Appendix 13-3: Response to Department of Transport (MSO)

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

rps
A TETRA TECH COMPANY

JERA NEX BP

ESB Energy for generations

ORIEL WIND FARM PROJECT

Environmental Impact Assessment Report - Addendum
Appendix 13-3: Response to Department of Transport (MSO)

MDR1520C
EIAR– Appendix 13-3
A1 C01
December 2025

rpsgroup.com

Contents

Figures

Tables

Acronyms

Term	Meaning
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
CCTV	Closed Circuit Television
CSO	Central Statistics Office
CIL	Commissioners of Irish Lights
DESNZ	Department for Energy Security and Net Zero
DTTS	Department of Transport, Tourism and Sport
DHLGH	Department of Housing, Local Government and Heritage
DoT	Department of Transport
EIAR	Environmental Impact Assessment Report
EU	European Union
GoI	Government of Ireland
HW	High Water
IMO	International Maritime Organisation
INFOMAR	Integrated Mapping for the Sustainable Development of Ireland's Marine Resource
IRCG	Irish Coast Guard
LOA	Length Overall
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MSO	Marine Survey Office
NMPF	National Marine Planning Framework
NRA	Navigation Risk Assessment
OWF	Offshore Wind Farm
PIANC	Permanent International Association of Navigation Congresses
RNLI	Royal National Lifeboat Institution
SAR	Search and Rescue
UK	United Kingdom
UKC	Under Keel Clearance
VHF	Very High Frequency
WTG	Wind Turbine Generator

Units

Unit	Description
GW	Gigawatt
km^2	Square kilometre
kt	Knot (unit of speed equal to nautical mile per hour, approximately 1.15 mph)
m	Metre
m/s	Metres per second
MW	Megawatt
nm	Nautical Mile (1 NM = 1,852 m)

1 INTRODUCTION

This report has been prepared by NASH Maritime on behalf of the Applicant (Oriel Windfarm Ltd) in response to the issues raised in the submission from the Department of Transport (DoT) during the statutory consultation on the planning application (case reference: 319799) for the Oriel Wind Farm Project (hereafter referred to as 'the Project').

The submission was divided into two key elements:

- Submission by Marine Survey Office (MSO); and
- Submission by Irish Coast Guard (IRCG).

This report provides responses to the key issues raised by the MSO

The response by the Irish Coastguard is provided under a separate addendum (see EIAR volume 2B Addendum, appendix 13.2: Safety Justification for Single Line of Orientation). To provide context, information on the site selection for the offshore wind farm (OWF) and the project need is provided in sections 1.1 and 1.2.

Statement of Competence

NASH Maritime are specialists in shipping, navigation and maritime risk. The multi-disciplinary team have worked in the maritime, ports and offshore renewable energy sectors, understanding the value of risk-based decision-making and taking an active role in driving new approaches to safety and cost reduction. NASH Maritime has extensive experience throughout the world in conducting Navigation Risk Assessments (NRAs) for OWFs.

Dr Andrew Rawson PhD BA (Hons) FRGS CEng MIMarEST is a maritime consultant with more than 14 years of experience, specialising in data analysis, modelling and NRAs. He is an Associate Director at NASH Maritime and has worked on a multitude of projects for developers, ports and governments as a project manager or technical lead. His specialism lies in developing and applying innovative quantitative methods to measure the risk of maritime accidents and predict the impact of developments such as offshore renewables. Andrew has an extensive track record in authoring NRAs, EIA technical chapters, quantitative risk assessments (QRAs) and providing specialist technical advice to clients. Andrew has led the development of scientific approaches to navigation risk, with numerous peer-reviewed academic publications in high-impact journals. In 2022, Andrew was awarded a PhD from the University of Southampton investigating the use of machine learning and big data to support maritime risk assessment. In 2023, Andrew acted as Chair of the Technical Committee at the European, Safety and Reliability Conference.

