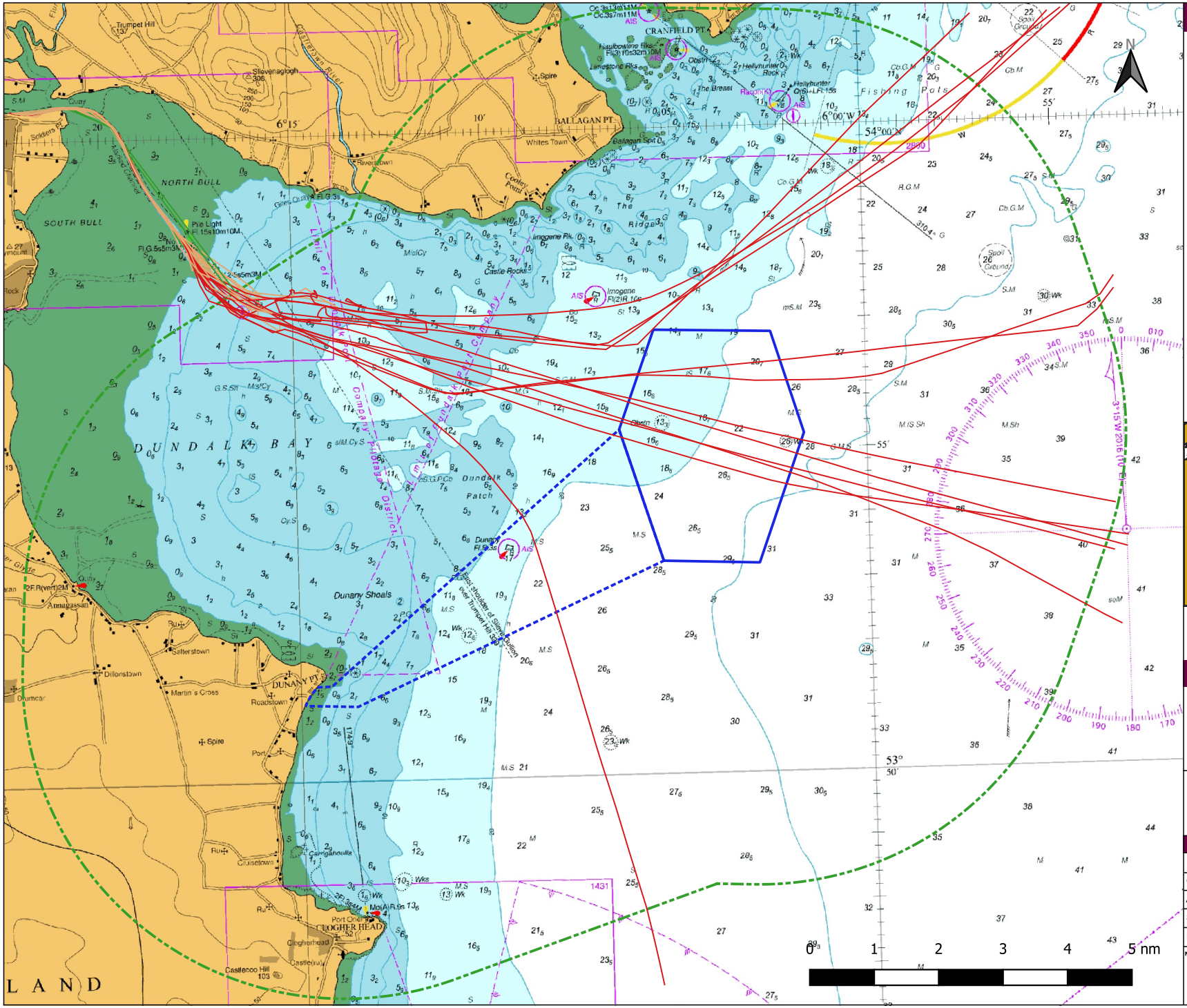
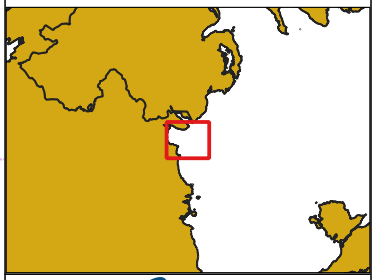


Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area

Vessel Types

- Cargo Vessel Track
- Fishing Vessel Track
- Service Vessel Track



Client: ORIEL WINDFARM OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-17 AIS Vessel Tracks - Dundalk (January and July 2022)

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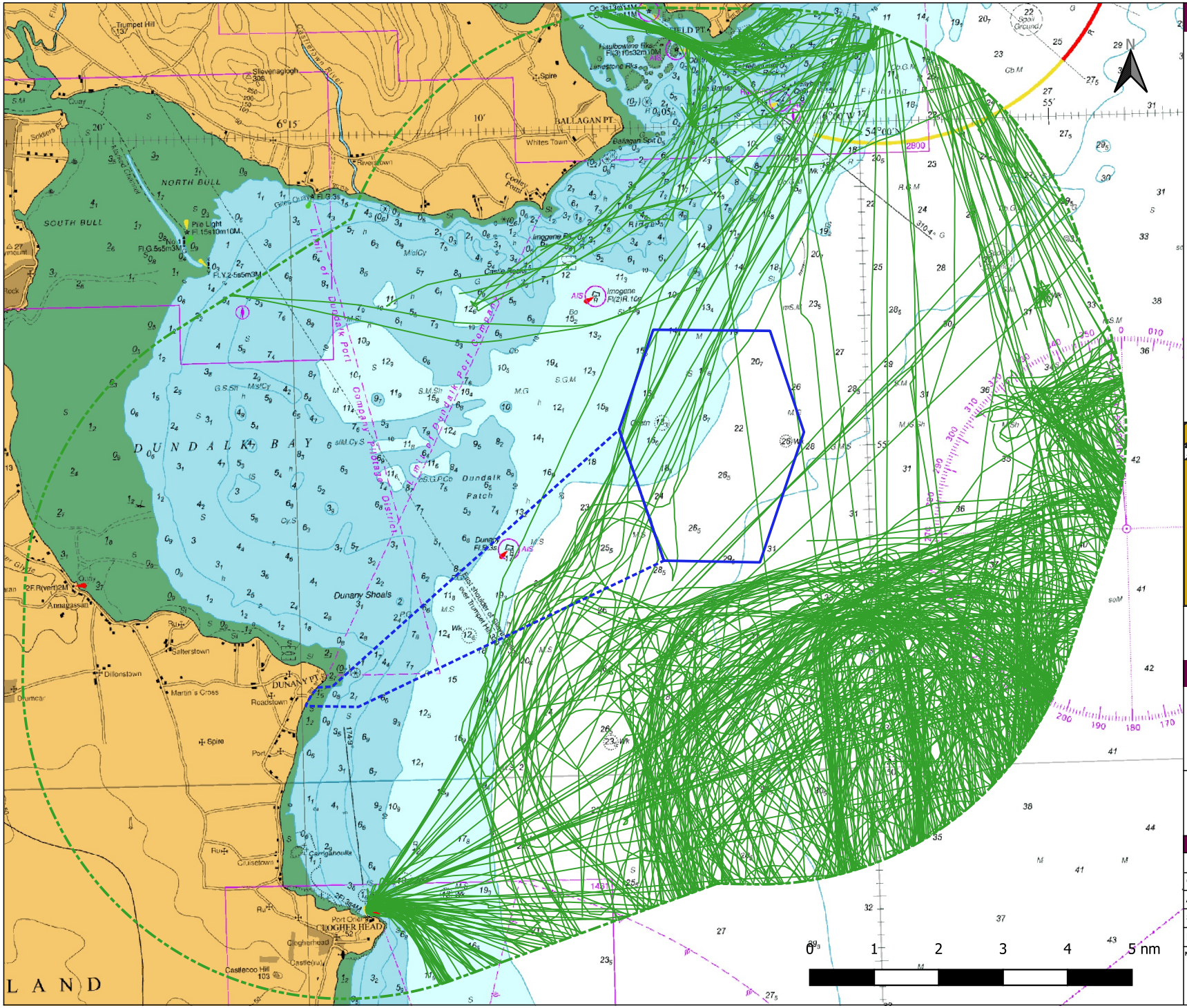
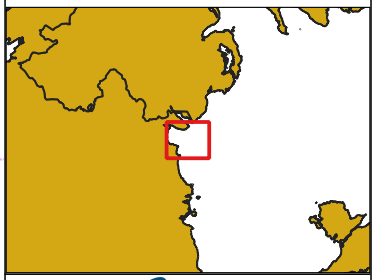
Issue Details

Drawn:	RM	**Project:** MDR1520B
Checked:	AF	**File Ref:**
Approved:	ER	MDR1520QG0000D01
Scale:	1:150,000@ A4	**Projection:**
Date:	25/01/2024	IRENET95 / ITM



Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Fishing Vessel Track



Client: ORIEL WINDFARM OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-18 Fishing Vessel Tracks (January/July 2022)

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Issue Details

Drawn:	RM	**Project:**	MDR1520B
Checked:	AF	**File Ref:**	MDR1520QG0000D01
Approved:	ER		
Scale:	1:150,000@ A4	**Projection:**	IRENET95 / ITM
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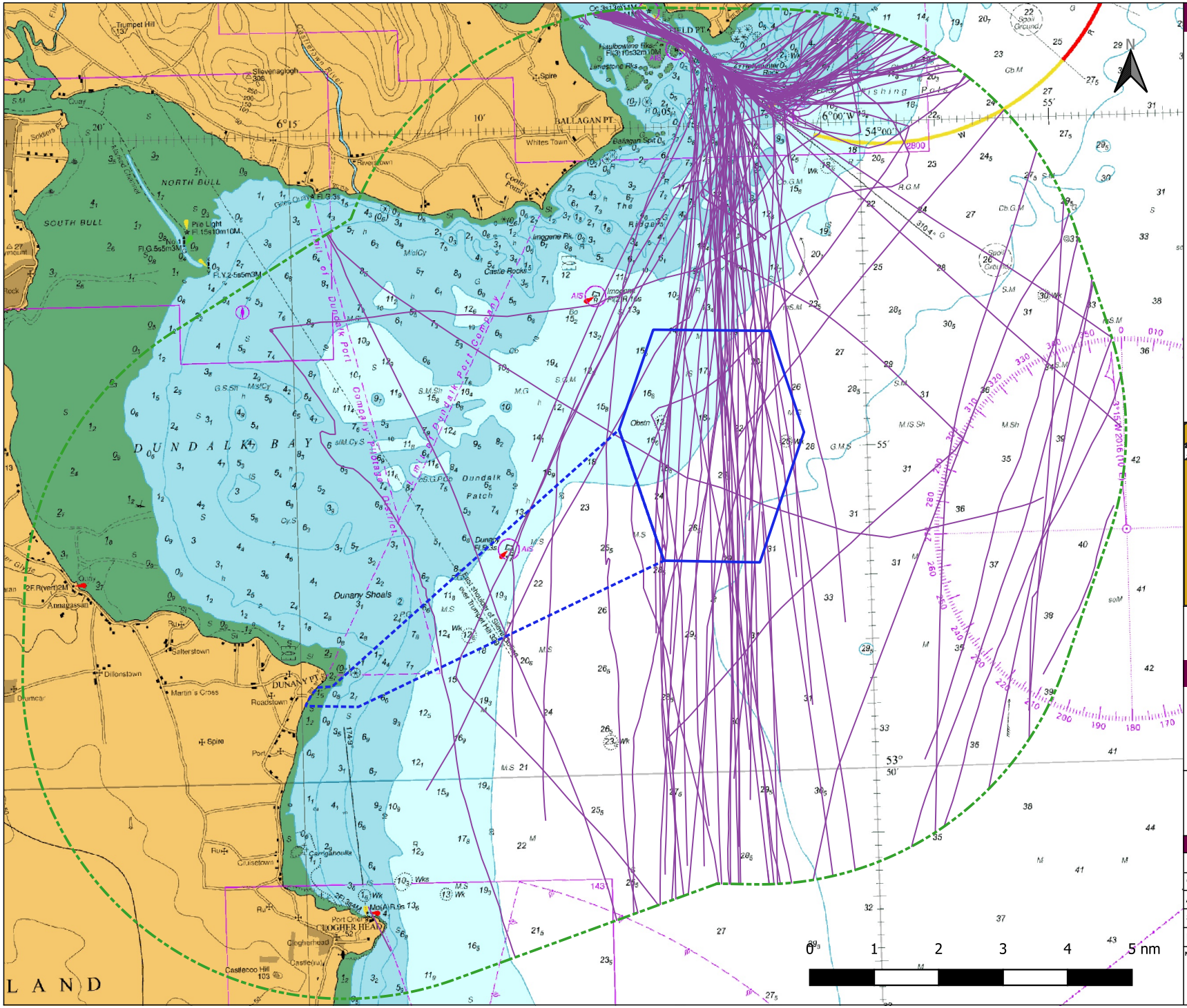
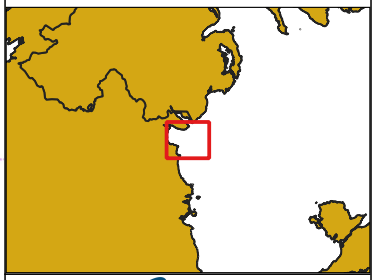


Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Recreational Vessel Track



Client: ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-19 Recreational Vessel Tracks (January/July 2022)

RPS Ireland
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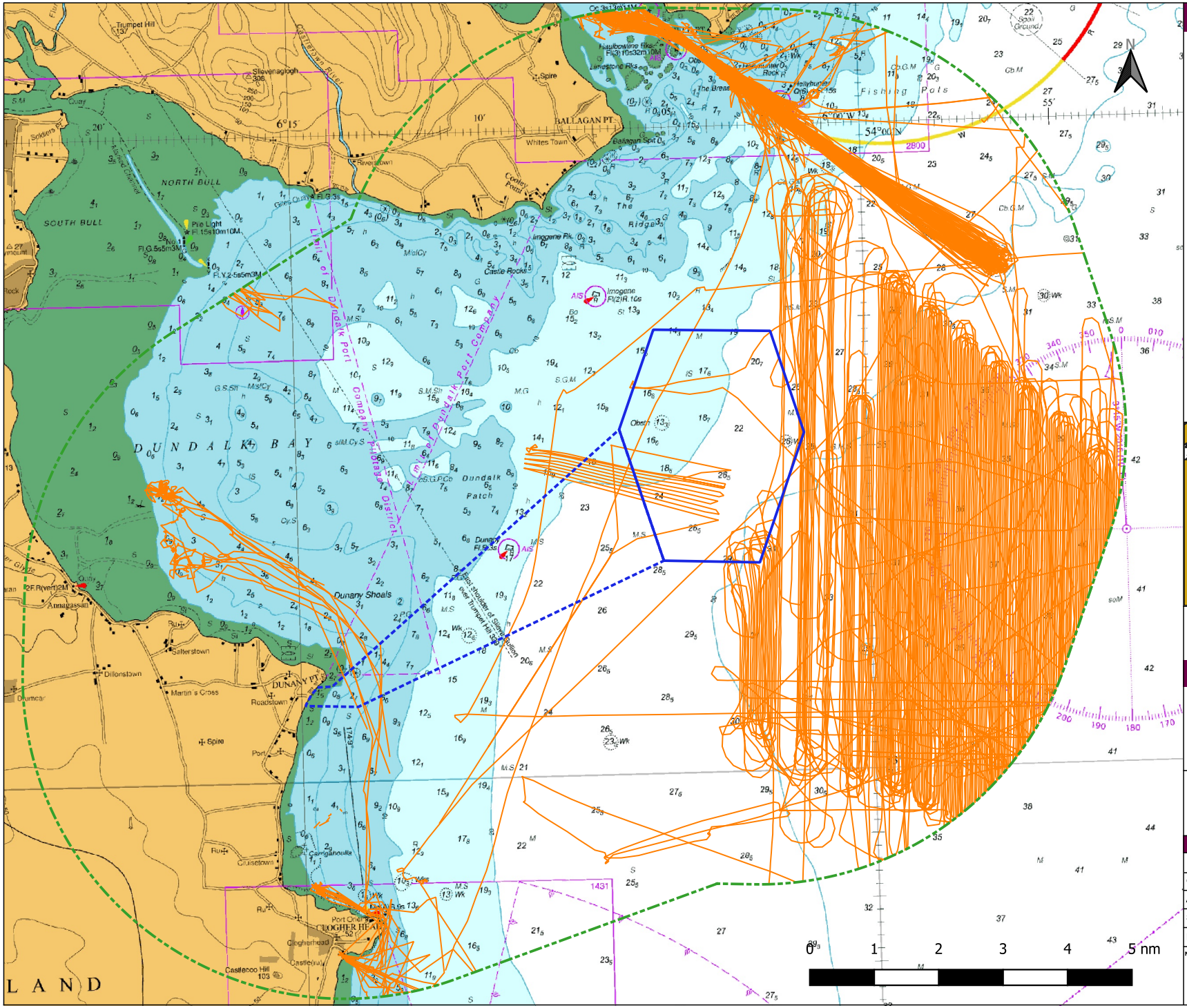
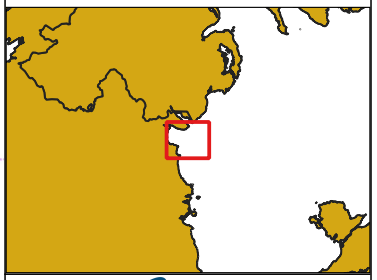
Issue Details

Drawn:	RM	**Project:** MDR1520B
Checked:	AF	**File Ref:**
Approved:	ER	MDR1520QG0000D01
Scale:	1:150,000@ A4	**Projection:**
Date:	25/01/2024	IRENET95 / ITM



Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area
- Tug & Service Track



Client: ORIEL WINDFARM OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 4-20 Tug & Service Vessel Tracks (January/July 2022)

RPS Ireland — A TETRA TECH COMPANY

Issue Details

Drawn:	RM	**Project:** MDR1520B
Checked:	AF	**File Ref:**
Approved:	ER	MDR1520QG0000D01
Scale:	1:150,000@ A4	**Projection:**
Date:	25/01/2024	IRENET95 / ITM

4.4.3 Vessel traffic validation

This section compares the vessel traffic data obtained for January and July 2019 with the same months in 2022. This is to determine whether there have been any significant changes in vessel traffic volume or patterns which may affect this NRA.

Comparing the AIS vessel tracks between 2019 and 2022, there are no significant differences when considering all tracks, but some notable differences can be seen between the summer and winter periods.

Winter 2022 shows significant activity to/from the Warrenpoint Disposal Site which is associated with a maintenance dredging campaign by Warrenpoint Harbour in January 2022. There is significantly more activity to the south of the offshore wind farm area in January 2019 compared with 2022 which relates to fishing vessel activity. Through consultation it has been determined that the change in fishing vessel tracks is associated with local vessels affected by Brexit and will likely return to 2019 levels.

During July 2019, there were 81 individual vessel tracks through the offshore wind farm area. During July 2022, there were 68 tracks, showing an approximately 16% reduction in vessel tracks over the two periods. Notably, there is significant activity to the east of the offshore wind farm area in July 2022, which relates to the Baltic Explorer undertaking a survey for the proposed Clogherhead offshore wind farm.

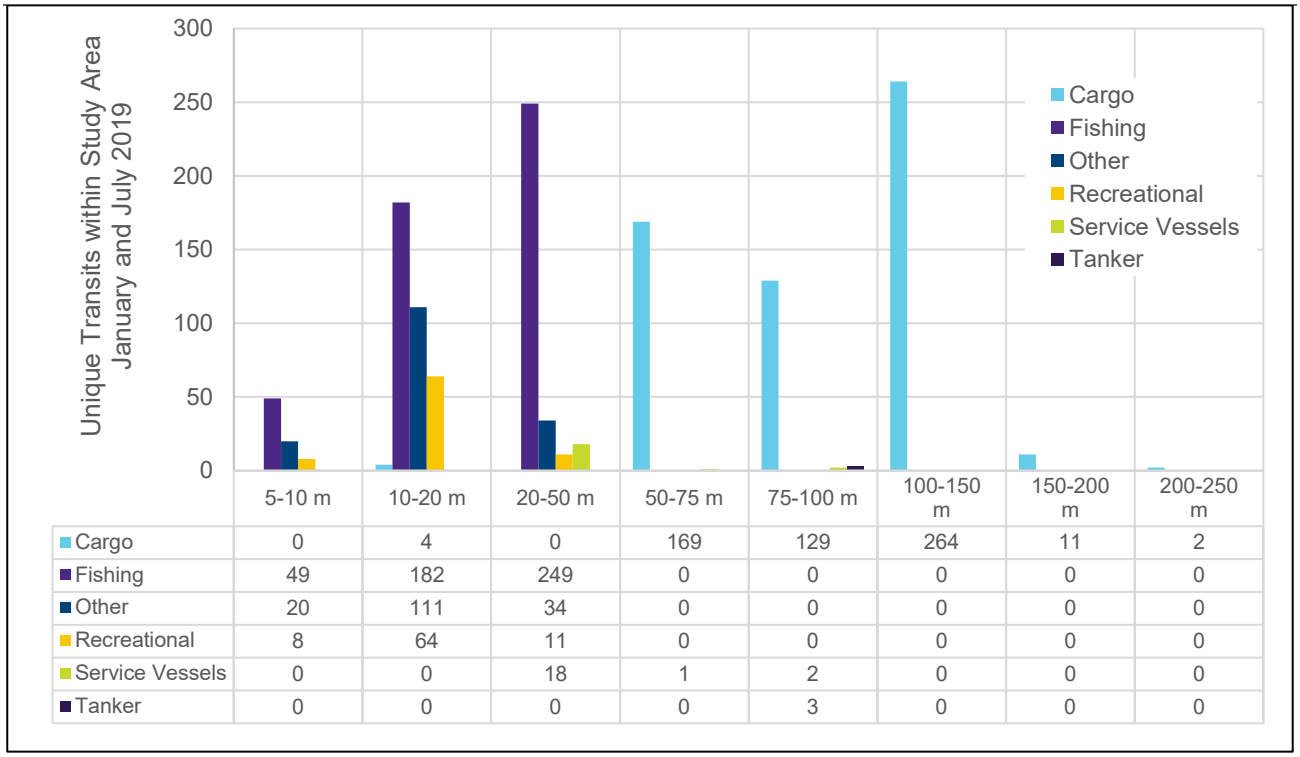
When considering the vessel tracks by vessel type over the two periods the following points have been noted:

- There has been anchoring of cargo vessels identified in the 2022 AIS data to the east of the offshore wind farm area. No anchoring vessels were observed in 2019;
- There was an increase in tanker activity in the northeast of the study area related to activity at Warrenpoint Harbour. This traffic generally navigates at approximately 3 NM distance from the offshore wind farm area;
- The differences in tracks for cargo vessels, tankers and vessels transiting to/from Dundalk are minor with a similar traffic pattern;
- There is reduced fishing activity to the south of the offshore wind farm area and transiting fishing vessel tracks are comparable with 2019 data which is expected to return to similar levels;
- There is a minor increase in the number of recreational tracks crossing the offshore wind farm area in a north/south direction with similar routeing as shown in the 2019 AIS data; and
- There is an increase in tug and service vessel tracks in 2022 associated with surveys and dredging operations. These are limited operations which will not be undertaken regularly.