Pete Lloyd MBE FRAeS MBA MA spent a working career spanning two diverse professions with surprising parallels requiring similar competences and capabilities. The first career was built around military service as an officer in the Royal Air Force, with a core activity as a helicopter pilot, instructor, commander and staff officer delivering aviation Search and Rescue (SAR). Away from SAR, periods were spent establishing a helicopter training school, supporting United Kingdom (UK) industry within defence exports and actively involved in overseas defence conflicts. During his last tour of duty as Chief of Staff of the RAF SAR Force, Peter co-chaired the UK SAR Operations Group with the UK's Chief Coastguard and assisted Renewable UK in establishing Offshore Renewable Energy Emergency Forum (OREEF), becoming its first Chair. This led to a second career in the renewable wind industry focusing on health, safety, security, environmental protection and training. Specialising in risk management, as applied to the operation and maintenance (O&M) of wind turbine generators (WTGs) both on and offshore; becoming the industry leader in offshore emergency response from wind farms, an activity that bridged both careers, leading to coordinating the creation of the UK's IOER – Renewable guidance. Latterly, activity has been dedicated in sharing knowledge and experiences as a volunteer Council Member with the Royal National Lifeboat Institution (RNLI).

Captain Nigel Bassett QVRM is a seagoing professional with nearly 50 years' experience of ship and port operations. He has 15 years worldwide merchant navy sea-going experience, including tanker and mega yacht command. This was followed by 25 years as a Class 1 specialist pilot in a major UK port, safely

manoeuvring over 8,000 of the world's largest container, tanker and cruise vessels. In tandem, Nigel completed 30 years as a Royal Navy Reservist, appointed in numerous management and overseas operational roles primarily involved with commercial shipping, before retiring as the Royal Navy's most senior ranking reservist. Nigel has considerable consultancy experience as a nautical subject matter expert, particularly in port and infrastructure developments, specialist in ship handling, navigation, pilotage, full mission bridge simulation and NRAs. Nigel is also regularly instructed by well-known ship operating companies to conduct remote and onboard navigation audits and incident investigations.

1.1 Project Site Selection

A wide range of factors were considered to select the location of the Offshore Wind Farm (OWF) area, including wind resource, depth of water, shelter from high wave loads, seabed sediments, marine archaeology and principal shipping routes. These are described in the Environmental Impact Assessment Report (EIAR) chapter 4: Consideration of Alternatives (volume 2A). Potential areas were therefore evaluated against a range of criteria that represented these factors, which included metocean criteria (wind resource > 9 m/s and shelter from high wave loads), marine processes criteria (seabed sediments, tidal streams <0.5 m/s and bathymetry water depths <30 m), and material assets (landing points with proximity to existing high voltage transmission grid network and proximity to ports suitable for construction and operation and maintenance).

Areas in the Atlantic (West) coast of Ireland were considered as alternative locations due to the excellent wind capacity (SEAI Wind Atlas, 2003), but deep nearshore water depths, extreme wave loads, and exposed bedrock on the seabed determined these locations unsuitable for fixed bottom foundations. Moreover, given that the available electricity transmission capacity and existing infrastructure is severely limited along most of the Atlantic coast, and some of the main demand centres are on the east coast, these locations would have required significant grid infrastructure development across the country. Therefore, the east coast (Irish Sea) became the preferred location for the OWF Area.

The wind capacity on the east coast of Ireland also meets the Project's criteria, with >9 m/s wind resource, and has a less severe wave climate compared to the Atlantic coast. Areas along the narrow sand banks along the Wicklow and Wexford coast were considered as potential sites, but were ruled out due to the limited capacity of the grid infrastructure in these locations. Available grid capacity for a suitable scale of OWF was found in the area north of Dublin and, within this area, there were also a number of possible locations with extensive water depths suitable for the construction of current (fixed bottom) offshore wind technology and which provided opportunities to locate WTGs to minimise environmental effects. As a result, the north Irish Sea area was evaluated against detailed constraint mapping of the critical parameters such as metocean, bathymetry, existing fisheries and grid access and the assessment focused on a regional area between the entrance to Drogheda Harbour and the border with Northern Ireland, with a minimum area of ~30 km^2 is required to generate the capacity available at the grid connection point (Woodlands to Louth 220 kilovolts Overhead Powerline).