Through comparison of the AIS data it is concluded that there have not been significant changes to the vessel traffic volumes or patterns between 2019 and 2022.

4.5 Analysis of vessel traffic by size

Analysis of vessel transits within the NRA Study Area is presented in Figure 4-21. The chart shows the prevalence of fishing vessel transits in the NRA Study Area, followed by that of cargo vessels. However, it should be noted that cargo vessel transits relate primarily to those bound to/from Carlingford Lough of which the vast majority transit well to the north of the offshore wind farm area.



	5-10 m	10-20 m	20-50 m	50-75 m	75-100 m	100-150 m	150-200 m	200-250 m
Cargo	0	4	0	169	129	264	11	2
Fishing	49	182	249	0	0	0	0	0
Other	20	111	34	0	0	0	0	0
Recreational	8	64	11	0	0	0	0	0
Service Vessels	0	0	18	1	2	0	0	0
Tanker	0	0	0	0	3	0	0	0

Figure 4-21: Transits by vessel types within the NRA Study Area.

Analysis showing the total amount of vessel exposure, expressed as vessel days for the January and July 2019 data is presented in Figure 4-22. The analysis shows that cargo vessel exposure is similar in winter and summer, but fishing vessels, other vessels and recreational craft show strong seasonal variation, peaking in the summer.

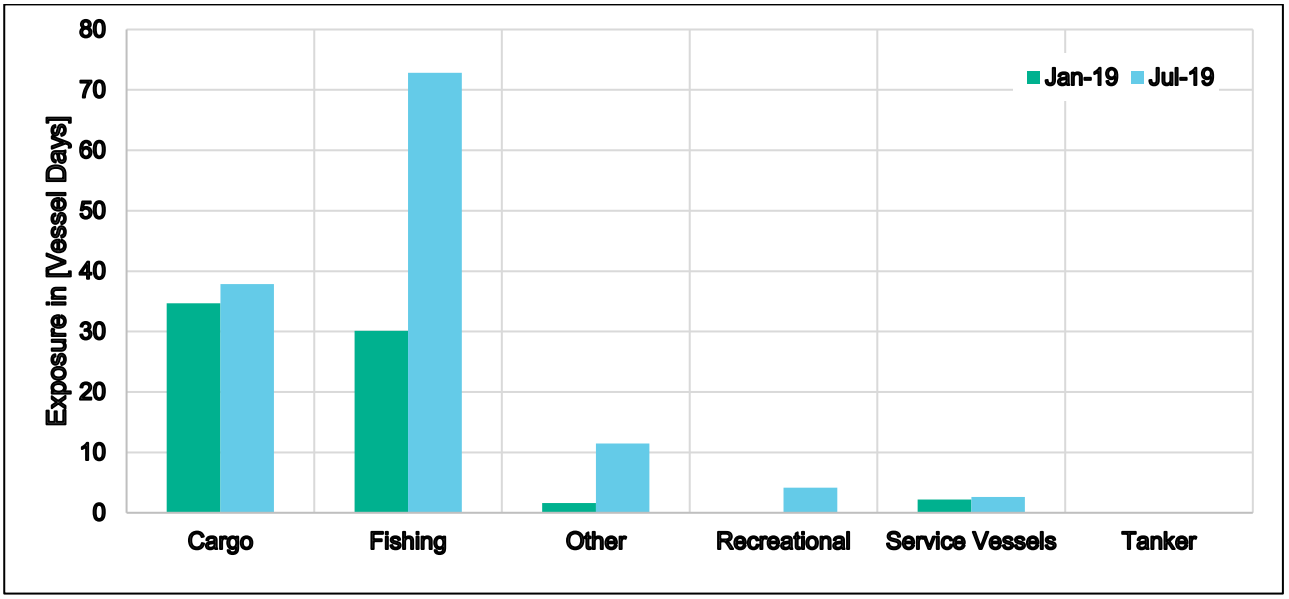


Figure 4-22: Exposure (in vessel days) by vessel type for January and July 2019 in the NRA Study Area.

4.6 Historical incidents

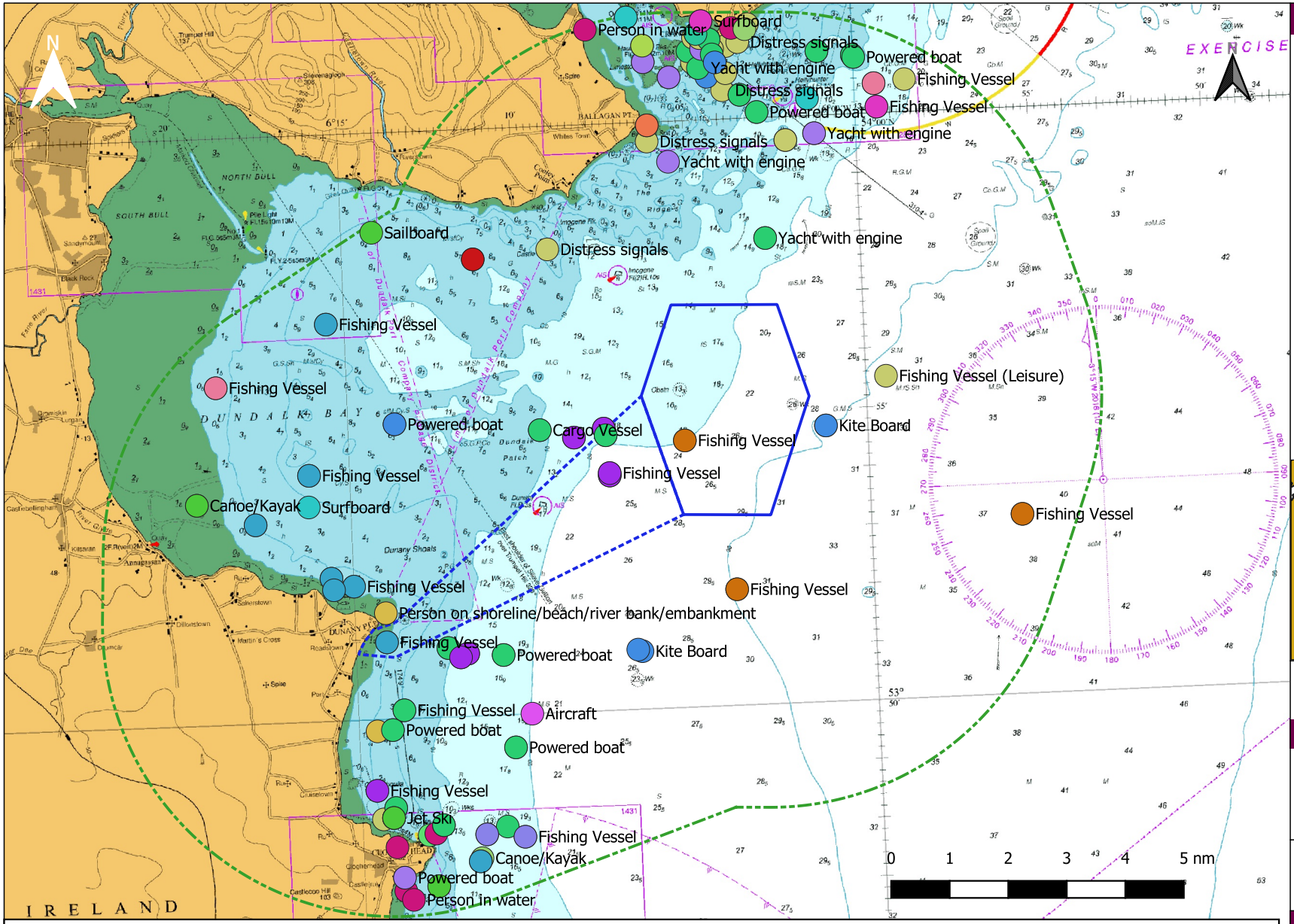
The Irish Marine Casualty Investigation Board were contacted as part of the study and a request made for historical incident data in the vicinity of the offshore wind farm area. Details were not available of specific incidents, except those published as part of their annual report, which do not contain geographic details to identify the location of incidents and hence proximity to the Project.

Historical incident data of the area is available from the RNLI and data are plotted in Figure 4-23. The analysis shows that most RNLI "call-outs", in the vicinity of the offshore wind farm area, were fishing vessels and recreational craft, largely related to incidents that would not be exacerbated by the Project (e.g. "*ill crewman on vessel*", "*adverse conditions*", "*leaks / swamping*", "*out of fuel*", etc.).

4.7 Future traffic profile

During consultation meetings, the IRCG noted that Warrenpoint was anticipating an upturn of vessel movements following the UK's departure from the European Union and that this was worth taking into consideration when accounting for any future trading pattern. Through the data validation exercise using AIS data from 2022, there has been no appreciable increase in vessel movements at Warrenpoint.

Greenore Port completed a project to extend quay infrastructure for Lo-Lo (Load on – Load off) facilities in 2022 with further plans to develop the port for use in the offshore renewables industry, which will have the potential to increase commercial traffic throughput.



Legend

- Offshore Cable Corridor
- Offshore Wind Farm Area
- NRA Study Area

- Adverse conditions
- Aircraft thought to be in trouble
- Capsize
- Collision
- Fouled propeller / impeller
- Ill crewman on vessel
- In danger of drowning
- Leaks / Swamping
- Machinery failure
- Man overboard
- Motor vehicle in the sea
- Out of fuel
- Person in distress
- Person missing
- Sail failure / dismasting
- Steering failure
- Stranding or grounding
- Thought to be in trouble
- Vessel abandoned, derelict or adrift
- Vessel overdue
- Vessel unsure of position

Client: ORIEL WINDFARM OFFSHORE RENEWABLE ENERGY

Project: Oriel Wind Farm Project

Title

Figure 4-23 RNLI Call Outs (2008-2020)

RPS Ireland, A TETRA TECH COMPANY

Issue Details

Drawn:	AJF	Project:	MDR1520B
Checked:	AJF	File Ref:	MDR1520QG0000D01
Approved:	EJR		
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5 IMPACT OF THE PROJECT

5.1 Impact on vessel traffic routeing

There are up to three commercial vessels per month that transit to and from Drogheda and Greenore Port that will be required to adjust their passage plan to pass either to the west or east of the offshore wind farm area accordingly. Consequently, there is a maximum deviation of 1.1 NM (18.8 NM – 17.7 NM) eastwards of the offshore wind farm area and 0.6 NM (18.3 NM – 17.7 NM) deviating westwards of the offshore wind farm area (see Figure 5-1). On a pilot-to-pilot distance of 17.7 NM this equates to an 8% (7 minutes at 12 knots) and 4% (under 4 minutes at 12 knots) increase respectively.

Vessels entering and leaving Dundalk Harbour on an east/west course will also be required to adjust their passage plans accordingly to avoid the offshore wind farm area (see Figure 4-10). Consultation with the Dundalk pilot and harbour master (Dublin) has advised that there were 53 vessel arrivals (106 movements) at Dundalk Harbour in 2018. It was understood through consultation that the level of sea trade through the port is decreasing.

The highest level of vessel activity in the NRA Study Area is represented by fishing vessels, as apparent from the AIS data and as advised through consultation. It is therefore anticipated that fishing vessels operating out of Kilkeel and to a lesser extent those operating out of Carlingford Lough will be required to adjust their passage plans accordingly when transiting between their home ports and to and from their respective fishing grounds particularly during the construction phase. However, once the Project is operational there will be no long-term restrictions on navigation within the offshore wind farm area.

Recreational craft may be required to adjust their passage, however, through consultation it is understood that there are few yachts visiting ports close to the NRA Study Area.

5.2 Impact on transits of tidally constrained vessels

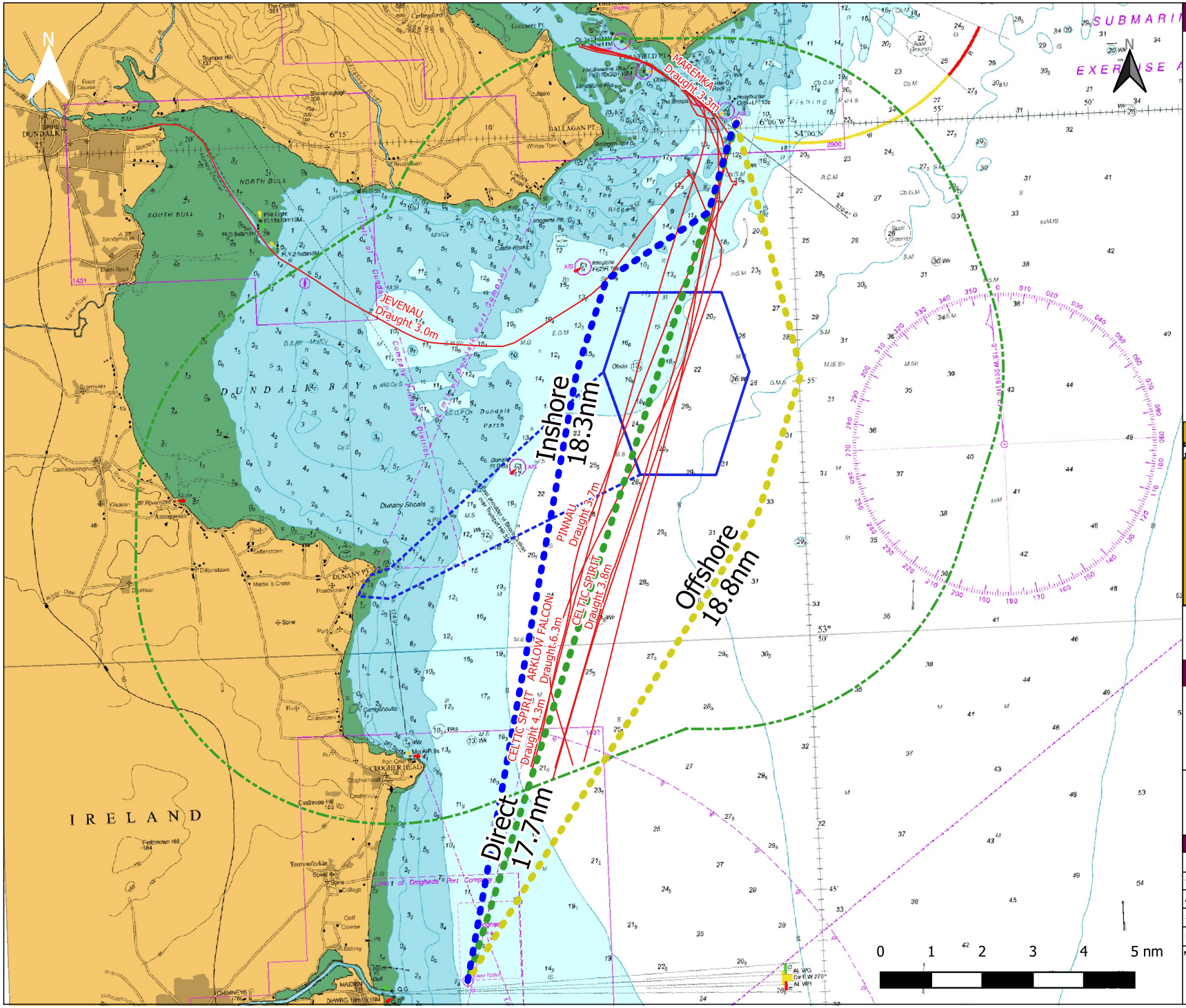
The western edge of the offshore wind farm area is approximately 1.5 NM to the east of the 10 m chart datum contour line and therefore transits of tidally constrained vessels will not be affected.

5.3 Impact on pilotage operations

Carlingford Lough pilot boarding/landing area (Hellyhunter Buoy) is approximately 3.2 NM north of the northern most edge of the offshore wind farm area and therefore the operation is not affected.

Dundalk pilot boarding/landing area situated in Dundalk Bay is approximately 6 NM from the western extremity of the offshore wind farm area. Vessels normally approach and depart the pilot boarding station from the east and west respectively and therefore will be required to adjust their passage plan accordingly and pass either to the north or south of the offshore wind farm area.

If the Dundalk pilot vessel is not operational the Dundalk pilot will use the Carlingford Lough pilot boat and board/disembark vessels bound to and from Dundalk at Hellyhunter Buoy. See section 3.4 also.

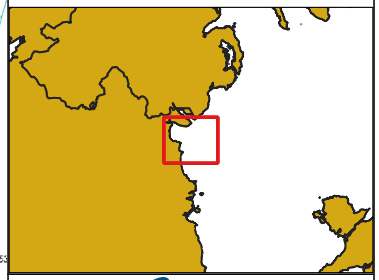


Legend

- Lease Area
- Offshore Cable Corridor
- NRA Study Area
- Impacted Traffic

Routes

- Direct
- Inshore
- Offshore



Client: ORIEL WINDFARM OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title

Figure 5-1 AIS North South Tracks (Jan/July 2019)

RPS Ireland — A TETRA TECH COMPANY

Issue Details

Drawn:	EJR	**Project:** MDR1520B
Checked:	PJF	**File Ref:**
Approved:	EJR	MDR1520QG0000D01
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5.4 Impact on search and rescue

In the absence of any specific guidance from the IRCG, the Project will, where practicable, be compliant with the MCA (the UK maritime safety regulator) requirements for SAR compatibility[5]. Consultation will be required to take place with the IRCG to ensure that the final layout taken forward is compatible with their SAR objectives.

The MCA's SAR guidance is given in "Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for Search and Rescue and Emergency Response (December 2016)". The following list provides a precis of specific requirements to assist and enable SAR and other emergency response to, within, and in the vicinity of OREIs:

- **Emergency Response Cooperation Plans (ERCoP)** – A plan is drafted in collaboration with SAR authorities for the construction, operational and maintenance and decommissioning phases of a project. The plans provide contact details and procedures for use in an emergency;
- **Offshore SAR management courses** – Training to staff working on OREIs on the correct procedures and processes to be followed in SAR situations;
- **Layouts** – Developers should plan for two lines of orientation unless they can clearly demonstrate that fewer is acceptable and safe for SAR helicopter and rescue boat operations. Provision of a layout plan for IRCG to assess effects on SAR response, this may include computer generated models or visualisations and to scale drawings;
- **Marking and lighting** – Clear and unique identification markings visible to surface craft and aircraft. Hover reference marking on WTG blades. Aviation hazard and aviation SAR lighting of WTGs;
- **Monitoring** – Provision of in-field AIS, VHF Digital Selective Calling (DSC), for use by IRCG;
- **Rapid Control and shutdown capability** – If a rescue by air is required, the SAR mission coordinator will need to know how a WTG is shut down, feathered and orientated to allow access; and
- **Equipment and capability of offshore wind farm vessels** – capability of offshore wind farm assets to undertake SAR.

It should be noted that the MCA guidance document referred to above recognises that OREIs may provide valuable contribution to SAR. This includes availability of OREI support vessels for rescue response, the use of OREI communications equipment (such as VHF and AIS) and assistance in the drafting of offshore emergency response documentation.

5.5 Impact on visual navigation and collision avoidance

This section considers the impact of increased vessel activities associated with the construction, operational and maintenance and decommissioning phases of the Project; the potential for the Project to hinder the view of other vessels and the potential for the Project to hinder the view of any navigational features or navigation aids.

5.5.1 Project vessels

Vessels involved in construction and maintenance activities may be encountered within or around the offshore wind farm area and offshore cable corridor, in addition to other vessels including commercial and fishing vessels. Indications are that fishing vessels will be fishing or passing through the offshore wind farm area heading to and from fishing grounds.

[5] The Department of Transport have prepared guidance on navigation risk and emergency response assessments and is currently in draft and undergoing consultation with the relevant stakeholders (as of February 2024). The Applicant will also consider the final guidance once published.

Project vessel activities will be controlled and monitored from an onshore operation base. It is recommended that the onshore base is fitted with VHF radio and AIS monitoring facilities. It is also recommended that for construction and major maintenance activities, a local navigational warning is placed with the IRCG for broadcast. In addition, project vessels are required to comply with the International Regulations for Preventing Collisions at Sea and ensure that all relevant international lights and signals are displayed.

5.5.2 Hindering the view of other vessels under way

WTG towers have the potential to mask vessels from visual identification. The phenomena are dependent on several conditions, most significant of which is the distance between the observer and the WTG. At the most extreme case, a vessel within 50 m of a WTG would be unable to locate another vessel for a short period of time. However, it is expected that the spacing between each of the WTGs will be greater than 944 m, depending on the WTG selected, ensuring good visibility throughout the offshore wind farm area to identify any vessels navigating close-by. Furthermore, mariners would be expected to leave enough sea room when close to the WTGs to navigate safely when navigating within or leaving the wind farm. The risk of collision is therefore not considered to be significantly increased as a result of masking within the offshore wind farm area (see section 6.2.2).

It is expected that commercial vessels will pass at least 0.5 NM from the offshore wind farm area boundary, giving sufficient time, for both vessels, to take avoiding action should small craft be obscured when exiting from the wind farm.

5.5.3 Hindering the view of any navigational feature or aids to navigation

AtoN installed on the Project infrastructure may result in an increase in background lights within the vicinity, with the potential to diminish the effectiveness of the two navigation buoys to the west of the offshore wind farm area namely; Imogene and Dunany light buoys (see section3.4), which are within 1 NM and 2 NM respectively of the offshore wind farm area boundary. The nature and location of all Project AtoN will be agreed with CIL and promulgated to mariners.

A maintenance regime for all AtoNs related to the Project will be put in place, such that the specified availability criteria are always met.

It is understood through consultation that CIL will be undertaking a 5-yearly review of all navigational aids around the Irish coastline.

5.5.4 Summary

With regards to the impact on visual navigation and collision avoidance due to, increased vessel activities associated with the construction/decommissioning and operational and maintenance phases, the following conclusions are made:

- Project vessel activities should be controlled and monitored by an onshore operation base;
- Major Project activities to be promulgated through a local navigation notice and broadcast warnings;
- The layout of the offshore wind farm area has significant spacing between each of the WTGs to ensure that vessels (including Project vessels) will not lose sight of each other in the array;
- Commercial vessels would be expected to pass more than 0.5 NM from the boundary of the offshore wind farm area, giving sufficient time to take avoiding action should small craft unexpectedly exit from the offshore wind farm area;
- All vessels are required to comply with the International Regulations for Preventing Collisions at Sea;
- The nature and location of all Project AtoN must be agreed with IRCG;
- Excessive brightness of markings of the WTGs and OSS may diminish the effectiveness of the major navigational lights adjacent to the offshore wind farm area; and

- A maintenance regime for all AtoNs related to the Project will be put in place.

5.6 Impact on communications, radar and positioning systems

5.6.1 Overview

Offshore structures carry the potential to impact the navigation systems and communications equipment essential to safe navigation. Consistent and effective radio communications are required to ensure safety at sea. For example, mariners are reliant on radio for:

- Navigation – using electronic charts and similar satellite-based technologies;
- Distress or safety communications; and
- Communications relating to commercial operations.

Furthermore, emergency services such as SAR helicopters require dependable radio communications to rapidly detect and react to maritime casualties. In addition, radio communications are increasingly essential to coastal zone management. This includes enforcement of environmental controls implemented to minimise marine pollution and the protection of essential maritime resources such as fisheries.

As with other large structures, WTGs have the capacity to interfere with radio signals by blocking or otherwise disrupting the propagation of electromagnetic energy. Any disruption to radio communication by a proposed wind farm has the potential to reduce the effectiveness of the services outlined above.

The effect of WTGs on navigation technology has been previously examined in the studies described below. There is a consensus that the impact of WTGs on technology routinely used in maritime navigation is benign, except for radar.

5.6.2 Previous studies

There has been extensive study into the effects that WTG arrays have on marine radar including:

- North Hoyle Impact Assessment (2004); and
- Kentish Flats Study (2006-2007).

The following text is taken from MGN 372 (OREIs: Guidance to Mariners Operating in the Vicinity of UK OREIs).

“The trials indicated that there is minimal impact on VHF radio, Global Positioning Systems (GPS) receivers, cellular telephones and AIS. Ultra-High Frequency and other microwave systems suffered from the normal masking effect when turbines were in the line of the transmissions. The turbines produced strong radar echoes giving early warning of their presence. At close range, however, the trials showed that they may produce multiple reflected and side lobe echoes that can mask real targets. These develop at about 1.5 NM, with progressive deterioration in the radar display as the range closes. Where a shipping lane passes within this range considerable interference may be expected along a line of turbines. Target size of the turbine echo increases close to the turbine with a consequent degradation of target definition and bearing discrimination. These effects were encountered on both 3 cm and 10 cm radars.

Similar effects were found during the British Wind Energy Association funded trials undertaken off the Kentish Flats wind farm in 2006. Radar antennae which are sited unfavourably with respect to items of the ship’s structure can enhance these effects. Careful adjustment of radar controls can suppress some of these spurious radar returns but mariners are warned that there is a consequent risk of losing targets with a small radar cross-section, which may include buoys or small craft, particularly yachts or glass reinforced plastic constructed craft, therefore due care should be taken in making such adjustments.”

5.6.3 Summary of impacts on radar from WTGs

From both the wider literature and the above studies the following conclusions can be drawn:

- Many vessels experience some unwanted interference on radar screens when passing near WTG arrays;
- This can in many cases be kept to a minimum by proper placement of the radar units clear of the mast or of reflective surfaces;
- There is strong evidence that shows that the presence of WTG arrays does not significantly diminish the echoes of vessels navigating either among the WTGs or those detected on the other side of the offshore wind farm area;
- Experienced navigators and masters are quickly learning how to interpret radar signals received in the proximity of WTG arrays;
- Furthermore, the training of new mariners and navigators (in the UK) now incorporates the study of radar interference from OREIs; and
- It is considered that if WTGs are sufficiently spaced apart that they will have little effect on marine radar, and any interference can be mitigated by maintaining a proper lookout.

It is considered that the proposed Project will not adversely affect the use of radar for collision avoidance for those vessels navigating outside or inside the wind farm area.

5.6.4 Summary of impacts on Very High Frequency (VHF) communications from WTGs

VHF communications are the most common form of marine communications for ship-shore and ship-ship. As part of the North Hoyle 2004 assessment by the MCA and QinetiQ, tests were made on the quality of VHF transmissions when made near WTGs. This assessment concluded that there were no discernible impacts on VHF communications, a conclusion which was supported by further tests by the MCA on SAR capabilities in wind farms in 2005.

Therefore, it is considered that the Project will not have any negative impact upon VHF communications.

5.6.5 Summary of impacts on automatic identification system from WTGs

Studies undertaken at North Hoyle in 2004 found no discernible impact upon AIS and therefore it is anticipated that this Project will not adversely impact the use of AIS in the NRA Study Area.

5.6.6 Summary of impacts on sound from WTGs

Any sound that may be generated by the WTGs, when operating, is not expected to mask any vessel sound signals used for navigational and safety purposes.

5.6.7 Summary of impacts relating to electromagnetic interference from cables

Subsea cables can have impacts as a result of electromagnetic interference, in particular on the accuracy of a compass which is essential to good navigation.

All compasses are impacted by the proximity of certain materials and strong magnetic forces which could cause the compass to falsely indicate a direction and potentially disorientate a vessel's navigator. The degree of deviation as a result of subsea cables is related to the water depth and burial depth of the cable, the type of current carried, and the spacing and geometry of the cable (Crown Estate, 2012). Whilst some degree of deviation could be expected, it is likely minimal given the depth of water within the offshore wind farm area and along much of the offshore cable corridor.

5.6.8 Summary

A review of previous studies undertaken have not identified any significant adverse impacts which may reduce the effectiveness of shore based or ship-board communications, radar or positioning systems.

5.7 Impact on snagging risk from subsea cables

Inter-array and export cables can at times be exposed to the risks of vessel anchors and fishing gear which could damage the cables or the vessel. The potential risk to each vessel type is considered below.

5.7.1 Commercial vessels

The anchors carried by commercial vessels can be of a significant size and therefore have a great penetration depth (albeit dependent on soil density but generally considered to be less than 1 m) into the seabed, posing a significant hazard to subsea cables. There are several reasons as to why a vessel would deploy its anchor:

- Firstly, a vessel may anchor in an anchorage to hold position for an extended period;
- Secondly, an anchor may be deployed in an emergency to prevent an incident such as a collision or a grounding when a vessel is disabled;
- Thirdly, anchors can be used to aid turning, particularly in confined waterways and whilst berthing; and
- Finally, anchors may be released accidently or through equipment failure on a transiting vessel.

The penetration depth of an anchor, and therefore the potential for damage to a subsea cable, is dependent upon several factors such as the size and the type of the anchor (particularly the size of the fluke length) as well as ground conditions. The size of a ship's anchor is dependent upon several factors, including the ship design and classification society requirements.

The depth of water within the offshore wind farm area is between 15 to 33 m chart datum and becomes progressively shallower along the offshore cable corridor towards the shoreline at Dunany Point (see section 3.2.1).

There are no charted anchorages within the offshore wind farm area or the offshore cable corridor as noted in section 3.7.6. Emergency anchoring is unlikely to occur along much of the offshore cable corridor given the significant sea room available to avoid other vessels and obstacles. In the event of a blackout on a vessel, the vessel master would be expected to deploy his anchor after consulting charts to be clear of charted obstacles.

Accidental release of anchors is a rare occurrence and is therefore not a significant threat to the Project subsea cables. The full Marine Accident Investigation Branch (MAIB) database does not differentiate anchoring incidents; however, in a MAIB investigation report into the "*mv Young Lady*" (MAIB, 2008) it was noted that between 1997 and 2006, eight incidents were recorded of an anchor cable running free. The MAIB identified the causes of these incidents as a combination of brake reliability, human error and windlass power failure. In several of these incidents the vessel was already at anchor before the uncontrolled release of the cable (MAIB, 2008).

5.7.2 Fishing gear and small anchors

In general, fishing activity is the principal cause of cable faults globally accounting for 44% of all incidents between 1959 and 2006 (ICPC, 2009)[6]. Many recorded incidents occur through bottom demersal trawling by both beam and otter boards over an exposed or uncovered cable. Other instances include shellfish dredging and scallop dredging that invasively penetrate the seabed.

Estimations of trawl boards, beam trawls and scallop dredgers penetration depths are shown below in Table 5-1.

[6] Result of analysis of a database of 2,162 incidents between 1959 and 2006 undertaken by Tyco Telecommunications (US) Inc

Table 5-1: Penetration of fishing gear in various soil types (Sharples, 2011).

Gear	Fine Sand	Firm Clay	Coarse Sand	Very Soft Clay
Trawl boards, Beam trawls and Scallop dredgers.	<0.4 m	<0.4 m	0.5 m	>0.85 m

Research has shown that the probability of snagging occurring is low, this is due to design considerations in the trawl equipment to pass clear of underwater obstructions. More than 90% of crossings of fishing gear over cables result in no cable damage (cited in International Cable Protection Committee, 2009).

Snagging on cables (or any underwater object) either when fishing or with anchors could be hazardous to vessels. It can lead to cable damage and can in principle, in extreme cases, lead to capsize and loss of life (ICPC, 2009)[7]. There is also a risk of electrocution from damage to cables.

The Project structures (WTG, OSS), inter-array and export cables and landfall infrastructure will be marked on navigation charts, through promulgation of information to UKHO and the Kingfisher Information Services Cable Awareness (KISCA) (see also

[7] CIGRE, 2009. Third-Party Damage to Underground and Submarine Cables: https://www.iscpc.org/

Table 6-3). KISCA charts are freely available and identify surface and subsea hazards around the coasts of the UK and Northern Europe.

As described in section 2.1, cables will be buried in the seabed where possible to a minimum burial depth of 0.5 m, and there may be cable protection along 50% of the inter-array cables and 50% of the offshore cable corridor where burial in the seabed is not possible. Cable protection may consist of rock placement or concrete mattresses. Cable protection may reduce the impacts to the cable from fishing activity in the vicinity of the offshore wind farm area and offshore cable corridor (see section 4.3) (see also section 5.8 below). Cable protection is also relevant in the vicinity of the cable landfall where there is the potential for small vessels to anchor (see section 5.8 below).

There are no charted anchorages in proximity to the offshore wind farm area or offshore cable corridor. However, between the cable landfall at Dunany Point and Dunany Light Buoy (see section3.4) (i.e. within the 5 m chart datum contour) there is a potential for small vessels to anchor (see section 5.7.2). In exceptional circumstances, a small vessel's anchor may drag in adverse weather conditions towards the cable and cause damage, but the shelter from prevailing south westerlies and separation distance makes this unlikely. It is noted that the Dundalk pilot reported that he had not known any vessel to be anchored in an area off Dunany Point within or close to the offshore cable corridor.

5.8 Impact on navigation from cable protection

There is potential for cable protection along 50% of the inter-array cables and offshore cable corridor. Cable protection may consist of rock placement and/or concrete mattresses and will be 10 m in width and 2 m in height above the seabed within the offshore wind farm area; and 10 m in width and 2 m in height along the offshore cable corridor. The location of the offshore cable corridor means that only vessels transiting the area inshore of the Project would cross the export cable and so would be crossing areas with depths of 12.3 m below CD or less. The location of Dunany buoy means that vessels should pass between the buoy and the Project. In this area the minimum depths in the export cable corridor are approximately 16 m below CD. This means that with 2.0 m of cable protection, there would still be more depth of water available than at other points of the transit. From the AIS data for January and July 2022, the greatest draught of a vessel transiting either through the offshore wind farm area or offshore cable corridor was 6.8 m meaning that there would still be sufficient Under Keel Clearance (UKC) to transit between the Dunany Buoy and the Project.

When the area closer to shore is considered, AIS data shows that the dredger Darcy Rose has crossed the offshore cable corridor close to shore where there is less available depth of water (see Figure 4-20). If there is cable protection required for this section of the export cable, there would potentially be a significant change to UKC for these transits. There is, however, sufficient searoom to the east of the export cable corridor where there is a greater depth of water allowing for vessels to safely transit the area.

A cable burial risk assessment will be carried out prior to construction which will consider potential impacts to navigating vessels with respect to cable burial depths and cable protection in further detail. It is suggested through previous experience that typically a loss of up to 5% of UKC as a result of cable protection is acceptable. Where this would not be achievable for the offshore cable corridor it should be considered in further detail in the cable burial risk assessment.

Post-installation surveys will be required to determine where target burial depth has not been achieved and where additional cable protection may be required.

5.8.1 Impact on navigation of cable laying

As discussed in the preceding sections, the presence of the cable itself is unlikely to cause any significant adverse impacts, however, the laying of the cable can be disruptive if not effectively managed.

It is recommended that during the laying of the cable, liaison is held with user groups (including the relevant harbour authorities (Dundalk and Carlingford Lough Commissioners), recreational users and fishing organisations) to provide updates on progress and to minimise the overlap with their activities. In addition, a moving 500 m advisory clearance distance should only apply around the cable-laying vessel, rather than across the whole route and the position of the vessel should be effectively communicated to interested parties.

5.9 Cumulative impacts

The cumulative NRA Study Area encompasses an area within 20 NM (37 km) of the offshore wind farm area and offshore cable corridor. This section provides a high-level qualitative review of potential cumulative impacts to shipping within the cumulative NRA Study Area.

The projects and plans selected as relevant to the assessment of cumulative impacts to shipping and navigation are based upon an initial screening exercise (see volume 2A, appendix 3-1: EIA Screening Annex).

The specific projects screened into the cumulative assessment are outlined in Table 5-2.

Table 5-2: List of other projects considered within the cumulative assessment.

Project	Status	Distance from offshore wind farm area (km)	Distance from offshore cable corridor (km)	Description of Project/	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Project
Site Investigation Works							
Site Investigations for Mainstream Renewable Power (North East Wind) off Co, Dublin (Mainstream, Renewable Power Ltd – Ref No. FS007373)	Application	4.2	0.7	Foreshore Licence application for site investigation works off County Dublin. Surveys include Geophysical, Geotechnical, Metocean and Ecological site investigations.	N/A	Unknown (subject to award of licence).	Potential to increase vessel movements within the NRA Study Area. Potential to result in further displacement of vessels already affected by the Project.
Site Investigations for the proposed Lir Offshore Array, off Counties Louth, Meath and Dublin (Lir Offshore Array Ltd Ref No. FS007392).	Application	15.0	7.9	Foreshore Licence application for site investigation works off County Dublin. Surveys include Geophysical, Geotechnical, Metocean and Ecological site investigations.	N/A	Unknown (subject to award of licence).	
Offshore Renewable Energy Projects							
North Irish Sea Array (NISA) (Statkraft)	Maritime Area Consent	16.2	18.1	Scoping report (2021) refers to the construction of an offshore wind farm of up to 500 MW, consisting of 36 turbines with a maximum height of 320 m and rotor diameter of up to 290 m. Offshore substation platforms may be required.	Unknown	Unknown (Design life minimum 35 years)	Potential to increase vessel movements within the NRA Study Area. Potential to result in further displacement of vessels already affected by the Project.

5.9.1 Cumulative impact on visual navigation and collision avoidance

The projects listed in Table 5-2 have the potential to result in increased vessel activity.

As the site investigation surveys are expected to involve up to 3-4 small vessels operating in and around the 20 NM cumulative NRA Study Area, they will have no discernible cumulative impact on navigational safety in the cumulative NRA Study Area, and compliance with the Collision Regulations would mitigate any risk.

The cumulative effects of the North Irish Sea Array regarding visual navigation and collision avoidance are influenced by the characteristics of the vessels navigating in the proximity of the projects and the distance between the projects. The North Irish Sea Array is located approximately 8.6 NM from the Oriel Wind Farm Area meaning that there is sufficient available searoom for vessels to take appropriate action to avoid collision.

During the construction, operational and maintenance and decommissioning phases of the Project, there will be a number of individual risk controls in place to avoid any undue conflict with other vessels due to cumulative impact (see section 6.3).

Any increase to the number of vessels due to the projects listed above in Table 5-2 in the cumulative NRA Study Area would be low and therefore the cumulative impact from any increase in vessel activity is considered to be negligible.

It is therefore considered unlikely that any of the projects listed in the table above will have any cumulative effect with the Project on shipping and navigation receptors.

5.9.2 Cumulative impact on vessel traffic routeing

The site investigation projects listed in Table 5-2 have the potential to result in further displacement of vessels already affected by the Project.

Any cumulative impact on vessel routeing due to the projects listed in Table 5-2 is not considered to be relevant to the offshore wind farm area, due to the insignificant nature of any rerouting due to avoiding survey or site investigation activities (see section 5.1). Any re-routing would only be related to avoidance of survey or site investigation vessels engaged on the site investigation works.

The North Irish Sea Array has the potential to provide a cumulative impact of vessel traffic routeing specifically related to vessels using a coastal route either in a north/south orientation or when on passage to/from Dundalk. As noted in section 5.1, vessels using either of these routes would need to deviate due to the presence of the Project. The presence of the North Irish Sea Array means that any vessels that deviate to the east of the Project may need to deviate further if proceeding east of the North Irish Sea Array. It should be noted however, that there is sufficient sea room to proceed inshore of the North Irish Sea Array meaning that no additional changes to traffic routeing would be required.

It is therefore considered that any cumulative effects on vessel traffic routeing will be negligible given the limited number of vessels associated with site investigations and the available searoom in the area.

6 NAVIGATION RISK ASSESSMENT

6.1 Introduction and methodology

This NRA considers any impact on navigation safety potentially caused by the construction, operational and maintenance and decommissioning phases of the Project. The NRA is limited to identifying and quantifying any additional or increased navigational risk resulting from the Project. It subsequently identifies possible mitigation measures where appropriate and makes recommendations. The NRA has been carried out as per the requirements of MGN 654 as summarised in section 1.2.

6.1.1 Definitions

The methodology uses the following definitions:

- **Risk** is a measure of the consequence and likelihood of a hazard occurring;
- **Hazard** is an occurrence that can create an unsafe situation (i.e. *"something with the potential to cause harm, loss or injury"*);
- **Baseline risk** is a measure of risk without the proposed Project in place;
- **Inherent risk** is a measure of risk with the Project in place prior to additional risk controls being added (existing control measures, including IMO obligations and those local risk control measures set out in section3.4, are included in this assessment); and
- **Residual risk** is a measure of risk once additional risk controls have been added.

Risk is the product of the consequence and the likelihood of an unwanted event (i.e. a hazard).

RISK ASSESSMENT MATRIX: RISK CRITERIA			FREQUENCY				
			Level 1	Level 2	Level 3	Level 4	Level 5
			Rare	Unlikely	Possible	Likely	Almost Certain
			greater than 1 in every 100 years	1 every 100 years	1 every 10 years	1 per year	more than 1 per year
Consequence	5		5.0	10.0	15.0	20.0	25.0
	4		4.0	8.0	12.0	16.0	20.0
	3		3.0	6.0	9.0	12.0	15.0
	2		2.0	4.0	6.0	8.0	10.0
	1		1.0	2.0	3.0	4.0	5.0
ACTION KEY	Slight (1 - 3.99)	No Action is required					
	Minor (4 - 5.99)	No additional controls are required, monitoring is required to ensure no changes in circumstances					
	Moderate (6 - 9.99)	Efforts should be made to reduce risk to 'As low as reasonably practicable' (ALARP), but activity may be undertaken					
	High (10 - 14.99)	Efforts should be made to reduce risk to 'As low as reasonably practicable' (ALARP). Activity can only be undertaken with further additional controls.					
	Extreme (15 - 25)	Intolerable risk. Activity not authorised					

Figure 6-1: Risk assessment matrix criteria.

The IMO Guidelines define a hazard as "*something with the potential to cause harm, loss or injury*", 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".

To assess likelihood and, to a lesser extent, consequence, it is necessary to use a combination of historical incident (including near miss data) statistics (see section 4.6), local stakeholder judgement, vessel traffic analysis and the professional judgement of the NRA personnel.

The combination of consequence and likelihood of occurrence of a hazard, to produce a risk score is undertaken using a risk matrix (see Figure 6-1) which enables hazards to be scored and ranked. The resulting scale can be divided into three general categories (see Action Key in Figure 6-1 for specific classifications):

- Acceptable;
- As Low as Reasonably Practicable (ALARP); and
- Intolerable.

6.1.2 Hazard likelihood

Each hazard is scored for "likelihood" using the table presented in Table 6-1 for each individual hazard.

Table 6-1: Hazard likelihood criteria.

Likelihood score	Likelihood description	Definition operational interpretation
5	Almost Certain	An event occurring in the range once a week to once an operating year.
4	Likely	An event occurring in the range once a year to once every 10 operating years.
3	Possible	An event occurring in the range once every 10 operating years to once in 100 operating years.
2	Unlikely	An event occurring in the range less than once in 100 operating years.
1	Rare	Considered to occur less than once in 1,000 operating years (e.g. it may have occurred at a similar sites, elsewhere in the world).

6.1.3 Hazard consequence

Consequence assessments are made for each hazard in the “Most Likely” and “Worst Credible” outcome of each hazard for categories associated with impact to “People”, “Property”, “Environment” and “Business/Stakeholders”. Consequence criteria were defined as presented in Table 6-2.

Table 6-2: Hazard consequence criteria.