An area in the North Irish Sea to the east of Dundalk Bay that met the Project's criteria was identified as the preferred regional area of interest for the Project location. Further investigations (including geophysical surveys, benthic samples, vessel traffic assessments and stakeholder consultations) were then undertaken into this area to determine its suitability and four options within this area were selected for further evaluation against the project location criteria. From this evaluation, the OWF area was selected due to a series of advantages:

- Avoids areas of hard ground and shallower water to the northwest of the area;
- Avoids European designated sites;
- Avoids fisheries area in the mud beds to the south;
- Avoids shipping lanes;
- Has available grid capacity; and
- Is the appropriate size.

In selecting a suitable site many criteria are required to be considered of which consideration of shipping and navigation is one criterion. The selection of the preferred site is the one that best meets the majority of criteria across a range of topics.

1.2 Project Need

There is a clear need for increased offshore renewables in Ireland driven by the need for climate action. According to Met Éireann's Annual Climate Statement for 2023, 2023 was Ireland's warmest year on record, with above average rainfall. The energy sector is one of the main generators of greenhouse gas and consequently a significant cause of climate change and global warming. Offshore wind energy will play a key role in achieving national renewable energy and decarbonisation targets. An overall energy target of at least 42.5% binding at European Union (EU) level by 2030 was set by the Revised Renewable Energy Directive in November 2023 (EU, 2009), and the Department of the Environment, Climate and Communications (DECC)'s Climate Action Plan 2025 targets 80% renewable electricity in Ireland by 2030 (DECC, 2025). Given that the demand for energy is increasing across all sectors in Ireland, these demands need to be offset by electricity generated from renewable sources and other key national plans (such as the Department of Housing, Local Government and Heritage (DHLGH)'s National Planning Framework and the Government of Ireland (GoI)'s National Development Plan 2018-2027) are calling for increased electrification of the heat and transport sectors (DHLGH, 2018 & GoI, 2019). Decarbonising Ireland's electricity generation would strengthen Ireland's sustainable development performance, in line with the United Nations Sustainable Development Goals – particularly Goal 7 (Affordable and Clean Energy) and Goal 13 (Climate Action) (United Nations, 2015), inevitably leading to improved environmental and societal wellbeing.

The development of the Project will also help Ireland meet national targets set by the government. A national target of at least 5 Gigawatts (GW) (i.e. 5,000 Megawatts (MW)) of offshore wind energy by 2030 in the Climate Action Plan (DECC, 2025), of which, at present, none is being generated in Ireland. Hence, in proposing to generate up to 375 MW, which would represent approximately 7.5% of the 5 GW of offshore wind energy objective, the Project can help enable the achievement of the national target when operational.

The Project can also aid Ireland in its development of energy security. While the importance of energy security has long been understood at European Union (EU) and national levels, recent events (including the Covid-19 pandemic and the Russian invasion of Ukraine) have reinforced the risks inherent in long supply chains and dependence upon other states for energy sources. The DECC published Energy Security in Ireland to 2030 in November 2023 which notes that Ireland is currently one of the most energy import dependent countries in the EU, having imported 77% of its energy supply in 2021 (DECC, 2023). As a result, by investing in multiple renewable energy sources (including offshore wind), Ireland will reduce its dependence on imported fossil fuels and, consequently, its vulnerability to energy shocks.

Moreover, from an economic perspective, OWFs (including the Project) can benefit Ireland's economy in multiple ways: broadly, through the provision of clean, reliable, cost-effective energy and a reduction in the need to import fossil fuels; and directly, through employment generation at construction, operational and maintenance, and decommissioning phases, while also generating indirect and induced employment. The EU Blue Economy Report 2023 (European Commission, 2023) identifies marine renewable energy (offshore wind) development to be an established sector in Europe since 2021 and an increasingly important area for employment, gross value addition, gross profit, net investment in tangible good and turnover.

2 MSO

2.1 Position Overview

A summary of the key points raised by the MSO is provided in Table 2-1 along with a summary response and a section reference to where the full response is provided.

Table 2-1: Summary of key points raised in letter submission by the MSO.