Category	People	Property	Environment[a]	Business
1	**Negligible**	**Negligible**	**Negligible**	**Negligible**
	Possible very minor injury (e.g. bruising)	Negligible damage to vessel(s) / infrastructure	No effect of note. Tier 1 may be declared but criteria not necessarily met.	No adverse publicity. No loss of revenue.
		Costs <€10k	Costs <€10k	Costs <€10k
2	**Minor**	**Minor**	**Minor**	**Minor**
	(single minor injury)	Minor damage to vessel(s) / infrastructure	Tier 1 –Tier 2 criteria reached. Small operational (oil) spill with little effect on environmental amenity	Bad local publicity. Short-term loss of revenue.
		Costs €10k - €100k	Costs €10k - €100k	Costs €10k - €100k
3	**Moderate**	**Moderate**	**Moderate**	**Moderate**
	Multiple minor or single major injury	Moderate damage to vessel(s) / infrastructure	Tier 2 spill criteria reached but capable of being limited to immediate area within offshore wind farm area	Bad widespread publicity. Temporary suspension of operations or prolonged restrictions.
		Costs €100k-€1M	Costs €10k - €100k	Costs €10k - €100k
4	**Major**	**Major**	**Major**	**Major**
	Multiple major injuries or single fatality	Major damage to vessel(s) / infrastructure	Tier 3 criteria reached with pollution requiring national support. Chemical spillage or small gas release	National publicity. Temporary closure.
		Costs €1M - €10M	Costs €1M - €10M	Costs €1M - €10M
5	**Catastrophic**	**Catastrophic**	**Catastrophic**	**Catastrophic**
	Multiple fatalities	Catastrophic damage	Tier 3 oil spill criteria reached. International support required. Widespread shoreline contamination. Serious chemical or gas release. Significant threat to environmental amenity.	International media publicity. Operations and revenue seriously disrupted for more than two days. Ensuing loss of revenue.
		Costs >€10M	Costs >€10M	Costs >€10M

[a] The International Petroleum Industry Environmental Conservation Association has defined the three tiers according to various characteristics based more on the capabilities of the response than on the volume or size of the spill as follows:

- Tier 1 spills use locally held resources and are less severe spills addressed by a company's internal spill management team;
- Tier 2 spills may require national or regional response teams with specialised knowledge to intervene; and
- Tier 3 spills are global in need for necessary, available, large-scale resource response.

6.1.4 Risk reduction

Risk controls aim to reduce the risk of a hazard and can affect both the likelihood and consequence of that hazard (for example buoyage reduces the likelihood of vessel grounding whereas lifeboats can be said to reduce the consequences if a grounding occurs). It is possible to estimate or calculate the effectiveness of a risk control at reducing the risk of a hazard occurring. This is beneficial in determining the merits (either absolute or relative) of implementing risk controls, which can also lead on to effective cost benefit analysis.

The effectiveness of additional risk controls is assessed against a nominal scale, which applies differing percentage reductions, based on their estimated effectiveness. The percentage reduction is then made to either/or both, the likelihood or consequence values, essentially entailing a further calculation using the risk matrix, and a "residual" risk score is calculated.

As an example, take a hazard with a consequence score equivalent to €100,000. An additional risk control judged to reduce the consequence of this hazard by 20% will generate a residual consequence value, equivalent to €80,000, and the risk matrix is used to determine the residual risk score. The residual risk score is calculated the same as for baseline risk.

The application of additional risk control measures is assessed using a compound calculation. From the example above, a further risk control could be applied at 20%, which would reduce the consequence cost, from €80,000 to €64,000. A third risk control, with 10% effectiveness, would reduce the same property cost from €64,000 to €57,600, and so on. The residual risk score, with all these risk control measures in place, would therefore utilise the €57,600 consequence value in the calculation of risk. In terms of the final risk score the order that risk controls are added does not affect the final score.

It should be noted that as "risk" is a non-dimensional number (being a combination of likelihood and consequence), a 50% reduction in likelihood of hazard occurrence will not result in a 50% reduction in risk, because no similar reduction in consequences has been applied.

Also, it can be difficult to determine the exact effectiveness of risk controls in a dynamic and changing system and, as such, a significant degree of subjectivity is commonly used where quantitative methods are not available or are prohibitively expensive to assess. However, given that a standardised framework is applied across all hazards, then the resulting scores can be used to judge the relative and absolute merits of implementing additional risk controls.

6.1.5 Hazard scoring

Hazard risk scores were calculated using the risk matrix for each "Most Likely" and "Worst Credible" consequence criteria ("People", "Property", "Environment" and "Business/Stakeholders") and were then combined into a single hazard risk score as follows:

- The average risk score of the four categories in the "most likely" set;
- The average risk score of the four categories in the "worst credible" set;
- The maximum risk score of the four categories in the "most likely" set; and
- The maximum risk score of the four categories in the "worst credible" set.

The hazard list was then sorted in order of the aggregate of the four indices to produce a "Ranked Hazard List" with the highest risk hazards prioritised at the top.

6.2 Hazard identification

Hazard identification follows a structured and logical process to ensure that hazards of appropriate likelihood (ranging from common to potential hazards) and consequence are considered.

Potential hazards were reviewed under each of the following headings:

- Project phase;
- Incident category;
- Geographical area; and
- Vessel type.

6.2.1 Project phase

The three Project phases (construction, operational and maintenance and decommissioning) have been assessed, however following a review of the relative impacts of each, it was decided that the construction and decommissioning phases will be assessed together as they have similar activities. By way of example, the frequency and consequences of collision during the construction/decommissioning phase will differ significantly due to the many movements of larger specialist vessels associated with construction/decommissioning when compared with the operational and maintenance phase.

6.2.2 Incident category

The four incident categories identified as being relevant to this study are:

- Collision;
- Contact;
- Dragging anchor/snagging; and
- Grounding (during construction and decommissioning).

In the context of this study, foundering, defined as "*filling from above the waterline and sinking*" and pollution have been treated as possible consequences of a collision, contact or snagging incident.

The four incident categories are discussed in greater detail below.

Collision

Three broad categories of collision hazards can be identified during the construction, operational and maintenance and decommissioning phases:

- Firstly, the proximity of Project vessels operating within the offshore wind farm area represents a collision hazard. This hazard is particularly relevant during the construction/decommissioning phases when multiple small, high speed craft, crew boats and larger vessels navigate in a constrained space;
- Secondly, as the construction vessels or maintenance craft transit to and from their operational base they may encounter other marine users; and
- Finally, the displacement of vessel traffic beyond the physical extent of the offshore wind farm area may cause vessels to navigate in closer proximity with each other than they would otherwise do.

Contact

Contact hazards are those when a vessel contacts a physical structure such as the WTG or OSS. Any mariner may contact a WTG or OSS either: under power, through human error or steering failure, or whilst drifting, through loss of power.

Dragging anchor and snagging

Vessels may encounter underwater obstructions that form part of the infrastructure of the Project, such as inter-array and export cables. These may be anchors or fishing gear snagging the cable or damage to the rock armouring. Subsea cables should therefore be buried to a safe level (see also section 5.7) so as not to be affected by anchoring of vessels known to be in the area. The possibilities of a large vessel not under power and drifting, and requiring the deployment of larger anchors, are considered unlikely and is therefore not assessed.

Grounding

As the offshore wind farm area is located in depths of between 16 m and 30 m and as there is sufficient sea room either side of the offshore wind farm area as well as taking into account the type of foundation to be

used (i.e. monopile), it is considered highly unlikely that a vessel will run aground as a result of the Project. Therefore, for the operational and maintenance phase this category has not been assessed.

For the construction/decommissioning phase grounding has been assessed for vessels transiting inside the 5 m contour line during cable installation activities within the offshore cable corridor.

6.2.3 Geographical hazard area

The geographical hazard area is defined as the NRA Study Area, which covers the navigation of passing vessels likely to be impacted by the Project.

6.2.4 Vessel type

The vessel groups assessed are given below:

- Construction vessels – major construction vessels used for the installation of the foundations, WTGs, OSS and cables. Includes cable-laying vessels, heavy-lift and crane barges of around 100 m LOA;
- Commercial vessels – cargo, naval, passenger vessels, tankers, bulk carriers, Ro-Ro etc.;
- Commercial workboats – all other commercial vessels such as wind farm support vessels, crew transfer vessels, pilot boats, survey boats and tugs;
- Fishing vessels – all commercial fishing vessels engaged in fishing or trawling; and
- Recreational – including yachts, motor launches, and unpowered recreational craft.

6.3 Additional risk controls

Note: Prior to construction, the Applicant will prepare comprehensive and proven operational procedures, policies and plans in respect of the construction and subsequent maintenance of the Project which have been agreed, published and distributed to all relevant parties including sub-contractors. This will also include an assessment whereby all construction and operational staff have been evaluated as being fully competent, and where appropriate formally qualified, before undertaking their assigned duties.

Several additional risk controls have been identified as relevant for the Project, many of which are identified in MGN 654, which are presented below in

Table 6-3. These additional risk controls have been included in the residual assessment of risk for the Project to mitigate any increase in navigation risk brought about by the Project.

In addition to these additional risk controls, the following assumptions have been made as part of this assessment:

- All those involved in construction, operational and maintenance operations are to be trained and competent persons;
- Use of appropriate PPE by personnel;
- Incidents and near misses are reported and investigated by the Applicant; and
- Electromagnetic interference minimisation in cable design.

Table 6-3: Additional risk controls.

ID	Risk Control
1.	**Promulgation of information.** Promulgation of information and warnings through Notice to Mariners and other appropriate Maritime Safety Information (MSI) dissemination methods. Throughout the life of the wind farm regular liaison meetings to be held between project, sub-contractors and local marine stakeholders such as local harbour authorities, pilots, fishermen, and leisure groups such as yacht clubs. Information and warnings concerning any restrictions to navigation, including the imposition of any Safety Zones to be promulgated by Radio Navigation Warning Signals (NAVAREA 1 or HYDROLANT), Notice to Mariners, Notice to Airmen Publication.
2.	**Continuous Watch.** Continuous watch by multi-channel VHF, including DSC.
3.	**500 m Safety Zones/Advisory Clearance Distances.** Safety zones of 500 m in radius will be implemented around WTGs and OSS undergoing construction/decommissioning or major maintenance activities. A rolling advisory clearance distance of 500 m in radius will be implemented around the cable laying vessel. There should also be appropriate means for the Applicant to notify, and provide evidence of, the infringement of any safety zones.
4.	**Aids to Navigation.** Aids to Navigation management plan (marking and lighting) to be submitted to IRCG/CIL for approval and implementation prior to construction.
5.	**Vessel Traffic Monitoring.** Vessel traffic monitoring by: AIS, VHF, closed circuit television (CCTV) or other agreed means with all Project vessels throughout all phases.
6.	**Safety Documents:** **Emergency Response Co-operation Plan (ERCoP)** An ERCoP to be drafted in conjunction with the IRCG and other key stakeholders (see appendix 5-7 in volume 2A). **Navigation Safety Management System (NSMS)** Prior to construction the Applicant should prepare a Navigational Safety Management System based initially on this NRA, which includes policy statements, delegated responsibilities and references to operational procedures as appropriate. The system should also address how accidents are investigated and recorded, and the means by which the NSMS is kept under review.
7.	**Provision of Guard Vessel.** Provision of a guard vessel to monitor third party vessel traffic and intervene with warnings as necessary. Guard vessels should be considered during the construction/decommissioning phases (including the cable laying) to patrol the offshore wind farm area and offshore cable corridor, monitor the effectiveness of control measures and advise any passing vessels of the works being conducted. Guard vessels which are fully operational before the construction phase commences can also be utilised as support craft, or as an additional SAR resource.
8.	**Cable Burial Risk Assessment.** A cable burial risk assessment to be conducted. Cable protection so not to exceed 5% reduction in UKC.
9.	**Vessel Compliance with Standards.** Compliance from all Project vessels 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)).
10.	**Under Keel Clearance.** Subsea cables to be buried to an agreed depth which provides sufficient protection without compromising UKC.
11.	**Fisheries Liaison Plan.** Production of a fisheries liaison plan; provision of detailed Project information to fishermen, such as offshore wind farm area and offshore cable corridor location for upload into fish plotters. The plan will include a process for liaising with the relevant ports and local fishing organisations in advance of construction and major maintenance activities to enable vessels to navigate around activities effectively and safely within the offshore wind farm area and offshore cable corridor.

ID	Risk Control
12.	**Marine Coordination.** Planning and coordination for Project vessels. Project marine traffic coordination to define Project vessel passage plans available to all maritime users.
13.	**Air Draught Clearance.** Blade clearance of at least 22 m above MHWS.
14.	**Charting.** Charting of the offshore wind farm structures (WTG, OSS), inter-array and export cables and landfall infrastructure on navigation charts. Inform UKHO and KISCA accordingly.
15.	**Lines of Orientation.** Agree lines of orientation with IRCG. WTG and OSS layout plan to be agreed with IRCG/CIL prior to construction.

The additional risk controls identified above were applied to hazards as relevant and appropriate to generate residual risk scores. The effectiveness of risk controls at reducing with the likelihood or consequence of hazard occurrence was determined by applying the following percentage reduction effectiveness of each control when applied to each hazard:

- Risk Control Effectiveness “Low” – 5% reduction in “Likelihood” or “Consequence” scores;
- Risk Control Effectiveness “Medium” - 10% reduction in “Likelihood” or “Consequence” scores; and
- Risk Control Effectiveness “High” - 20% reduction in “Likelihood” or “Consequence” scores.

The following table attributes each of the identified additional risk controls in

Table 6-3 to the construction/decommissioning phase, the operational and maintenance phase, or both.

Table 6-4: Additional risk control measures by Project phase.

ID	Risk Control	Construction / Decommissioning Phase	Operational and maintenance Phase
1.	**Promulgation of information**	✓	✓
2.	**Continuous Watch**	✓	
3.	**500 m Safety Zones**.	✓	✓
4.	**Aids to Navigation.**	✓	✓
5.	**Vessel Traffic Monitoring**	✓	✓
6.	**Safety Plans: ERCoP / NSMS**	✓	✓
7.	**Provision of Guard Vessel**	✓	
8.	**Cable Burial Risk Assessment**		✓
9.	**Vessel Compliance with Standards**	✓	✓
10.	**Under Keel Clearance**	✓	✓
11.	**Fisheries Liaison Plan**	✓	✓
12.	**Marine Coordination**	✓	✓
13.	**Air Draught Clearance**	✓	✓
14.	**Charting**	✓	✓
15.	**Lines of Orientation**	✓	✓

6.4 Risk assessment results

The following section provides an overview of the risk assessment results for the construction/decommissioning and operational and maintenance phases. The full risk assessment tables can be found in the appendices.

6.4.1 Construction/decommissioning

In total 30 individual navigation hazards were assessed for the construction/decommissioning phases of the Project. These included the following hazards:

- Haz ID#1: Collision - Commercial vs Commercial;
- Haz ID#2: Collision - Commercial vs Fishing;
- Haz ID#3: Collision - Commercial vs Recreational;
- Haz ID#4: Collision - Commercial vs Wind Farm Service Vessel (WFSV), Workboats;
- Haz ID#5: Collision - Fishing vs Fishing;
- Haz ID#6: Collision - Fishing vs Recreational;
- Haz ID#7: Collision - Fishing vs WFSV, Workboats;
- Haz ID#8: Collision - Recreational vs Recreational;
- Haz ID#9: Collision - Recreational vs WFSV, Workboats;
- Haz ID#10: Collision - WFSV, Workboats vs WFSV, Workboats;

- Haz ID#11: Contact with Partially built offshore wind farm – Commercial;
- Haz ID#12: Contact with Partially built offshore wind farm – Fishing;
- Haz ID#13: Contact with Partially built offshore wind farm – Recreational;
- Haz ID#14: Contact with Partially built offshore wind farm - WFSV, Workboats;
- Haz ID#15: Grounding at Dunany Point – Commercial;
- Haz ID#16: Grounding at Dunany Point – Fishing;
- Haz ID#17: Grounding at Dunany Point – Recreational;
- Haz ID#18: Grounding at Dunany Point - WFSV, Workboats;
- Haz ID#19: Snagging offshore wind farm infrastructure – Commercial;
- Haz ID#20: Snagging offshore wind farm infrastructure – Fishing;
- Haz ID#21: Snagging offshore wind farm infrastructure – Recreational;
- Haz ID#22: Snagging offshore wind farm infrastructure - WFSV, Workboats;
- Haz ID#23: Collision – Construction vessels vs Construction vessels;
- Haz ID#24: Collision – Construction vessels vs Commercial;
- Haz ID#25: Collision – Construction vessels vs Fishing;
- Haz ID#26: Collision – Construction vessels vs Recreational;
- Haz ID#27: Collision – Construction vessels vs WFSV, Workboats;
- Haz ID#28: Contact with Partially built offshore wind farm – Construction vessels;
- Haz ID#29: Grounding at Dunany Point – Construction vessels; and
- Haz ID#30: Snagging offshore wind farm infrastructure – Construction vessels.

The results of the construction/decommissioning phases risk assessment are presented below in Table 6-5. As discussed above in section 6.1 the scores in the baseline column are the measure of risk without the proposed Project, and therefore are blank for construction vessels, workboats etc. as well as the partially constructed Project for the baseline risk.

It is important to note that the residual assessment of risk is calculated by applying one or more of the additional risk controls listed in

Table 6-3 to each of the appropriate hazards.

The top four hazards relate to fishing vessels, being the most prevalent type of vessel in the NRA Study Area, in collision with other vessels or contact by a fishing vessel with a partially constructed offshore wind farm.

The resultant table shows that a "*collision between fishing vessels*" is the highest risk score for the baseline, inherent and residual assessment of risk. With the relevant additional risk control measures applied to the risk score the hazard drops from a "Moderate" risk score defined as "*Efforts should be made to reduce risk to ALARP, but activity may be undertaken"* to a "Minor" risk score defined as "*No additional controls are required, monitoring is required to ensure no changes in circumstances*" (see Figure 6-1: Action Key). The mitigation measures applied were as follows:

- Risk Control ID# 1: Promulgation of Information;
- Risk Control ID# 2: Construction - Continuous Watch;
- Risk Control ID# 5: Vessel Traffic Monitoring;
- Risk Control ID# 6: Emergency Response Cooperation Plan;
- Risk Control ID# 7: Construction - Provision of Guard Vessel;
- Risk Control ID# 10: Under keel clearance requirements; and
- Risk Control ID# 11: Fisheries Liaison Plan.

It is, however, important to note that the application of the additional risk controls (see

Table 6-3) mitigates the residual risk for all hazards to the minor or negligible levels and as such the construction and decommissioning phases of the Project can, with regards to navigation risk, be considered acceptable.

Table 6-5: Construction/decommissioning risk assessment result – baseline, inherent and residual assessment – ranked by residual risk scores (blank cells indicates hazards that do not occur in the baseline scenario).

Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Hazard Type - Vessel Type	Baseline Risk	Baseline Level	Inherent Risk	Inherent Level	Residual Risk	Residual Level
5	2	1	1	Collision - Fishing vs Fishing	6.2	Minor	7.7	Moderate	6.5	Minor
25	19	2	2	Collision - Construction vs Fishing			7.6	Moderate	6.3	Minor
6	6	7	3	Collision - Fishing vs Recreational	5.9	Minor	7.2	Moderate	6.0	Minor
12	19	3	3	Contact with Partially built OWF - Fishing			7.4	Moderate	6.0	Minor
8	8	8	5	Collision - Recreational vs Recreational	5.3	Minor	6.8	Minor	5.9	Minor
7	7	6	6	Collision - Fishing vs WFSV, Workboats	5.9	Minor	7.3	Moderate	5.9	Minor
3	5	10	7	Collision - Commercial vs Recreational	6.0	Minor	6.8	Minor	5.8	Minor
28	19	4	8	Contact with Partially built OWF - Construction			7.3	Moderate	5.8	Minor
20	1	4	9	Snagging OWF infrastructure - Fishing			7.3	Moderate	5.6	Minor
2	10	13	10	Collision - Commercial vs Fishing	5.2	Minor	6.6	Minor	5.6	Minor
26	19	10	11	Collision - Construction vs Recreational			6.8	Minor	5.6	Minor
13	19	8	12	Contact with Partially built OWF - Recreational			6.8	Minor	5.4	Minor
9	11	14	13	Collision - Recreational vs WFSV, Workboats	5.2	Minor	6.5	Minor	5.3	Minor
10	14	15	14	Collision - WFSV, Workboats vs WFSV, Workboats	4.5	Negligible	6.4	Minor	5.3	Minor
27	19	10	15	Collision - Construction vs WFSV, Workboats			6.8	Minor	5.2	Minor
21	3	21	16	Snagging OWF infrastructure - Recreational			6.1	Minor	5.1	Minor
30	19	18	17	Snagging OWF infrastructure - Construction			6.3	Minor	5.0	Minor
29	19	20	18	Grounding at Dunany Point - Construction			6.3	Minor	4.9	Negligible
14	19	19	19	Contact with Partially built OWF - WFSV, Workboats			6.3	Minor	4.9	Negligible
11	19	16	20	Contact with Partially built OWF - Commercial			6.4	Minor	4.9	Negligible
4	13	17	21	Collision - Commercial vs WFSV, Workboats	5.1	Minor	6.4	Minor	4.8	Negligible
15	12	23	22	Grounding at Dunany Point - Commercial	5.1	Minor	5.6	Minor	4.8	Negligible
19	9	22	23	Snagging OWF infrastructure - Commercial			5.6	Minor	4.7	Negligible
22	3	24	24	Snagging OWF infrastructure - WFSV, Workboats			5.5	Minor	4.5	Negligible
1	15	25	25	Collision - Commercial vs Commercial	4.3	Negligible	5.3	Minor	4.5	Negligible
23	19	27	26	Collision - Construction vs Construction			4.3	Negligible	3.9	Negligible
24	19	27	26	Collision - Construction vs Commercial			4.3	Negligible	3.9	Negligible
16	16	26	28	Grounding at Dunany Point - Fishing	4.1	Negligible	4.5	Negligible	3.8	Negligible
17	17	29	29	Grounding at Dunany Point - Recreational	3.7	Negligible	4.0	Negligible	3.3	Negligible
18	17	29	30	Grounding at Dunany Point - WFSV, Workboats	3.7	Negligible	4.0	Negligible	3.3	Negligible

6.4.2 Operational and Maintenance

In total 18 individual navigation hazards were assessed for the operational and maintenance phase of the Project; these included the following hazards:

- Haz ID#1: Collision - Commercial vs Commercial;
- Haz ID#2: Collision - Commercial vs Fishing;
- Haz ID#3: Collision - Commercial vs Recreational;
- Haz ID#4: Collision - Commercial vs WFSV, Workboats;
- Haz ID#5: Collision - Fishing vs Fishing;
- Haz ID#6: Collision - Fishing vs Recreational;

- Haz ID#7: Collision - Fishing vs WFSV, Workboats;
- Haz ID#8: Collision - Recreational vs Recreational;
- Haz ID#9: Collision - Recreational vs WFSV, Workboats;
- Haz ID#10: Collision - WFSV, Workboats vs WFSV, Workboats;
- Haz ID#11: Contact with offshore wind farm – Commercial;
- Haz ID#12: Contact with offshore wind farm – Fishing;
- Haz ID#13: Contact with offshore wind farm – Recreational;
- Haz ID#14: Contact with offshore wind farm - WFSV, Workboats;
- Haz ID#15: Snagging offshore wind farm infrastructure – Commercial;
- Haz ID#16: Snagging offshore wind farm infrastructure – Fishing;
- Haz ID#17: Snagging offshore wind farm infrastructure – Recreational; and
- Haz ID#18: Snagging offshore wind farm infrastructure - WFSV, Workboats.

The results of the operational and maintenance phase assessment of navigation risk are presented below in Table 6-6. It is important to note that the r*esidual* assessment of risk is calculated by applying the appropriate additional risk controls.

As with the construction and decommissioning risk assessment, a collision between fishing vessels has been identified as the highest individual hazard score. The hazard table presented in Table 6-6 indicates the same risk score for this hazard as shown above in the construction and decommissioning baseline assessment, a slightly lower assessment of risk for the inherent assessment (due to the Project not being in a temporary construction phase), but a slightly higher residual assessment risk as highly effective and costly risk controls such as guard vessels are not specified. The risk controls identified for the highest hazard "*collisions between fishing vessels*" include:

- Risk Control ID# 1: Promulgation of Information;
- Risk Control ID# 6: Emergency Response Cooperation Plan;
- Risk Control ID# 11: Fisheries Liaison Plan;
- Risk Control ID# 14: Charting; and
- Risk Control ID# 5: Lines of Orientation.

Also, and as with the construction and decommissioning assessment, all hazards in the residual assessment with risk controls applied fall into the "Minor" risk classification (see Figure 6-1) which is defined as "*No additional controls are required, monitoring is required to ensure no changes in circumstances"*.

In conclusion, all the hazards fall into the "Minor" or "Negligible" residual levels of risk and as such the Project operational and maintenance phase can, with regards to navigation risk, be considered acceptable.

Table 6-6: Operational risk assessment result – baseline, inherent and residual assessment – ranked by residual risk scores (blank cells indicates hazards that do not occur in the baseline scenario).

Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Hazard Type - Vessel Type	Baseline Risk	Baseline Level	Inherent Risk	Inherent Level	Residual Risk	Residual Level
5	2	1	1	Collision - Fishing vs Fishing	6.2	Minor	7.3	Moderate	6.7	Minor
6	6	5	2	Collision - Fishing vs Recreational	5.9	Minor	6.6	Minor	6.2	Minor
7	7	3	3	Collision - Fishing vs WFSV, Workboats	5.9	Minor	7.0	Minor	6.2	Minor
8	9	7	4	Collision - Recreational vs Recreational	5.3	Minor	6.4	Minor	6.1	Minor
16	1	1	5	Snagging OWF infrastructure - Fishing			7.3	Moderate	6.0	Minor
3	5	9	6	Collision - Commercial vs Recreational	6.0	Minor	6.4	Minor	6.0	Minor
14	19	4	7	Contact with OWF - WFSV, Workboats			6.9	Minor	5.9	Minor
2	12	11	8	Collision - Commercial vs Fishing	5.2	Minor	6.2	Minor	5.9	Minor
17	3	14	10	Snagging OWF infrastructure - Recreational			6.1	Minor	5.8	Minor
12	19	6	11	Contact with OWF - Fishing			6.6	Minor	5.8	Minor
13	19	7	12	Contact with OWF - Recreational			6.4	Minor	5.7	Minor
9	13	12	15	Collision - Recreational vs WFSV, Workboats	5.2	Minor	6.2	Minor	5.5	Minor
15	11	19	16	Snagging OWF infrastructure - Commercial			5.6	Minor	5.4	Minor
10	17	17	17	Collision - WFSV, Workboats vs WFSV, Workboats	4.5	Negligible	6.0	Minor	5.3	Minor
11	19	16	18	Contact with OWF - Commercial			6.0	Minor	5.2	Minor
18	3	20	19	Snagging OWF infrastructure - WFSV, Workboats			5.5	Minor	5.1	Minor
4	15	15	20	Collision - Commercial vs WFSV, Workboats	5.1	Minor	6.0	Minor	5.1	Minor
1	18	22	22	Collision - Commercial vs Commercial	4.3	Negligible	4.7	Negligible	4.5	Negligible

6.5 Conclusions

This assessment has considered the activities of vessels in and around the NRA Study Area and the possible impacts the Project would have on navigational safety.

1. The Project is located 22 km off the coast of Dundalk, County Louth in the northwest Irish Sea;

2. The Project will consist of 25 WTGs and will include an OSS, inter-array cabling and an export cable to the landfall at Dunany Point;

3. There are no other renewable energy, aggregate or oil and gas developments near the offshore wind farm area. The cumulative assessment considered other project site investigation activities and port development activities within the cumulative NRA Study Area; and

4. Discussions relating to shipping activity and the safety of navigation were held with a wide range of consultees and no major concerns were raised.

6.5.1 Vessel traffic

1. The vessel traffic AIS data identified a range of activities within the NRA Study Area including commercial shipping, fishing and recreational users;

2. The AIS data indicates that the majority of vessel tracks within the NRA Study Area are fishing vessels;

3. Commercial vessel traffic passing the offshore wind farm area service Warrenpoint and Greenore port in Carlingford Lough as well as Dundalk port to the west of the offshore wind farm area;

4. There are three commercial vessels per month that transit to and from Drogheda and Greenore Port that will be required to adjust their passage plan to pass either to the west or east of the offshore wind farm area accordingly;

5. Vessels entering and leaving Dundalk Harbour on an east/west course will have to adjust their passage plans accordingly to avoid the offshore wind farm area;

6. Tankers, service vessels and recreational craft activity in the NRA Study Area is minimal; and

7. Based on the results of the AIS analysis and through consultation the overall level of marine traffic transiting through the NRA Study Area is considered low.

6.5.2 Impact assessment

1. The impact on vessel routeing between Drogheda and Greenore was considered and a comparison made between existing routes and those with the Project in place (note point 8 above). A small increase in transit time was identified as the likely impact but this was not considered significant to make commercial operations of the ports unviable;

2. There would be no impact on pilotage operations for vessels entering/departing Carlingford Lough or Dundalk;

3. It is recommended that during cable installation activities, liaison is held with user groups (including the relevant harbour authorities, recreational and fishing users) to provide updates on progress and to minimise the overlap with their activities;

4. The final Project layout will be designed with attention to the key principles of SAR in OREIs so that there are no adverse impacts;

5. The offshore cable corridor overlaps with the Dundalk Port Company pilotage district, close to Dunany Point. Discussions will be required, with the Dublin Harbour Master (currently acting as Dundalk Harbour Master) on any navigation impacts this may have on their operations. A local notice to mariners will be required;

6. A review of research on the impacts of WTGs on communications, radar and positioning systems was undertaken. Whilst there would be some impacts, these could be effectively managed and would not increase navigation risk as a result; and

7. The potential cumulative impacts were reviewed and are considered to have an insignificant effect with the Project on shipping and navigation receptors.

6.5.3 Navigation Risk Assessment

1. The NRA was undertaken in line with the FSA and MGN 654 guidance documents for the construction/decommissioning phase and the operational and maintenance phase, for which 30 and 18 distinct hazards were identified respectively;

2. A suite of additional risk controls was identified which reduced each of the risks in all phases to a lower level;

3. Of the hazards identified in both the operational and maintenance and the construction/decommissioning phases, all fall into either “Minor” or “Negligible” categories;

4. The most significant hazard in both the operational and maintenance and construction/decommissioning phases relates to the risk of fishing vessels in collision with each other at both the baseline and residual risk levels; and

5. With regards to navigation risk the construction/decommissioning and operational and maintenance phases were considered acceptable.

6.6 Summary

In summary, this assessment has considered a variety of impacts and hazards associated with the Project drawing upon evidence presented from analysis, review of information and stakeholder consultation.

The assessment concludes that no over-riding navigational issues have been identified that presents an insurmountable threat to navigational safety for shipping, be that commercial, fishing or recreational.

It is the view of the Project consultants that, with the implementation of the recommended additional risk controls, this Project during the construction/decommissioning and operational and maintenance phases will not undermine navigational safety in the NRA Study Area.

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A.1 Risk Assessment Logs

Project:	Oriel Offshore Wind Farm	Construction / Decommissioning Phase	Nash Maritime	Revision:	Rev 01-00

Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls													Inherent Risk: Windfarm No Additional Controls												Inherent Risk	Residual Risk: With Additional Controls in Place					Residual Risk	Detailed Results
							Most Likely						Worst Credible						Baseline Risk	Most Likely						Worst Credible													
							Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business		Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business			Risk Control ID	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control		
																																					Baseline Risk
1	15	25	25	Study Area	Commercial vs Commercial	Collision - Commercial vs Commercial	100	2	2	2	1	2	1000	1	5	5	4	5	4.3	50	2.301	2	2	1	2	500	1.301	5	5	4	5	5.3		Baseline with no additional risk controls				5.3	4.5	4.3
																																1	Promulgation of Information	Yes	5%	0%	5.3		Baseline Level
																																2	Construction - Continuous Watch	Yes	10%	0%	5.1		Negligible
																																3	Safety Zones	No	20%	0%	5.1		Inherent Risk
																																4	Aids to Navigation	No	10%	0%	5.1		5.3
																																5	Vessel Traffic Monitoring	Yes	20%	0%	4.9		Inherent Level
																																6	Emergency Response Cooperation Plan	Yes	0%	5%	4.8		Minor
																																7	Construction - Provision of Guard Vessel	Yes	20%	10%	4.5		Residual Risk
																																8	Cable Burial Risk Assessment	No	10%	0%	4.5		4.5
																																9	Construction - Compliance with International Regulations	No	10%	0%	4.5		Residual Level
																																10	Under keel clearance Requirements	No	10%	0%	4.5		Negligible
																																11	Fishing Liaison Plan	No	10%	0%	4.5		Risk Reduction
																																12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	4.5		0.8
																																13	Air Draught Clearance	No	10%	0%	4.5		
																																14	Charting	No	5%	0%	4.5		
																																15	Lines of Orientation	No	5%	0%	4.5		
																																	Baseline with no additional risk controls				6.6		Baseline Risk
2	10	13	10	Study Area	Commercial vs Fishing	Collision - Commercial vs Fishing	50	2.301	2	2	1	2	500	1.301	5	5	3	5	5.2	20	2.699	2	2	1	2	200	1.699	5	5	3	5	6.6		1	Promulgation of Information	Yes	5%	0%	6.5		5.2
																																2	Construction - Continuous Watch	Yes	10%	0%	6.4		Baseline Level
																																3	Safety Zones	No	20%	0%	6.4		Minor
																																4	Aids to Navigation	No	10%	0%	6.4		Inherent Risk
																																5	Vessel Traffic Monitoring	Yes	20%	0%	6.1		6.6
																																6	Emergency Response Cooperation Plan	Yes	0%	5%	6.1		Inherent Level
																																7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.7		Moderate
																																8	Cable Burial Risk Assessment	No	10%	0%	5.7		Residual Risk
																																9	Construction - Compliance with International Regulations	No	10%	0%	5.7		5.6
																																10	Under keel clearance Requirements	No	10%	0%	5.7		
																																11	Fishing Liaison Plan	Yes	10%	0%	5.6		Residual Level
																																12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.6		Minor
																																13	Air Draught Clearance	No	10%	0%	5.6		
																																14	Charting	No	5%	0%	5.6		Risk Reduction
																																15	Lines of Orientation	No	5%	0%	5.6		1.0
																																	Baseline with no additional risk controls				6.8		Baseline Risk
3	5	10	7	Study Area	Commercial vs Recreational	Collision - Commercial vs Recreational	25	2.6021	2	2	1	2	250	1.6021	5	4	2	5	6.0	15	2.8239	2	2	1	2	150	1.8239	5	4	2	5	6.8		1	Promulgation of Information	Yes	5%	0%	6.6		6.0
																																2	Construction - Continuous Watch	Yes	10%	0%	6.4		Baseline Level
																																3	Safety Zones	No	20%	0%	6.4		Moderate
																																4	Aids to Navigation	No	10%	0%	6.4		Inherent Risk
																																5	Vessel Traffic Monitoring	Yes	20%	0%	6.2		6.8
																																6	Emergency Response Cooperation Plan	Yes	0%	5%	6.2		Inherent Level
																																7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.8		Moderate
																																8	Cable Burial Risk Assessment	No	10%	0%	5.8		Residual Risk
																																9	Construction - Compliance with International Regulations	No	10%	0%	5.8		5.8
																																10	Under keel clearance Requirements	No	10%	0%	5.8		
																																11	Fishing Liaison Plan	No	10%	0%	5.8		Residual Level
																																12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.8		Minor
																																13	Air Draught Clearance	No	10%	0%	5.8		
																																14	Charting	No	5%	0%	5.8		Risk Reduction
																																15	Lines of Orientation	No	5%	0%	5.8		0.9
																																	Baseline with no additional risk controls				6.4		Baseline Risk
4	13	17	21	Study Area	Commercial v WFSV, Workboats	Collision - Commercial vs WFSV, Workboats	50	2.301	2	2	1	2	500	1.301	5	4	3	4	5.1	20	2.699	2	2	1	2	200	1.699	5	4	3	4	6.4		1	Promulgation of Information	Yes	5%	0%	5.8		5.1
																																2	Construction - Continuous Watch	YEs	10%	0%	5.6		Baseline Level
																																3	Safety Zones	No	20%	0%	5.6		Minor
																																4	Aids to Navigation	No	10%	0%	5.6		Inherent Risk
																																5	Vessel Traffic Monitoring	Yes	20%	0%	5.4		6.4
																																6	Emergency Response Cooperation Plan	Yes	0%	5%	5.4		Inherent Level
																																7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.1		Moderate
																																8	Cable Burial Risk Assessment	No	10%	0%	5.1		Residual Risk
																																9	Construction - Compliance with International Regulations	Yes	10%	0%	4.9		4.8
																																10	Under keel clearance Requirements	No	10%	0%	4.9		
																																11	Fishing Liaison Plan	No	10%	0%	4.9		Residual Level
																																12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	4.8		Negligible
																																13	Air Draught Clearance	No	10%	0%	4.8		
																																14	Charting	No	5%	0%	4.8		Risk Reduction
																																15	Lines of Orientation	No	5%	0%	4.8		1.5

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls							Inherent Risk: Windfarm No Additional Controls							Inherent Risk	Residual Risk: With Additional Controls in Place						Residual Risk	Detailed Results
							Most Likely						Worst Credible							Most Likely						Worst Credible							
							Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Baseline Risk	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Inherent Risk	Risk Control ID	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control	Residual Risk	
5	2	1	1	Study Area	Fishing vs Fishing	Collision - Fishing vs Fishing	20	2.699	2	2	1	2	200	1.699	5	3	3	4	6.2	7.5	3.1249	2	2	1	2	75	2.1249	5	3	3	5	7.7		Baseline with no additional risk controls				7.7	6.5	Baseline Risk
																																1	Promulgation of Information	Yes	5%	0%	7.4		6.2
																																2	Construction - Continuous Watch	Yes	10%	0%	7.3		Baseline Level
																																3	Safety Zones	No	20%	0%	7.3		Moderate
																																4	Aids to Navigation	No	10%	0%	7.3		Inherent Risk
																																5	Vessel Traffic Monitoring	YEs	20%	0%	7.0		7.7
																																6	Emergency Response Cooperation Plan	Yes	0%	5%	7.0		Inherent Level
																																7	Construction - Provision of Guard Vessel	YEs	20%	10%	6.6		Moderate
																																8	Cable Burial Risk Assessment	No	10%	0%	6.6		Residual Risk
																																9	Construction - Compliance with International Regulations	No	10%	0%	6.6		6.5
																																10	Under keel clearance Requirements	No	10%	0%	6.6		
																																11	Fishing Liaison Plan	Yes	10%	0%	6.5		Residual Level
																																12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	6.5		Moderate
																																13	Air Draught Clearance	No	10%	0%	6.5		
																																14	Charting	No	5%	0%	6.5		Risk Reduction
																																15	Lines of Orientation	No	5%	0%	6.5		1.2
6	6	7	3	Study Area	Fishing vs Recreational	Collision - Fishing vs Recreational	25	2.6021	2	2	1	2	250	1.6021	5	3	2	5	5.9	10	3	2	2	1	2	100	2	5	3	2	5	7.2		Baseline with no additional risk controls				7.2	6.0	Baseline Risk
																																1	Promulgation of Information	Yes	5%	0%	6.9		5.9
																																2	Construction - Continuous Watch	Yes	10%	0%	6.8		Baseline Level
																																3	Safety Zones	No	20%	0%	6.8		Minor
																																4	Aids to Navigation	No	10%	0%	6.8		Inherent Risk
																																5	Vessel Traffic Monitoring	Yes	20%	0%	6.5		7.2
																																6	Emergency Response Cooperation Plan	Yes	0%	5%	6.5		Inherent Level
																																7	Construction - Provision of Guard Vessel	Yes	20%	10%	6.1		Moderate
																																8	Cable Burial Risk Assessment	No	10%	0%	6.1		Residual Risk
																																9	Construction - Compliance with International Regulations	No	10%	0%	6.1		6.0
																																10	Under keel clearance Requirements	No	10%	0%	6.1		
																																11	Fishing Liaison Plan	Yes	10%	0%	6.0		Residual Level
																																12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	6.0		Moderate
																																13	Air Draught Clearance	No	10%	0%	6.0		
																																14	Charting	No	5%	0%	6.0		Risk Reduction
																																15	Lines of Orientation	No	5%	0%	6.0		1.2
7	7	6	6	Study Area	Fishing vs WFSV, Workboats	Collision - Fishing vs WFSV, Workboats	50	2.301	2	2	1	3	500	1.301	5	4	3	5	5.9	20	2.699	2	2	1	3	200	1.699	5	4	3	5	7.3		Baseline with no additional risk controls				7.3	5.9	Baseline Risk
																																1	Promulgation of Information	Yes	5%	0%	7.1		5.9
																																2	Construction - Continuous Watch	YEs	10%	0%	7.0		Baseline Level
																																3	Safety Zones	No	20%	0%	7.0		Minor
																																4	Aids to Navigation	No	10%	0%	7.0		Inherent Risk
																																5	Vessel Traffic Monitoring	Yes	20%	0%	6.7		7.3
																																6	Emergency Response Cooperation Plan	Yes	0%	5%	6.7		Inherent Level
																																7	Construction - Provision of Guard Vessel	Yes	20%	10%	6.3		Moderate
																																8	Cable Burial Risk Assessment	No	10%	0%	6.3		Residual Risk
																																9	Construction - Compliance with International Regulations	Yes	10%	0%	6.2		5.9
																																10	Under keel clearance Requirements	No	10%	0%	6.2		
																																11	Fishing Liaison Plan	Yes	10%	0%	6.0		Residual Level
																																12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	5.9		Minor
																																13	Air Draught Clearance	No	10%	0%	5.9		
																																14	Charting	No	5%	0%	5.9		Risk Reduction
																																15	Lines of Orientation	No	5%	0%	5.9		1.4
8	8	8	5	Study Area	Recreational vs Recreational	Collision - Recreational vs Recreational	25	2.6021	2	2	1	2	250	1.6021	4	3	2	4	5.3	7.5	3.1249	2	2	1	2	75	2.1249	4	3	2	4	6.8		Baseline with no additional risk controls				6.8	5.9	Baseline Risk
																																1	Promulgation of Information	Yes	5%	0%	6.6		5.3
																																2	Construction - Continuous Watch	Yes	10%	0%	6.5		Baseline Level
																																3	Safety Zones	No	20%	0%	6.5		Minor
																																4	Aids to Navigation	No	10%	0%	6.5		Inherent Risk
																																5	Vessel Traffic Monitoring	Yes	20%	0%	6.3		6.8
																																6	Emergency Response Cooperation Plan	Yes	0%	5%	6.2		Inherent Level
																																7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.9		Moderate
																																8	Cable Burial Risk Assessment	No	10%	0%	5.9		Residual Risk
																																9	Construction - Compliance with International Regulations	No	10%	0%	5.9		5.9
																																10	Under keel clearance Requirements	No	10%	0%	5.9		
																																11	Fishing Liaison Plan	No	10%	0%	5.9		Residual Level
																																12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.9		Minor
																																13	Air Draught Clearance	No	10%	0%	5.9		
																																14	Charting	No	5%	0%	5.9		Risk Reduction
																																15	Lines of Orientation	No	5%	0%	5.9		0.9

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls													Inherent Risk: Windfarm No Additional Controls													Inherent Risk
							Most Likely						Worst Credible						Baseline Risk	Most Likely						Worst Credible							
							Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business		Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business			
9	11	14	13	Study Area	Recreational vs WFSV, Workboats	Collision - Recreational vs WFSV, Workboats	50	2.301	2	2	1	3	500	1.301	4	3	2	4	5.2	20	2.699	2	2	1	3	200	1.699	4	3	2	4	6.5	
10	14	15	14	Study Area	WFSV, Workboats vs WFSV, Workboats	Collision - WFSV, Workboats vs WFSV, Workboats	50	2.301	2	2	1	2	500	1.301	4	3	2	4	4.5	10	3	2	2	1	2	100	2	4	3	2	4	6.4	
11	19	16	20	Study Area	Commercial	Contact with Partially built OWF - Commercial														40	2.3979	2	2	2	3	400	1.3979	4	5	3	5	6.4	
12	19	3	3	Study Area	Fishing	Contact with Partially built OWF - Fishing														5	3.301	2	2	1	2	50	2.301	4	4	2	4	7.4	

Residual Risk: With Additional Controls in Place						Residual Risk
Risk Control ID	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control	
	Baseline with no additional risk controls				6.5	5.3
1	Promulgation of Information	Yes	5%	0%	6.3	
2	Construction - Continuous Watch	Yes	10%	0%	6.2	
3	Safety Zones	No	20%	0%	6.2	
4	Aids to Navigation	No	10%	0%	6.2	
5	Vessel Traffic Monitoring	Yes	20%	0%	5.9	
6	Emergency Response Cooperation Plan	Yes	0%	5%	5.9	
7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.6	
8	Cable Burial Risk Assessment	No	10%	0%	5.6	
9	Construction - Compliance with International Regulations	Yes	10%	0%	5.4	
10	Under keel clearance Requirements	No	10%	0%	5.4	
11	Fishing Liaison Plan	No	10%	0%	5.4	
12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	5.3	
13	Air Draught Clearance	No	10%	0%	5.3	
14	Charting	No	5%	0%	5.3	
15	Lines of Orientation	No	5%	0%	5.3	
	Baseline with no additional risk controls				6.4	5.3
1	Promulgation of Information	Yes	5%	0%	6.3	
2	Construction - Continuous Watch	Yes	10%	0%	6.1	
3	Safety Zones	No	20%	0%	6.1	
4	Aids to Navigation	Yes	10%	0%	6.0	
5	Vessel Traffic Monitoring	Yes	20%	0%	5.8	
6	Emergency Response Cooperation Plan	Yes	0%	5%	5.8	
7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.5	
8	Cable Burial Risk Assessment	No	10%	0%	5.5	
9	Construction - Compliance with International Regulations	Yes	10%	0%	5.4	
10	Under keel clearance Requirements	No	10%	0%	5.4	
11	Fishing Liaison Plan	No	10%	0%	5.4	
12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	5.3	
13	Air Draught Clearance	No	10%	0%	5.3	
14	Charting	No	5%	0%	5.3	
15	Lines of Orientation	No	5%	0%	5.3	
	Baseline with no additional risk controls				6.4	4.9
1	Promulgation of Information	Yes	5%	0%	6.4	
2	Construction - Continuous Watch	YEs	10%	0%	6.2	
3	Safety Zones	Yes	20%	0%	5.9	
4	Aids to Navigation	Yes	10%	0%	5.8	
5	Vessel Traffic Monitoring	Yes	20%	0%	5.5	
6	Emergency Response Cooperation Plan	Yes	0%	5%	5.5	
7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.1	
8	Cable Burial Risk Assessment	No	10%	0%	5.1	
9	Construction - Compliance with International Regulations	No	10%	0%	5.1	
10	Under keel clearance Requirements	No	10%	0%	5.1	
11	Fishing Liaison Plan	No	10%	0%	5.1	
12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.1	
13	Air Draught Clearance	Yes	10%	0%	5.0	
14	Charting	Yes	5%	0%	4.9	
15	Lines of Orientation	No	5%	0%	4.9	
	Baseline with no additional risk controls				7.4	6.0
1	Promulgation of Information	Yes	5%	0%	7.4	
2	Construction - Continuous Watch	YEs	10%	0%	7.2	
3	Safety Zones	Yes	20%	0%	7.0	
4	Aids to Navigation	Yes	10%	0%	6.9	
5	Vessel Traffic Monitoring	Yes	20%	0%	6.7	
6	Emergency Response Cooperation Plan	Yes	0%	5%	6.6	
7	Construction - Provision of Guard Vessel	Yes	20%	10%	6.3	
8	Cable Burial Risk Assessment	No	10%	0%	6.3	
9	Construction - Compliance with International Regulations	No	10%	0%	6.3	
10	Under keel clearance Requirements	No	10%	0%	6.3	
11	Fishing Liaison Plan	Yes	10%	0%	6.2	
12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	6.2	
13	Air Draught Clearance	Yes	10%	0%	6.1	
14	Charting	Yes	5%	0%	6.0	
15	Lines of Orientation	No	5%	0%	6.0	

Detailed Results
Baseline Risk
5.2
Baseline Level
Minor
Inherent Risk
6.5
Inherent Level
Moderate
Residual Risk
5.3
Residual Level
Minor
Risk Reduction
1.1
Baseline Risk
4.5
Baseline Level
Negligible
Inherent Risk
6.4
Inherent Level
Moderate
Residual Risk
5.3
Residual Level
Minor
Risk Reduction
1.2
Baseline Risk
0.0
Baseline Level
Negligible
Inherent Risk
6.4
Inherent Level
Moderate
Residual Risk
4.9
Residual Level
Negligible
Risk Reduction
1.5
Baseline Risk
0.0
Baseline Level
Negligible
Inherent Risk
7.4
Inherent Level
Moderate
Residual Risk
6.0
Residual Level
Moderate
Risk Reduction
1.4

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls													Inherent Risk: Windfarm No Additional Controls												Inherent Risk
							Most Likely						Worst Credible						Baseline Risk	Most Likely						Worst Credible						
							Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business		Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business		
13	19	8	12	Study Area	Recreational	Contact with Partially built OWF - Recreational														7.5	3.1249	2	2	1	2	75	2.1249	4	3	2	4	6.8
14	19	19	19	Study Area	WFSV, Workboats	Contact with Partially built OWF - WFSV, Workboats														5	3.301	1	1	1	2	100	2	4	3	2	4	6.3
15	12	23	22	Study Area	Commercial	Grounding at Dunany Point - Commercial	100	2	2	3	2	3	1000	1	4	5	4	5	5.1	75	2.1249	2	3	2	3	750	1.1249	4	5	4	5	5.6
16	16	26	28	Study Area	Fishing	Grounding at Dunany Point - Fishing	100	2	2	2	1	2	1000	1	4	4	3	5	4.1	75	2.1249	2	2	1	2	750	1.1249	4	4	3	5	4.5

Residual Risk: With Additional Controls in Place							
Risk Control ID	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control	Residual Risk	Detailed Results
	Baseline with no additional risk controls				6.8	5.4	Baseline Risk
1	Promulgation of Information	Yes	5%	0%	6.6		0.0
2	Construction - Continuous Watch	YEs	10%	0%	6.5		Baseline Level
3	Safety Zones	Yes	20%	0%	6.3		Negligible
4	Aids to Navigation	Yes	10%	0%	6.2		Inherent Risk
5	Vessel Traffic Monitoring	Yes	20%	0%	5.9		6.8
6	Emergency Response Cooperation Plan	Yes	0%	5%	5.9		Inherent Level
7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.6		Moderate
8	Cable Burial Risk Assessment	No	10%	0%	5.6		Residual Risk
9	Construction - Compliance with International Regulations	No	10%	0%	5.6		5.4
10	Under keel clearance Requirements	No	10%	0%	5.6		
11	Fishing Liaison Plan	No	10%	0%	5.6		Residual Level
12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.6		Minor
13	Air Draught Clearance	Yes	10%	0%	5.5		
14	Charting	Yes	5%	0%	5.4		Risk Reduction
15	Lines of Orientation	No	5%	0%	5.4		1.4
	Baseline with no additional risk controls				6.3	4.9	Baseline Risk
1	Promulgation of Information	Yes	5%	0%	6.1		0.0
2	Construction - Continuous Watch	YEs	10%	0%	6.0		Baseline Level
3	Safety Zones	Yes	20%	0%	5.8		Negligible
4	Aids to Navigation	Yes	10%	0%	5.7		Inherent Risk
5	Vessel Traffic Monitoring	Yes	20%	0%	5.5		6.3
6	Emergency Response Cooperation Plan	Yes	0%	5%	5.5		Inherent Level
7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.2		Moderate
8	Cable Burial Risk Assessment	No	10%	0%	5.2		Residual Risk
9	Construction - Compliance with International Regulations	No	10%	0%	5.2		4.9
10	Under keel clearance Requirements	No	10%	0%	5.2		
11	Fishing Liaison Plan	No	10%	0%	5.2		Residual Level
12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	5.1		Negligible
13	Air Draught Clearance	Yes	10%	0%	5.0		
14	Charting	Yes	5%	0%	4.9		Risk Reduction
15	Lines of Orientation	No	5%	0%	4.9		1.4
	Baseline with no additional risk controls				5.6	4.8	Baseline Risk
1	Promulgation of Information	Yes	5%	0%	5.6		5.1
2	Construction - Continuous Watch	Yes	10%	0%	5.4		Baseline Level
3	Safety Zones	No	20%	0%	5.4		Minor
4	Aids to Navigation	Yes	10%	0%	5.3		Inherent Risk
5	Vessel Traffic Monitoring	YEs	20%	0%	5.1		5.6
6	Emergency Response Cooperation Plan	Yes	0%	5%	5.1		Inherent Level
7	Construction - Provision of Guard Vessel	Yes	20%	10%	4.9		Minor
8	Cable Burial Risk Assessment	Yes	10%	0%	4.8		Residual Risk
9	Construction - Compliance with International Regulations	No	10%	0%	4.8		4.8
10	Under keel clearance Requirements	Yes	10%	0%	4.8		
11	Fishing Liaison Plan	No	10%	0%	4.8		Residual Level
12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	4.8		Negligible
13	Air Draught Clearance	No	10%	0%	4.8		
14	Charting	Yes	5%	0%	4.8		Risk Reduction
15	Lines of Orientation	No	5%	0%	4.8		0.8
	Baseline with no additional risk controls				4.5	3.8	Baseline Risk
1	Promulgation of Information	Yes	5%	0%	4.5		4.1
2	Construction - Continuous Watch	Yes	10%	0%	4.3		Baseline Level
3	Safety Zones	No	20%	0%	4.3		Negligible
4	Aids to Navigation	Yes	10%	0%	4.2		Inherent Risk
5	Vessel Traffic Monitoring	YEs	20%	0%	4.1		4.5
6	Emergency Response Cooperation Plan	Yes	0%	5%	4.0		Inherent Level
7	Construction - Provision of Guard Vessel	Yes	20%	10%	3.9		Negligible
8	Cable Burial Risk Assessment	Yes	10%	0%	3.9		Residual Risk
9	Construction - Compliance with International Regulations	No	10%	0%	3.9		3.8
10	Under keel clearance Requirements	Yes	10%	0%	3.8		
11	Fishing Liaison Plan	Yes	10%	0%	3.8		Residual Level
12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	3.8		Negligible
13	Air Draught Clearance	No	10%	0%	3.8		
14	Charting	Yes	5%	0%	3.8		Risk Reduction
15	Lines of Orientation	No	5%	0%	3.8		0.7

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls							Inherent Risk: Windfarm No Additional Controls							Inherent Risk	Residual Risk: With Additional Controls in Place						Residual Risk
							Most Likely						Worst Credible							Most Likely						Worst Credible												
							Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Baseline Risk	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Inherent Risk	Risk Control ID	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control	
17	17	29	29	Study Area	Recreational	Grounding at Dunany Point - Recreational	100	2	2	2	1	2	1000	1	4	4	2	3	3.7	80	2.0969	2	2	1	2	800	1.0969	4	4	2	3	4.0		Baseline with no additional risk controls				4.0	3.3
																																1	Promulgation of Information	Yes	5%	0%	3.9	
																																2	Construction - Continuous Watch	Yes	10%	0%	3.8	
																																3	Safety Zones	No	20%	0%	3.8	
																																4	Aids to Navigation	Yes	10%	0%	3.7	
																																5	Vessel Traffic Monitoring	YEs	20%	0%	3.6	
																																6	Emergency Response Cooperation Plan	Yes	0%	5%	3.6	
																																7	Construction - Provision of Guard Vessel	Yes	20%	10%	3.4	
																																8	Cable Burial Risk Assessment	Yes	10%	0%	3.4	
																																9	Construction - Compliance with International Regulations	No	10%	0%	3.4	
																																10	Under keel clearance Requirements	Yes	10%	0%	3.4	
																																11	Fishing Liaison Plan	No	10%	0%	3.4	
																																12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	3.4	
																																13	Air Draught Clearance	No	10%	0%	3.4	
																																14	Charting	Yes	5%	0%	3.3	
																																15	Lines of Orientation	No	5%	0%	3.3	
18	17	29	30	Study Area	WFSV, Workboats	Grounding at Dunany Point - WFSV, Workboats	100	2	2	2	1	2	1000	1	4	4	2	3	3.7	80	2.0969	2	2	1	2	800	1.0969	4	4	2	3	4.0		Baseline with no additional risk controls				4.0	3.3
																																1	Promulgation of Information	Yes	5%	0%	3.9	
																																2	Construction - Continuous Watch	Yes	10%	0%	3.8	
																																3	Safety Zones	No	20%	0%	3.8	
																																4	Aids to Navigation	Yes	10%	0%	3.7	
																																5	Vessel Traffic Monitoring	YEs	20%	0%	3.6	
																																6	Emergency Response Cooperation Plan	Yes	0%	5%	3.6	
																																7	Construction - Provision of Guard Vessel	Yes	20%	10%	3.4	
																																8	Cable Burial Risk Assessment	Yes	10%	0%	3.4	
																																9	Construction - Compliance with International Regulations	No	10%	0%	3.4	
																																10	Under keel clearance Requirements	Yes	10%	0%	3.4	
																																11	Fishing Liaison Plan	No	10%	0%	3.4	
																																12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	3.3	
																																13	Air Draught Clearance	No	10%	0%	3.3	
																																14	Charting	Yes	5%	0%	3.3	
																																15	Lines of Orientation	No	5%	0%	3.3	
19	9	22	23	Study Area	Commercial	Snagging OWF infrastructure - Commercial	50	2.301	2	2	1	2	500	1.301	5	5	4	5	5.3	25	2.6021	2	2	1	2	250	1.6021	4	4	4	4	5.6		Baseline with no additional risk controls				5.6	4.7
																																1	Promulgation of Information	Yes	5%	0%	5.6	
																																2	Construction - Continuous Watch	Yes	10%	0%	5.5	
																																3	Safety Zones	No	20%	0%	5.5	
																																4	Aids to Navigation	Yes	10%	0%	5.3	
																																5	Vessel Traffic Monitoring	Yes	20%	0%	5.1	
																																6	Emergency Response Cooperation Plan	Yes	0%	5%	5.1	
																																7	Construction - Provision of Guard Vessel	Yes	20%	10%	4.8	
																																8	Cable Burial Risk Assessment	No	10%	0%	4.8	
																																9	Construction - Compliance with International Regulations	No	10%	0%	4.8	
																																10	Under keel clearance Requirements	No	10%	0%	4.8	
																																11	Fishing Liaison Plan	No	10%	0%	4.8	
																																12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	4.8	
																																13	Air Draught Clearance	No	10%	0%	4.8	
																																14	Charting	Yes	5%	0%	4.7	
																																15	Lines of Orientation	No	5%	0%	4.7	
20	1	4	9	Study Area	Fishing	Snagging OWF infrastructure - Fishing	25	2.6021	2	2	1	2	250	1.6021	5	5	4	5	6.3	10	3	2	2	1	2	100	2	5	4	3	4	7.3		Baseline with no additional risk controls				7.3	5.6
																																1	Promulgation of Information	Yes	5%	0%	6.6	
																																2	Construction - Continuous Watch	Yes	10%	0%	6.5	
																																3	Safety Zones	No	20%	0%	6.5	
																																4	Aids to Navigation	Yes	10%	0%	6.4	
																																5	Vessel Traffic Monitoring	Yes	20%	0%	6.2	
																																6	Emergency Response Cooperation Plan	Yes	0%	5%	6.1	
																																7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.8	
																																8	Cable Burial Risk Assessment	No	10%	0%	5.8	
																																9	Construction - Compliance with International Regulations	No	10%	0%	5.8	
																																10	Under keel clearance Requirements	No	10%	0%	5.8	
																																11	Fishing Liaison Plan	Yes	10%	0%	5.7	
																																12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.7	
																																13	Air Draught Clearance	No	10%	0%	5.7	
																																14	Charting	Yes	5%	0%	5.6	
																																15	Lines of Orientation	No	5%	0%	5.6	

Detailed Results
Baseline Risk
3.7
Baseline Level
Negligible
Inherent Risk
4.0
Inherent Level
Negligible
Residual Risk
3.3
Residual Level
Negligible
Risk Reduction
0.6
Baseline Risk
3.7
Baseline Level
Negligible
Inherent Risk
4.0
Inherent Level
Negligible
Residual Risk
3.3
Residual Level
Negligible
Risk Reduction
0.6
Baseline Risk
5.3
Baseline Level
Minor
Inherent Risk
5.6
Inherent Level
Minor
Residual Risk
4.7
Residual Level
Negligible
Risk Reduction
0.9
Baseline Risk
6.3
Baseline Level
Moderate
Inherent Risk
7.3
Inherent Level
Moderate
Residual Risk
5.6
Residual Level
Minor
Risk Reduction
1.7

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls													Inherent Risk: Windfarm No Additional Controls												Inherent Risk	Residual Risk: With Additional Controls in Place					Residual Risk	Detailed Results
							Most Likely						Worst Credible						Baseline Risk	Most Likely						Worst Credible												
							Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business		Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business			Risk Control ID	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control		
21	3	21	16	Study Area	Recreational	Snagging OWF infrastructure - Recreational	25	2.6021	2	2	1	2	250	1.6021	4	4	4	5	6.1	15	2.8239	2	2	1	2	150	1.8239	4	4	2	4	6.1			Baseline with no additional risk controls				6.1	5.1	Baseline Risk
																																	1	Promulgation of Information	Yes	5%	0%	6.0		6.1
																																	2	Construction - Continuous Watch	Yes	10%	0%	5.9		Baseline Level
																																	3	Safety Zones	No	20%	0%	5.9		Moderate
																																	4	Aids to Navigation	Yes	10%	0%	5.8		Inherent Risk
																																	5	Vessel Traffic Monitoring	Yes	20%	0%	5.6		6.1
																																	6	Emergency Response Cooperation Plan	Yes	0%	5%	5.5		Inherent Level
																																	7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.2		Moderate
																																	8	Cable Burial Risk Assessment	No	10%	0%	5.2		Residual Risk
																																	9	Construction - Compliance with International Regulations	No	10%	0%	5.2		5.1
																																	10	Under keel clearance Requirements	No	10%	0%	5.2		Residual Level
																																	11	Fishing Liaison Plan	No	10%	0%	5.2		Minor
																																	12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.2		
																																	13	Air Draught Clearance	No	10%	0%	5.2		Risk Reduction
																																	14	Charting	Yes	5%	0%	5.1		0.9
																																	15	Lines of Orientation	No	5%	0%	5.1		
22	3	24	24	Study Area	WFSV, Workboats	Snagging OWF infrastructure - WFSV, Workboats	25	2.6021	2	2	1	2	250	1.6021	4	4	4	5	6.1	25	2.6021	2	2	1	2	250	1.6021	4	4	3	4	5.5			Baseline with no additional risk controls				5.5	4.5	Baseline Risk
																																	1	Promulgation of Information	Yes	5%	0%	5.5		6.1
																																	2	Construction - Continuous Watch	Yes	10%	0%	5.4		Baseline Level
																																	3	Safety Zones	No	20%	0%	5.4		Moderate
																																	4	Aids to Navigation	Yes	10%	0%	5.2		Inherent Risk
																																	5	Vessel Traffic Monitoring	Yes	20%	0%	5.0		5.5
																																	6	Emergency Response Cooperation Plan	Yes	0%	5%	5.0		Inherent Level
																																	7	Construction - Provision of Guard Vessel	Yes	20%	10%	4.7		Minor
																																	8	Cable Burial Risk Assessment	No	10%	0%	4.7		Residual Risk
																																	9	Construction - Compliance with International Regulations	No	10%	0%	4.7		4.5
																																	10	Under keel clearance Requirements	No	10%	0%	4.7		Residual Level
																																	11	Fishing Liaison Plan	No	10%	0%	4.7		Negligible
																																	12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	4.6		
																																	13	Air Draught Clearance	No	10%	0%	4.6		Risk Reduction
																																	14	Charting	Yes	5%	0%	4.5		1.0
																																	15	Lines of Orientation	No	5%	0%	4.5		
23	19	27	26	Study Area	Construction vs Construction	Collision - Construction vs Construction														100	2	2	2	1	2	1000	1	5	5	4	5	4.3			Baseline with no additional risk controls				4.3	3.9	Baseline Risk
																																	1	Promulgation of Information	Yes	5%	0%	4.3		0.0
																																	2	Construction - Continuous Watch	Yes	10%	0%	4.3		Baseline Level
																																	3	Safety Zones	No	20%	0%	4.3		Negligible
																																	4	Aids to Navigation	No	10%	0%	4.3		Inherent Risk
																																	5	Vessel Traffic Monitoring	Yes	20%	0%	4.2		4.3
																																	6	Emergency Response Cooperation Plan	Yes	0%	5%	4.2		Inherent Level
																																	7	Construction - Provision of Guard Vessel	Yes	20%	10%	4.0		Negligible
																																	8	Cable Burial Risk Assessment	No	10%	0%	4.0		Residual Risk
																																	9	Construction - Compliance with International Regulations	Yes	10%	0%	4.0		3.9
																																	10	Under keel clearance Requirements	No	10%	0%	4.0		Residual Level
																																	11	Fishing Liaison Plan	No	10%	0%	4.0		Negligible
																																	12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	3.9		
																																	13	Air Draught Clearance	No	10%	0%	3.9		Risk Reduction
																																	14	Charting	No	5%	0%	3.9		0.4
																																	15	Lines of Orientation	No	5%	0%	3.9		
24	19	27	26	Study Area	Construction vs Commercial	Collision - Construction vs Commercial														100	2	2	2	1	2	1000	1	5	5	4	5	4.3			Baseline with no additional risk controls				4.3	3.9	Baseline Risk
																																	1	Promulgation of Information	Yes	5%	0%	4.3		0.0
																																	2	Construction - Continuous Watch	Yes	10%	0%	4.3		Baseline Level
																																	3	Safety Zones	No	20%	0%	4.3		Negligible
																																	4	Aids to Navigation	No	10%	0%	4.3		Inherent Risk
																																	5	Vessel Traffic Monitoring	Yes	20%	0%	4.2		4.3
																																	6	Emergency Response Cooperation Plan	Yes	0%	5%	4.2		Inherent Level
																																	7	Construction - Provision of Guard Vessel	Yes	20%	10%	4.0		Negligible
																																	8	Cable Burial Risk Assessment	No	10%	0%	4.0		Residual Risk
																																	9	Construction - Compliance with International Regulations	Yes	10%	0%	4.0		3.9
																																	10	Under keel clearance Requirements	No	10%	0%	4.0		Residual Level
																																	11	Fishing Liaison Plan	No	10%	0%	4.0		Negligible
																																	12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	3.9		
																																	13	Air Draught Clearance	No	10%	0%	3.9		Risk Reduction
																																	14	Charting	No	5%	0%	3.9		0.4
																																	15	Lines of Orientation	No	5%	0%	3.9		

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls													Inherent Risk: Windfarm No Additional Controls											Inherent Risk
							Most Likely						Worst Credible						Baseline Risk	Most Likely						Worst Credible					
							Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business		Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	
25	19	2	2	Study Area	Construction vs Fishing	Collision - Construction vs Fishing														10	3	2	2	1	2	100	2	5	5	3	5	7.6
26	19	10	11	Study Area	Construction vs Recreational	Collision - Construction vs Recreational														15	2.8239	2	2	1	2	150	1.8239	5	4	2	5	6.8
27	19	10	15	Study Area	Construction vs WFSV, Workboats	Collision - Construction vs WFSV, Workboats														15	2.8239	2	2	1	2	150	1.8239	5	4	3	4	6.8
28	19	4	8	Study Area	Construction	Contact with Partially built OWF - Construction														10	3	2	2	1	2	100	2	5	3	3	5	7.3

Residual Risk: With Additional Controls in Place						Residual Risk
Risk Control ID	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control	
	Baseline with no additional risk controls				7.6	6.3
1	Promulgation of Information	Yes	5%	0%	7.5	
2	Construction - Continuous Watch	Yes	10%	0%	7.4	
3	Safety Zones	No	20%	0%	7.4	
4	Aids to Navigation	No	10%	0%	7.4	
5	Vessel Traffic Monitoring	Yes	20%	0%	7.1	
6	Emergency Response Cooperation Plan	Yes	0%	5%	7.0	
7	Construction - Provision of Guard Vessel	Yes	20%	10%	6.7	
8	Cable Burial Risk Assessment	No	10%	0%	6.7	
9	Construction - Compliance with International Regulations	Yes	10%	0%	6.6	
10	Under keel clearance Requirements	No	10%	0%	6.6	
11	Fishing Liaison Plan	Yes	10%	0%	6.4	
12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	6.3	
13	Air Draught Clearance	No	10%	0%	6.3	
14	Charting	No	5%	0%	6.3	
15	Lines of Orientation	No	5%	0%	6.3	
	Baseline with no additional risk controls				6.8	5.6
1	Promulgation of Information	Yes	5%	0%	6.6	
2	Construction - Continuous Watch	Yes	10%	0%	6.4	
3	Safety Zones	No	20%	0%	6.4	
4	Aids to Navigation	No	10%	0%	6.4	
5	Vessel Traffic Monitoring	Yes	20%	0%	6.2	
6	Emergency Response Cooperation Plan	Yes	0%	5%	6.2	
7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.8	
8	Cable Burial Risk Assessment	No	10%	0%	5.8	
9	Construction - Compliance with International Regulations	Yes	10%	0%	5.7	
10	Under keel clearance Requirements	No	10%	0%	5.7	
11	Fishing Liaison Plan	No	10%	0%	5.7	
12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	5.6	
13	Air Draught Clearance	No	10%	0%	5.6	
14	Charting	No	5%	0%	5.6	
15	Lines of Orientation	No	5%	0%	5.6	
	Baseline with no additional risk controls				6.8	5.2
1	Promulgation of Information	Yes	5%	0%	6.1	
2	Construction - Continuous Watch	Yes	10%	0%	6.0	
3	Safety Zones	No	20%	0%	6.0	
4	Aids to Navigation	No	10%	0%	6.0	
5	Vessel Traffic Monitoring	Yes	20%	0%	5.8	
6	Emergency Response Cooperation Plan	Yes	0%	5%	5.7	
7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.4	
8	Cable Burial Risk Assessment	No	10%	0%	5.4	
9	Construction - Compliance with International Regulations	Yes	10%	0%	5.3	
10	Under keel clearance Requirements	No	10%	0%	5.3	
11	Fishing Liaison Plan	No	10%	0%	5.3	
12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	5.2	
13	Air Draught Clearance	No	10%	0%	5.2	
14	Charting	No	5%	0%	5.2	
15	Lines of Orientation	No	5%	0%	5.2	
	Baseline with no additional risk controls				7.3	5.8
1	Promulgation of Information	Yes	5%	0%	7.0	
2	Construction - Continuous Watch	Yes	10%	0%	6.9	
3	Safety Zones	Yes	20%	0%	6.6	
4	Aids to Navigation	Yes	10%	0%	6.5	
5	Vessel Traffic Monitoring	No	20%	0%	6.5	
6	Emergency Response Cooperation Plan	Yes	0%	5%	6.5	
7	Construction - Provision of Guard Vessel	Yes	20%	10%	6.1	
8	Cable Burial Risk Assessment	No	10%	0%	6.1	
9	Construction - Compliance with International Regulations	Yes	10%	0%	6.0	
10	Under keel clearance Requirements	No	10%	0%	6.0	
11	Fishing Liaison Plan	No	10%	0%	6.0	
12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	5.9	
13	Air Draught Clearance	No	10%	0%	5.9	
14	Charting	Yes	5%	0%	5.8	
15	Lines of Orientation	No	5%	0%	5.8	

Detailed Results
Baseline Risk
0.0
Baseline Level
Negligible
Inherent Risk
7.6
Inherent Level
Moderate
Residual Risk
6.3
Residual Level
Moderate
Risk Reduction
1.3
Baseline Risk
0.0
Baseline Level
Negligible
Inherent Risk
6.8
Inherent Level
Moderate
Residual Risk
5.6
Residual Level
Minor
Risk Reduction
1.2
Baseline Risk
0.0
Baseline Level
Negligible
Inherent Risk
6.8
Inherent Level
Moderate
Residual Risk
5.2
Residual Level
Minor
Risk Reduction
1.6
Baseline Risk
0.0
Baseline Level
Negligible
Inherent Risk
7.3
Inherent Level
Moderate
Residual Risk
5.8
Residual Level
Minor
Risk Reduction
1.5

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls													Inherent Risk: Windfarm No Additional Controls												Inherent Risk
							Most Likely						Worst Credible						Baseline Risk	Most Likely						Worst Credible						
							Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business		Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business		
29	19	20	18	Study Area	Construction	Grounding at Dunany Point - Construction														50	2.301	2	3	2	3	500	1.301	4	5	4	5	6.3
30	19	18	17	Study Area	Construction	Snagging OWF infrastructure - Construction														25	2.6021	2	2	1	2	250	1.6021	5	5	4	5	6.3

Hazard ID	Residual Risk: With Additional Controls in Place					Residual Risk
	Risk Control ID	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control	
29		Baseline with no additional risk controls				6.3	4.9
	1	Promulgation of Information	Yes	5%	0%	6.3	
	2	Construction - Continuous Watch	Yes	10%	0%	6.1	
	3	Safety Zones	No	20%	0%	6.1	
	4	Aids to Navigation	Yes	10%	0%	5.9	
	5	Vessel Traffic Monitoring	Yes	20%	0%	5.6	
	6	Emergency Response Cooperation Plan	Yes	0%	5%	5.6	
	7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.2	
	8	Cable Burial Risk Assessment	Yes	10%	0%	5.1	
	9	Construction - Compliance with International Regulations	No	10%	0%	5.1	
	10	Under keel clearance Requirements	Yes	10%	0%	5.0	
	11	Fishing Liaison Plan	No	10%	0%	5.0	
	12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	5.0	
	13	Air Draught Clearance	No	10%	0%	5.0	
	14	Charting	Yes	5%	0%	4.9	
	15	Lines of Orientation	No	5%	0%	4.9	
30		Baseline with no additional risk controls				6.3	5.0
	1	Promulgation of Information	Yes	5%	0%	6.3	
	2	Construction - Continuous Watch	Yes	10%	0%	6.1	
	3	Safety Zones	No	20%	0%	6.1	
	4	Aids to Navigation	Yes	10%	0%	6.0	
	5	Vessel Traffic Monitoring	Yes	20%	0%	5.7	
	6	Emergency Response Cooperation Plan	Yes	0%	5%	5.7	
	7	Construction - Provision of Guard Vessel	Yes	20%	10%	5.3	
	8	Cable Burial Risk Assessment	No	10%	0%	5.3	
	9	Construction - Compliance with International Regulations	Yes	10%	0%	5.2	
	10	Under keel clearance Requirements	Yes	10%	0%	5.1	
	11	Fishing Liaison Plan	No	10%	0%	5.1	
	12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.1	
	13	Air Draught Clearance	No	10%	0%	5.1	
	14	Charting	Yes	5%	0%	5.0	
	15	Lines of Orientation	No	5%	0%	5.0	

Detailed Results
Baseline Risk
0.0
Baseline Level
Negligible
Inherent Risk
6.3
Inherent Level
Moderate
Residual Risk
4.9
Residual Level
Negligible
Risk Reduction
1.3

Project:	Oriel Offshore Wind Farm		Nash Maritime	Revision:	Rev 01-00

Baseline Risk: No Windfarm with existing controls

Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Most Likely: Likelihood 1 in X yr	Most Likely: Likelihood Score	Most Likely: Consequence People	Most Likely: Consequence Property	Most Likely: Consequence Environment	Most Likely: Consequence Business	Worst Credible: Likelihood 1 in X yr	Worst Credible: Likelihood Score	Worst Credible: Consequence People	Worst Credible: Consequence Property	Worst Credible: Consequence Environment	Worst Credible: Consequence Business	Baseline Risk
1	18	22	22	Study Area	Commercial vs Commercial	Collision - Commercial vs Commercial	100	2	2	2	1	2	1000	1	5	5	4	5	**4.3**
2	12	11	8	Study Area	Commercial vs Fishing	Collision - Commercial vs Fishing	50	2.301	2	2	1	2	500	1.301	5	5	3	5	**5.2**
3	5	9	6	Study Area	Commercial vs Recreational	Collision - Commercial vs Recreational	25	2.6021	2	2	1	2	250	1.6021	5	4	2	5	**6.0**

Inherent Risk: Windfarm No Additional Controls

Hazard ID	Most Likely: Likelihood 1 in X yr	Most Likely: Consequence People	Most Likely: Consequence Property	Most Likely: Consequence Environment	Most Likely: Consequence Business	Worst Credible: Likelihood 1 in X yr	Worst Credible: Consequence People	Worst Credible: Consequence Property	Worst Credible: Consequence Environment	Worst Credible: Consequence Business	Inherent Risk	Residual Risk
1	75	2	2	1	2	750	5	5	4	5	**4.7**	**4.5**
2	25	2	2	1	2	250	5	5	3	5	**6.2**	**5.9**
3	20	2	2	1	2	200	5	4	2	5	**6.4**	**6.0**

Residual Risk: With Additional Controls in Place

Hazard ID 1

Risk Control ID.	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control
	Baseline with no additional risk controls				4.7
1	Promulgation of Information	Yes	5%	0%	4.7
2	Construction - Continuous Watch	No	10%	0%	4.7
3	Safety Zones	No	20%	0%	4.7
4	Aids to Navigation	No	10%	0%	4.7
5	Vessel Traffic Monitoring	No	20%	0%	4.7
6	Emergency Response Cooperation Plan	Yes	0%	5%	4.6
7	Construction - Provision of Guard Vessel	No	20%	10%	4.6
8	Cable Burial Risk Assessment	No	10%	0%	4.6
9	Construction - Compliance with International Regulations	No	10%	0%	4.6
10	Under keel clearance Requirements	No	10%	0%	4.6
11	Fishing Liaison Plan	No	10%	0%	4.6
12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	4.6
13	Air Draught Clearance	No	10%	0%	4.6
14	Charting	Yes	5%	0%	4.6
15	Lines of Orientation	Yes	5%	0%	4.5

Detailed Results

Baseline Risk	Baseline Level	Inherent Risk	Inherent Level	Residual Risk	Residual Level	Risk Reduction
4.3	Negligible	4.7	Negligible	4.5	Negligible	0.2

Hazard ID 2

Risk Control ID.	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control
	Baseline with no additional risk controls				6.2
1	Promulgation of Information	Yes	5%	0%	6.2
2	Construction - Continuous Watch	No	10%	0%	6.2
3	Safety Zones	No	20%	0%	6.2
4	Aids to Navigation	No	10%	0%	6.2
5	Vessel Traffic Monitoring	No	20%	0%	6.2
6	Emergency Response Cooperation Plan	Yes	0%	5%	6.1
7	Construction - Provision of Guard Vessel	No	20%	10%	6.1
8	Cable Burial Risk Assessment	No	10%	0%	6.1
9	Construction - Compliance with International Regulations	No	10%	0%	6.1
10	Under keel clearance Requirements	No	10%	0%	6.1
11	Fishing Liaison Plan	Yes	10%	0%	6.0
12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	6.0
13	Air Draught Clearance	No	10%	0%	6.0
14	Charting	Yes	5%	0%	5.9
15	Lines of Orientation	Yes	5%	0%	5.9

Detailed Results

Baseline Risk	Baseline Level	Inherent Risk	Inherent Level	Residual Risk	Residual Level	Risk Reduction
5.2	Minor	6.2	Minor	5.9	Minor	0.4

Hazard ID 3

Risk Control ID.	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control
	Baseline with no additional risk controls				6.4
1	Promulgation of Information	Yes	5%	0%	6.2
2	Construction - Continuous Watch	No	10%	0%	6.2
3	Safety Zones	No	20%	0%	6.2
4	Aids to Navigation	No	10%	0%	6.2
5	Vessel Traffic Monitoring	No	20%	0%	6.2
6	Emergency Response Cooperation Plan	Yes	0%	5%	6.1
7	Construction - Provision of Guard Vessel	No	20%	10%	6.1
8	Cable Burial Risk Assessment	No	10%	0%	6.1
9	Construction - Compliance with International Regulations	No	10%	0%	6.1
10	Under keel clearance Requirements	No	10%	0%	6.1
11	Fishing Liaison Plan	No	10%	0%	6.1
12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	6.1
13	Air Draught Clearance	No	10%	0%	6.1
14	Charting	Yes	5%	0%	6.1
15	Lines of Orientation	Yes	5%	0%	6.0

Detailed Results

Baseline Risk	Baseline Level	Inherent Risk	Inherent Level	Residual Risk	Residual Level	Risk Reduction
6.0	Minor	6.4	Minor	6.0	Minor	0.3

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls												Inherent Risk: Windfarm No Additional Controls										Inherent Risk	Residual Risk: With Additional Controls in Place						Residual Risk	Detailed Results
							Most Likely						Worst Credible						Baseline Risk	Most Likely					Worst Credible													
							Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business		Likelihood 1 in X yr	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Consequence People	Consequence Property	Consequence Environment	Consequence Business			Risk Control ID.	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control		
4	15	15	20	Study Area	Commercial vs WFSV, Workboats	Collision - Commercial vs WFSV, Workboats	50	2.301	2	2	1	2	500	1.301	5	4	3	4	**5.1**	25	2	2	1	2	250	5	4	3	4	**6.0**		Baseline with no additional risk controls				6.0	**5.1**	Baseline Risk
																														1	Promulgation of Information	Yes	5%	0%	5.5		5.1
																														2	Construction - Continuous Watch	No	10%	0%	5.5		Baseline Level
																														3	Safety Zones	No	20%	0%	5.5		Minor
																														4	Aids to Navigation	No	10%	0%	5.5		Inherent Risk
																														5	Vessel Traffic Monitoring	No	20%	0%	5.5		6.0
																														6	Emergency Response Cooperation Plan	Yes	0%	5%	5.4		Inherent Level
																														7	Construction - Provision of Guard Vessel	No	20%	10%	5.4		Minor
																														8	Cable Burial Risk Assessment	No	10%	0%	5.4		Residual Risk
																														9	Construction - Compliance with International Regulations	Yes	10%	0%	5.3		5.1
																														10	Under keel clearance Requirements	No	10%	0%	5.3		Residual Level
																														11	Fishing Liaison Plan	No	10%	0%	5.3		Minor
																														12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	5.2		Risk Reduction
																														13	Air Draught Clearance	No	10%	0%	5.2		1.0
																														14	Charting	Yes	5%	0%	5.1		
																														15	Lines of Orientation	Yes	5%	0%	5.1		
5	2	1	1	Study Area	Fishing vs Fishing	Collision - Fishing vs Fishing	20	2.699	2	2	1	2	200	1.699	5	3	3	4	**6.2**	10	2	2	1	2	100	5	3	3	5	**7.3**		Baseline with no additional risk controls				7.3	**6.7**	Baseline Risk
																														1	Promulgation of Information	Yes	5%	0%	7.0		6.2
																														2	Construction - Continuous Watch	No	10%	0%	7.0		Baseline Level
																														3	Safety Zones	No	20%	0%	7.0		Minor
																														4	Aids to Navigation	No	10%	0%	7.0		Inherent Risk
																														5	Vessel Traffic Monitoring	No	20%	0%	7.0		7.3
																														6	Emergency Response Cooperation Plan	Yes	0%	5%	6.9		Inherent Level
																														7	Construction - Provision of Guard Vessel	No	20%	10%	6.9		Moderate
																														8	Cable Burial Risk Assessment	No	10%	0%	6.9		Residual Risk
																														9	Construction - Compliance with International Regulations	No	10%	0%	6.9		6.7
																														10	Under keel clearance Requirements	No	10%	0%	6.9		Residual Level
																														11	Fishing Liaison Plan	Yes	10%	0%	6.8		Minor
																														12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	6.8		Risk Reduction
																														13	Air Draught Clearance	No	10%	0%	6.8		0.6
																														14	Charting	Yes	5%	0%	6.8		
																														15	Lines of Orientation	Yes	5%	0%	6.7		
6	6	5	2	Study Area	Fishing vs Recreational	Collision - Fishing vs Recreational	25	2.6021	2	2	1	2	250	1.6021	5	3	2	5	**5.9**	15	2	2	1	2	150	5	3	2	5	**6.6**		Baseline with no additional risk controls				6.6	**6.2**	Baseline Risk
																														1	Promulgation of Information	Yes	5%	0%	6.3		5.9
																														2	Construction - Continuous Watch	No	10%	0%	6.3		Baseline Level
																														3	Safety Zones	No	20%	0%	6.3		Minor
																														4	Aids to Navigation	No	10%	0%	6.3		Inherent Risk
																														5	Vessel Traffic Monitoring	No	20%	0%	6.3		6.6
																														6	Emergency Response Cooperation Plan	Yes	0%	5%	6.3		Inherent Level
																														7	Construction - Provision of Guard Vessel	No	20%	10%	6.3		Minor
																														8	Cable Burial Risk Assessment	No	10%	0%	6.3		Residual Risk
																														9	Construction - Compliance with International Regulations	No	10%	0%	6.3		6.2
																														10	Under keel clearance Requirements	No	10%	0%	6.3		Residual Level
																														11	Fishing Liaison Plan	No	10%	0%	6.3		Minor
																														12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	6.3		Risk Reduction
																														13	Air Draught Clearance	No	10%	0%	6.3		0.5
																														14	Charting	Yes	5%	0%	6.2		
																														15	Lines of Orientation	Yes	5%	0%	6.2		

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls												Inherent Risk: Windfarm No Additional Controls										Inherent Risk	Residual Risk: With Additional Controls in Place						Residual Risk
							Most Likely						Worst Credible						Baseline Risk	Most Likely					Worst Credible												
							Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business		Likelihood 1 in X yr	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Consequence People	Consequence Property	Consequence Environment	Consequence Business			Risk Control ID.	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control	
7	7	3	3	Study Area	Fishing vs WFSV, Workboats	Collision - Fishing vs WFSV, Workboats	50	2.301	2	2	1	3	500	1.301	5	4	3	5	**5.9**	25	2	2	1	3	250	5	4	3	5	**7.0**			Baseline with no additional risk controls				7.0	**6.2**
																														1	Promulgation of Information	Yes	5%	0%	6.8	
																														2	Construction - Continuous Watch	No	10%	0%	6.8	
																														3	Safety Zones	No	20%	0%	6.8	
																														4	Aids to Navigation	No	10%	0%	6.8	
																														5	Vessel Traffic Monitoring	No	20%	0%	6.8	
																														6	Emergency Response Cooperation Plan	Yes	0%	5%	6.7	
																														7	Construction - Provision of Guard Vessel	No	20%	10%	6.7	
																														8	Cable Burial Risk Assessment	No	10%	0%	6.7	
																														9	Construction - Compliance with International Regulations	Yes	10%	0%	6.6	
																														10	Under keel clearance Requirements	No	10%	0%	6.6	
																														11	Fishing Liaison Plan	Yes	10%	0%	6.5	
																														12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	6.3	
																														13	Air Draught Clearance	No	10%	0%	6.3	
																														14	Charting	Yes	5%	0%	6.2	
																														15	Lines of Orientation	Yes	5%	0%	6.2	
8	9	7	4	Study Area	Recreational vs Recreational	Collision - Recreational vs Recreational	25	2.6021	2	2	1	2	250	1.6021	4	3	2	4	**5.3**	10	2	2	1	2	100	4	3	2	4	**6.4**			Baseline with no additional risk controls				6.4	**6.1**
																														1	Promulgation of Information	Yes	5%	0%	6.3	
																														2	Construction - Continuous Watch	No	10%	0%	6.3	
																														3	Safety Zones	No	20%	0%	6.3	
																														4	Aids to Navigation	No	10%	0%	6.3	
																														5	Vessel Traffic Monitoring	No	20%	0%	6.3	
																														6	Emergency Response Cooperation Plan	Yes	0%	5%	6.2	
																														7	Construction - Provision of Guard Vessel	No	20%	10%	6.2	
																														8	Cable Burial Risk Assessment	No	10%	0%	6.2	
																														9	Construction - Compliance with International Regulations	No	10%	0%	6.2	
																														10	Under keel clearance Requirements	No	10%	0%	6.2	
																														11	Fishing Liaison Plan	No	10%	0%	6.2	
																														12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	6.2	
																														13	Air Draught Clearance	No	10%	0%	6.2	
																														14	Charting	Yes	5%	0%	6.1	
																														15	Lines of Orientation	Yes	5%	0%	6.1	
9	13	12	15	Study Area	Recreational vs WFSV, Workboats	Collision - Recreational vs WFSV, Workboats	50	2.301	2	2	1	3	500	1.301	4	3	2	4	**5.2**	25	2	2	1	3	250	4	3	2	4	**6.2**			Baseline with no additional risk controls				6.2	**5.5**
																														1	Promulgation of Information	Yes	5%	0%	6.0	
																														2	Construction - Continuous Watch	No	10%	0%	6.0	
																														3	Safety Zones	No	20%	0%	6.0	
																														4	Aids to Navigation	Yes	10%	0%	5.9	
																														5	Vessel Traffic Monitoring	No	20%	0%	5.9	
																														6	Emergency Response Cooperation Plan	Yes	0%	5%	5.8	
																														7	Construction - Provision of Guard Vessel	No	20%	10%	5.8	
																														8	Cable Burial Risk Assessment	No	10%	0%	5.8	
																														9	Construction - Compliance with International Regulations	Yes	10%	0%	5.7	
																														10	Under keel clearance Requirements	No	10%	0%	5.7	
																														11	Fishing Liaison Plan	No	10%	0%	5.7	
																														12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	5.6	
																														13	Air Draught Clearance	No	10%	0%	5.6	
																														14	Charting	Yes	5%	0%	5.5	
																														15	Lines of Orientation	Yes	5%	0%	5.5	

Detailed Results
Baseline Risk
5.9
Baseline Level
Minor
Inherent Risk
7.0
Inherent Level
Minor
Residual Risk
6.2
Residual Level
Minor
Risk Reduction
0.8
Baseline Risk
5.3
Baseline Level
Minor
Inherent Risk
6.4
Inherent Level
Minor
Residual Risk
6.1
Residual Level
Minor
Risk Reduction
0.3
Baseline Risk
5.2
Baseline Level
Minor
Inherent Risk
6.2
Inherent Level
Minor
Residual Risk
5.5
Residual Level
Minor
Risk Reduction
0.7

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls – Most Likely: Likelihood 1 in X yr	Most Likely: Likelihood Score	Most Likely: Consequence People	Most Likely: Consequence Property	Most Likely: Consequence Environment	Most Likely: Consequence Business	Worst Credible: Likelihood 1 in X yr	Worst Credible: Likelihood Score	Worst Credible: Consequence People	Worst Credible: Consequence Property	Worst Credible: Consequence Environment	Worst Credible: Consequence Business	Baseline Risk	Inherent Risk: Windfarm No Additional Controls – Most Likely: Likelihood 1 in X yr	Most Likely: Consequence People	Most Likely: Consequence Property	Most Likely: Consequence Environment	Most Likely: Consequence Business	Worst Credible: Likelihood 1 in X yr	Worst Credible: Consequence People	Worst Credible: Consequence Property	Worst Credible: Consequence Environment	Worst Credible: Consequence Business	Inherent Risk	Residual Risk
10	17	17	17	Study Area	WFSV, Workboats vs WFSV, Workboats	Collision - WFSV, Workboats vs WFSV, Workboats	50	2.301	2	2	1	2	500	1.301	4	3	2	4	4.5	15	2	2	1	2	150	4	3	2	4	6.0	5.3
11	19	16	18	Study Area	Commercial	Contact with OWF - Commercial														50	2	2	2	3	500	4	5	3	5	6.0	5.2
12	19	6	11	Study Area	Fishing	Contact with OWF - Fishing														10	2	2	1	2	100	4	4	2	4	6.6	5.8

Residual Risk: With Additional Controls in Place

Hazard ID	Risk Control ID.	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control
10		Baseline with no additional risk controls				6.0
10	1	Promulgation of Information	Yes	5%	0%	5.8
10	2	Construction - Continuous Watch	No	10%	0%	5.8
10	3	Safety Zones	No	20%	0%	5.8
10	4	Aids to Navigation	Yes	10%	0%	5.7
10	5	Vessel Traffic Monitoring	No	20%	0%	5.7
10	6	Emergency Response Cooperation Plan	Yes	0%	5%	5.6
10	7	Construction - Provision of Guard Vessel	No	20%	10%	5.6
10	8	Cable Burial Risk Assessment	No	10%	0%	5.6
10	9	Construction - Compliance with International Regulations	Yes	10%	0%	5.5
10	10	Under keel clearance Requirements	No	10%	0%	5.5
10	11	Fishing Liaison Plan	No	10%	0%	5.5
10	12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	5.4
10	13	Air Draught Clearance	No	10%	0%	5.4
10	14	Charting	Yes	5%	0%	5.3
10	15	Lines of Orientation	Yes	5%	0%	5.3
11		Baseline with no additional risk controls				6.0
11	1	Promulgation of Information	Yes	5%	0%	6.0
11	2	Construction - Continuous Watch	No	10%	0%	6.0
11	3	Safety Zones	Yes	20%	0%	5.7
11	4	Aids to Navigation	Yes	10%	0%	5.6
11	5	Vessel Traffic Monitoring	No	20%	0%	5.6
11	6	Emergency Response Cooperation Plan	Yes	0%	5%	5.6
11	7	Construction - Provision of Guard Vessel	No	20%	10%	5.6
11	8	Cable Burial Risk Assessment	No	10%	0%	5.6
11	9	Construction - Compliance with International Regulations	No	10%	0%	5.6
11	10	Under keel clearance Requirements	No	10%	0%	5.6
11	11	Fishing Liaison Plan	No	10%	0%	5.6
11	12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.6
11	13	Air Draught Clearance	Yes	10%	0%	5.4
11	14	Charting	Yes	5%	0%	5.3
11	15	Lines of Orientation	Yes	5%	0%	5.2
12		Baseline with no additional risk controls				6.6
12	1	Promulgation of Information	Yes	5%	0%	6.5
12	2	Construction - Continuous Watch	No	10%	0%	6.5
12	3	Safety Zones	Yes	20%	0%	6.3
12	4	Aids to Navigation	Yes	10%	0%	6.2
12	5	Vessel Traffic Monitoring	No	20%	0%	6.2
12	6	Emergency Response Cooperation Plan	Yes	0%	5%	6.1
12	7	Construction - Provision of Guard Vessel	No	20%	10%	6.1
12	8	Cable Burial Risk Assessment	No	10%	0%	6.1
12	9	Construction - Compliance with International Regulations	No	10%	0%	6.1
12	10	Under keel clearance Requirements	No	10%	0%	6.1
12	11	Fishing Liaison Plan	Yes	10%	0%	6.0
12	12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	6.0
12	13	Air Draught Clearance	Yes	10%	0%	5.9
12	14	Charting	Yes	5%	0%	5.8
12	15	Lines of Orientation	Yes	5%	0%	5.8

Detailed Results

Hazard ID	Baseline Risk	Baseline Level	Inherent Risk	Inherent Level	Residual Risk	Residual Level	Risk Reduction
10	4.5	Negligible	6.0	Minor	5.3	Minor	0.7
11	0.0	Negligible	6.0	Minor	5.2	Minor	0.8
12	0.0	Negligible	6.6	Minor	5.8	Minor	0.8

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls												Inherent Risk: Windfarm No Additional Controls										Inherent Risk	Residual Risk: With Additional Controls in Place						Residual Risk
							Most Likely						Worst Credible						Baseline Risk	Most Likely					Worst Credible												
							Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business		Likelihood 1 in X yr	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Consequence People	Consequence Property	Consequence Environment	Consequence Business			Risk Control ID.	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control	
13	19	7	12	Study Area	Recreational	Contact with OWF - Recreational														10	2	2	1	2	100	4	3	2	4	6.4		Baseline with no additional risk controls				6.4	5.7
																															1	Promulgation of Information	Yes	5%	0%	6.3	
																															2	Construction - Continuous Watch	No	10%	0%	6.3	
																															3	Safety Zones	Yes	20%	0%	6.0	
																															4	Aids to Navigation	Yes	10%	0%	5.9	
																															5	Vessel Traffic Monitoring	No	20%	0%	5.9	
																															6	Emergency Response Cooperation Plan	Yes	0%	5%	5.9	
																															7	Construction - Provision of Guard Vessel	No	20%	10%	5.9	
																															8	Cable Burial Risk Assessment	No	10%	0%	5.9	
																															9	Construction - Compliance with International Regulations	No	10%	0%	5.9	
																															10	Under keel clearance Requirements	No	10%	0%	5.9	
																															11	Fishing Liaison Plan	No	10%	0%	5.9	
																															12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.9	
																															13	Air Draught Clearance	Yes	10%	0%	5.8	
																															14	Charting	Yes	5%	0%	5.7	
																															15	Lines of Orientation	Yes	5%	0%	5.7	
14	19	4	7	Study Area	WFSV, Workboats	Contact with OWF - WFSV, Workboats														1	1	1	1	2	100	4	3	2	4	6.9		Baseline with no additional risk controls				6.9	5.9
																															1	Promulgation of Information	Yes	5%	0%	6.7	
																															2	Construction - Continuous Watch	No	10%	0%	6.7	
																															3	Safety Zones	Yes	20%	0%	6.5	
																															4	Aids to Navigation	Yes	10%	0%	6.4	
																															5	Vessel Traffic Monitoring	No	20%	0%	6.4	
																															6	Emergency Response Cooperation Plan	Yes	0%	5%	6.3	
																															7	Construction - Provision of Guard Vessel	No	20%	10%	6.3	
																															8	Cable Burial Risk Assessment	No	10%	0%	6.3	
																															9	Construction - Compliance with International Regulations	Yes	10%	0%	6.2	
																															10	Under keel clearance Requirements	No	10%	0%	6.2	
																															11	Fishing Liaison Plan	No	10%	0%	6.2	
																															12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	6.1	
																															13	Air Draught Clearance	Yes	10%	0%	6.0	
																															14	Charting	Yes	5%	0%	6.0	
																															15	Lines of Orientation	Yes	5%	0%	5.9	
G1	14	10	9	Study Area	Commercial	Grounding - Commercial	100	2	2	3	2	3	1000	1	4	5	4	5	5.1	50	2	3	2	3	500	4	5	4	5	6.3		Baseline with no additional risk controls				6.3	5.8
																															1	Promulgation of Information	Yes	5%	0%	6.3	
																															2	Construction - Continuous Watch	No	10%	0%	6.3	
																															3	Safety Zones	No	20%	0%	6.3	
																															4	Aids to Navigation	No	10%	0%	6.3	
																															5	Vessel Traffic Monitoring	No	20%	0%	6.3	
																															6	Emergency Response Cooperation Plan	Yes	0%	5%	6.2	
																															7	Construction - Provision of Guard Vessel	No	20%	10%	6.2	
																															8	Cable Burial Risk Assessment	Yes	10%	0%	6.1	
																															9	Construction - Compliance with International Regulations	No	10%	0%	6.1	
																															10	Under keel clearance Requirements	Yes	10%	0%	5.9	
																															11	Fishing Liaison Plan	No	10%	0%	5.9	
																															12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.9	
																															13	Air Draught Clearance	No	10%	0%	5.9	
																															14	Charting	Yes	5%	0%	5.8	
																															15	Lines of Orientation	No	5%	0%	5.8	

Detailed Results
Baseline Risk
0.0
Baseline Level
Negligible
Inherent Risk
6.4
Inherent Level
Minor
Residual Risk
5.7
Residual Level
Minor
Risk Reduction
0.8
Baseline Risk
0.0
Baseline Level
Negligible
Inherent Risk
6.9
Inherent Level
Minor
Residual Risk
5.9
Residual Level
Minor
Risk Reduction
1.0
Baseline Risk
5.1
Baseline Level
Minor
Inherent Risk
6.3
Inherent Level
Minor
Residual Risk
5.8
Residual Level
Minor
Risk Reduction
0.4

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls – Most Likely: Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Worst Credible: Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Baseline Risk	Inherent Risk: Windfarm No Additional Controls – Most Likely: Likelihood 1 in X yr	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Worst Credible: Likelihood 1 in X yr	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Inherent Risk	Residual Risk
G2	8	13	12	Study Area	Fishing	Grounding - Fishing	100	2	2	2	1	2	250	1.6021	4	4	3	5	**5.5**	75	2	2	1	2	150	4	4	3	5	**6.1**	**5.7**
G2	16	21	21	Study Area	Recreational	Grounding - Recreational	100	2	2	2	1	2	250	1.6021	4	4	2	3	**4.8**	75	2	2	1	2	200	4	4	2	3	**5.1**	**4.9**
G3	9	17	14	Study Area	WFSV, Workboats	Grounding - WFSV, Workboats	25	2.6021	2	2	1	2	250	1.6021	4	4	2	3	**5.3**	15	2	2	1	2	150	4	4	2	3	**6.0**	**5.6**

Residual Risk: With Additional Controls in Place – G2 Grounding - Fishing

Risk Control ID.	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control	Detailed Results	
	Baseline with no additional risk controls				6.1	Baseline Risk	5.5
1	Promulgation of Information	Yes	5%	0%	6.0	Baseline Level	Minor
2	Construction - Continuous Watch	No	10%	0%	6.0	Inherent Risk	6.1
3	Safety Zones	No	20%	0%	6.0	Inherent Level	Minor
4	Aids to Navigation	No	10%	0%	6.0	Residual Risk	5.7
5	Vessel Traffic Monitoring	No	20%	0%	6.0	Residual Level	Minor
6	Emergency Response Cooperation Plan	Yes	0%	5%	6.0	Risk Reduction	0.4
7	Construction - Provision of Guard Vessel	No	20%	10%	6.0		
8	Cable Burial Risk Assessment	No	10%	0%	6.0		
9	Construction - Compliance with International Regulations	No	10%	0%	6.0		
10	Under keel clearance Requirements	Yes	10%	0%	5.9		
11	Fishing Liaison Plan	Yes	10%	0%	5.7		
12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.7		
13	Air Draught Clearance	No	10%	0%	5.7		
14	Charting	Yes	5%	0%	5.7		
15	Lines of Orientation	No	5%	0%	5.7		

Residual Risk: With Additional Controls in Place – G2 Grounding - Recreational

Risk Control ID.	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control	Detailed Results	
	Baseline with no additional risk controls				5.1	Baseline Risk	4.8
1	Promulgation of Information	Yes	5%	0%	5.0	Baseline Level	Negligible
2	Construction - Continuous Watch	No	10%	0%	5.0	Inherent Risk	5.1
3	Safety Zones	No	20%	0%	5.0	Inherent Level	Minor
4	Aids to Navigation	No	10%	0%	5.0	Residual Risk	4.9
5	Vessel Traffic Monitoring	No	20%	0%	5.0	Residual Level	Negligible
6	Emergency Response Cooperation Plan	Yes	0%	5%	5.0	Risk Reduction	0.2
7	Construction - Provision of Guard Vessel	No	20%	10%	5.0		
8	Cable Burial Risk Assessment	No	10%	0%	5.0		
9	Construction - Compliance with International Regulations	No	10%	0%	5.0		
10	Under keel clearance Requirements	No	10%	0%	5.0		
11	Fishing Liaison Plan	No	10%	0%	5.0		
12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.0		
13	Air Draught Clearance	No	10%	0%	5.0		
14	Charting	Yes	5%	0%	4.9		
15	Lines of Orientation	No	5%	0%	4.9		

Residual Risk: With Additional Controls in Place – G3 Grounding - WFSV, Workboats

Risk Control ID.	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control	Detailed Results	
	Baseline with no additional risk controls				6.0	Baseline Risk	5.3
1	Promulgation of Information	Yes	5%	0%	5.9	Baseline Level	Minor
2	Construction - Continuous Watch	No	10%	0%	5.9	Inherent Risk	6.0
3	Safety Zones	No	20%	0%	5.9	Inherent Level	Minor
4	Aids to Navigation	NO	10%	0%	5.9	Residual Risk	5.6
5	Vessel Traffic Monitoring	No	20%	0%	5.9	Residual Level	Minor
6	Emergency Response Cooperation Plan	Yes	0%	5%	5.8	Risk Reduction	0.4
7	Construction - Provision of Guard Vessel	No	20%	10%	5.8		
8	Cable Burial Risk Assessment	Yes	10%	0%	5.7		
9	Construction - Compliance with International Regulations	No	10%	0%	5.7		
10	Under keel clearance Requirements	No	10%	0%	5.7		
11	Fishing Liaison Plan	No	10%	0%	5.7		
12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	5.6		
13	Air Draught Clearance	No	10%	0%	5.6		
14	Charting	Yes	5%	0%	5.6		
15	Lines of Orientation	No	5%	0%	5.6		

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls												Inherent Risk: Windfarm No Additional Controls										Inherent Risk	Residual Risk: With Additional Controls in Place						Residual Risk
							Most Likely						Worst Credible						Baseline Risk	Most Likely					Worst Credible												
							Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business		Likelihood 1 in X yr	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Consequence People	Consequence Property	Consequence Environment	Consequence Business			Risk Control ID.	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control	
15	11	19	16	Study Area	Commercial	Snagging OWF infrastructure - Commercial	50	2.301	2	2	1	2	500	1.301	5	5	4	5	**5.3**	25	2	2	1	2	250	4	4	4	4	**5.6**		Baseline with no additional risk controls				5.6	**5.4**
																														1	Promulgation of Information	Yes	5%	0%	5.6	
																														2	Construction - Continuous Watch	No	10%	0%	5.6	
																														3	Safety Zones	No	20%	0%	5.6	
																														4	Aids to Navigation	Yes	10%	0%	5.5	
																														5	Vessel Traffic Monitoring	No	20%	0%	5.5	
																														6	Emergency Response Cooperation Plan	Yes	0%	5%	5.4	
																														7	Construction - Provision of Guard Vessel	No	20%	10%	5.4	
																														8	Cable Burial Risk Assessment	No	10%	0%	5.4	
																														9	Construction - Compliance with International Regulations	No	10%	0%	5.4	
																														10	Under keel clearance Requirements	No	10%	0%	5.4	
																														11	Fishing Liaison Plan	No	10%	0%	5.4	
																														12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.4	
																														13	Air Draught Clearance	No	10%	0%	5.4	
																														14	Charting	Yes	5%	0%	5.4	
																														15	Lines of Orientation	No	5%	0%	5.4	
16	1	1	5	Study Area	Fishing	Snagging OWF infrastructure - Fishing	25	2.6021	2	2	1	2	250	1.6021	5	5	4	5	**6.3**	10	2	2	1	2	100	5	4	3	4	**7.3**		Baseline with no additional risk controls				7.3	**6.0**
																														1	Promulgation of Information	Yes	5%	0%	6.6	
																														2	Construction - Continuous Watch	No	10%	0%	6.6	
																														3	Safety Zones	No	20%	0%	6.6	
																														4	Aids to Navigation	Yes	10%	0%	6.5	
																														5	Vessel Traffic Monitoring	No	20%	0%	6.5	
																														6	Emergency Response Cooperation Plan	Yes	0%	5%	6.5	
																														7	Construction - Provision of Guard Vessel	No	20%	10%	6.5	
																														8	Cable Burial Risk Assessment	Yes	10%	0%	6.3	
																														9	Construction - Compliance with International Regulations	No	10%	0%	6.3	
																														10	Under keel clearance Requirements	Yes	10%	0%	6.2	
																														11	Fishing Liaison Plan	Yes	10%	0%	6.1	
																														12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	6.1	
																														13	Air Draught Clearance	No	10%	0%	6.1	
																														14	Charting	Yes	5%	0%	6.0	
																														15	Lines of Orientation	No	5%	0%	6.0	
17	3	14	10	Study Area	Recreational	Snagging OWF infrastructure - Recreational	25	2.6021	2	2	1	2	250	1.6021	4	4	4	5	**6.1**	15	2	2	1	2	150	4	4	2	4	**6.1**		Baseline with no additional risk controls				6.1	**5.8**
																														1	Promulgation of Information	Yes	5%	0%	6.0	
																														2	Construction - Continuous Watch	No	10%	0%	6.0	
																														3	Safety Zones	No	20%	0%	6.0	
																														4	Aids to Navigation	Yes	10%	0%	5.9	
																														5	Vessel Traffic Monitoring	No	20%	0%	5.9	
																														6	Emergency Response Cooperation Plan	Yes	0%	5%	5.8	
																														7	Construction - Provision of Guard Vessel	No	20%	10%	5.8	
																														8	Cable Burial Risk Assessment	No	10%	0%	5.8	
																														9	Construction - Compliance with International Regulations	oNo	10%	0%	5.8	
																														10	Under keel clearance Requirements	No	10%	0%	5.8	
																														11	Fishing Liaison Plan	No	10%	0%	5.8	
																														12	Project Vessel Traffic Co-ordination Plan	No	10%	0%	5.8	
																														13	Air Draught Clearance	No	10%	0%	5.8	
																														14	Charting	Yes	5%	0%	5.8	
																														15	Lines of Orientation	No	5%	0%	5.8	

Detailed Results
Baseline Risk
5.3
Baseline Level
Minor
Inherent Risk
5.6
Inherent Level
Minor
Residual Risk
5.4
Residual Level
Minor
Risk Reduction
0.3
Baseline Risk
6.3
Baseline Level
Minor
Inherent Risk
7.3
Inherent Level
Moderate
Residual Risk
6.0
Residual Level
Minor
Risk Reduction
1.3
Baseline Risk
6.1
Baseline Level
Minor
Inherent Risk
6.1
Inherent Level
Minor
Residual Risk
5.8
Residual Level
Minor
Risk Reduction
0.3

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Hazard ID	Baseline Hazard Rank	Inherent Hazard Rank	Residual Hazard Rank	Location	Vessel Type	Hazard Title	Baseline Risk: No Windfarm with existing controls												Inherent Risk: Windfarm No Additional Controls										Inherent Risk	Residual Risk: With Additional Controls in Place						Residual Risk
							Most Likely						Worst Credible						Baseline Risk	Most Likely					Worst Credible												
							Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Likelihood Score	Consequence People	Consequence Property	Consequence Environment	Consequence Business		Likelihood 1 in X yr	Consequence People	Consequence Property	Consequence Environment	Consequence Business	Likelihood 1 in X yr	Consequence People	Consequence Property	Consequence Environment	Consequence Business			Risk Control ID.	Additional Risk Control (RC) Measures	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Risk Score by control	
18	3	20	19	Study Area	WFSV, Workboats	Snagging OWF infrastructure - WFSV, Workboats	25	2.6021	2	2	1	2	250	1.6021	4	4	4	5	**6.1**	25	2	2	1	2	250	4	4	3	4	**5.5**			Baseline with no additional risk controls				5.5	**5.1**
																															1	Promulgation of Information	Yes	5%	0%	5.5	
																															2	Construction - Continuous Watch	No	10%	0%	5.5	
																															3	Safety Zones	No	20%	0%	5.5	
																															4	Aids to Navigation	Yes	10%	0%	5.4	
																															5	Vessel Traffic Monitoring	No	20%	0%	5.4	
																															6	Emergency Response Cooperation Plan	Yes	0%	5%	5.3	
																															7	Construction - Provision of Guard Vessel	No	20%	10%	5.3	
																															8	Cable Burial Risk Assessment	No	10%	0%	5.3	
																															9	Construction - Compliance with International Regulations	No	10%	0%	5.3	
																															10	Under keel clearance Requirements	No	10%	0%	5.3	
																															11	Fishing Liaison Plan	No	10%	0%	5.3	
																															12	Project Vessel Traffic Co-ordination Plan	Yes	10%	0%	5.2	
																															13	Air Draught Clearance	No	10%	0%	5.2	
																															14	Charting	Yes	5%	0%	5.1	
																															15	Lines of Orientation	No	5%	0%	5.1	

Detailed Results
Baseline Risk
6.1
Baseline Level
Minor
Inherent Risk
5.5
Inherent Level
Minor
Residual Risk
5.1
Residual Level
Minor
Risk Reduction
0.4