Number	Key Points Raised	Response Position
MSO.1	Approaches into Dundalk and effect of Project • Shipping proceeding to and from the Port of Dundalk approach from the north, south and east of Dundalk Bay. • Shipping shall be required to deviate to the north or to the south of the proposed site.	**Section 2.2**– relatively few vessels (c.1 per week) approach from the northeast (NE), and a credible route to south is available.
MSO.2	Design vessel size for Dundalk • The Port of Dundalk can accommodate vessels of up to 150 m and drafts of up to 6.1 m.	**Section 2.3** – a more appropriate design vessel size for Dundalk would be 90 m Length Overall (LOA) and 5.4 m draught.
MSO.3	Passing Distances from OWFs • >0.5 nm passing distance from the Project "does not reflect industry norms". Standard of 1 nm reflects best standard practice.	**Section 2.4** – passing distances should be case by case basis; for the sizes of vessels proposed, <1 nm is both appropriate and typical.
MSO.4	Depth of water and Under Keel Clearance (UKC) • Passage to the north within 10 m contour and <1 nm from grounding line for typical vessels. • In our [MSO] assessment, this will ensure that shipping navigating to the north of the proposed wind farm can maintain adequate under keel clearance and a minimum safe distance from the Wind Turbine, ORI-B04, and the 10 metre contour line that lies to the east of Cooley Point and Castle Rocks.	**Section 2.5** – there is sufficient depth of water for passage to the north for design vessels approaching Dundalk with appropriate UKC.
MSO.5	Available Sea Room • Primary concern relates to the location of three WTGs sited in the northern portion of the proposed site which will restrict available sea room for shipping to less than one nautical mile. • The Project boundaries to the south and west provide for adequate sea room so that shipping can safely navigate and take action to avoid other vessels operating in the area. Whilst the risk to safety of navigation is increased, it is considered the risk is acceptable and can be managed appropriately. • The northern boundary of the proposed wind farm…does significantly reduce the available sea room available to shipping. The risk to the safety of navigation is significantly increased to unacceptable levels. • Inadequate sea room in the event of any required action to avoid collision with other merchant shipping, fishing or recreational craft or experience mechanical failure of propulsion or steering leading to collision, allision or grounding. • Fishing and recreational activities in the Dundalk bay will also be displaced and will increase the risks to the safety of navigation in the area.	**Section 2.6 –** there is sufficient sea room for safe navigation north of the Project for design vessels in most conditions at the discretion of the Master and this is reflective of existing practice.
MSO.6	Future Port Developments • The NRA does not appear to consider in depth any future expansion or development of the ports in the region and associated potential increase in traffic volume calling at Dublin, Drogheda, Warrenpoint, Greenore or Dundalk.	**Section 2.7** – there is no evidence that proposed future expansions would aggravate these impacts.

Number	Key Points Raised	Response Position
MSO.7	Mitigation • Relocation of Wind Turbine ORI-A04, ORI-A05 and ORI-B05.	**Section 2.8** – this mitigation is not necessary or proportionate to reduce the risks to As Low As Reasonably Practicable. More appropriate mitigation is identified (see section 2.8).

2.2 Approaches into Dundalk and the Effect of the Project

The EIAR chapter 13: Shipping and Navigation presents the movements of vessels across a total of four months: two months in 2019 and two months in 2022 (both January and July). Supplementary vessel traffic Automatic Identification System (AIS) datasets comprising March to August 2024 have been obtained to support this response and to ensure recency and validity of the conclusions. Overall, the tracks from 2024 are broadly consistent with those presented within chapter 13 and appendix 13-1: Navigation Risk Assessment (volume 2B).

All the movements of vessels within the NRA Study Area (see Figure 1-1 in EIAR appendix 13-1: NRA) across 15 months (458 days: Jan and Jul 2019, Jan-Jul 2022 and Mar-Aug 2024) are presented in Figure 2-2 (commercial tracks) and Figure 2-3 (small craft).

The vessels identified transiting in and out of Dundalk have been isolated from passing transits and are shown in Figure 2-4. A total of 172 transits in or out of Dundalk were recorded throughout the 15 months of data (2019-2024), which have been broken down by vessel type and LOA in Figure 2-1. All vessels were less than 110 m in length. These tracks are broadly consistent with those presented within the NRA (EIAR appendix 13-1).

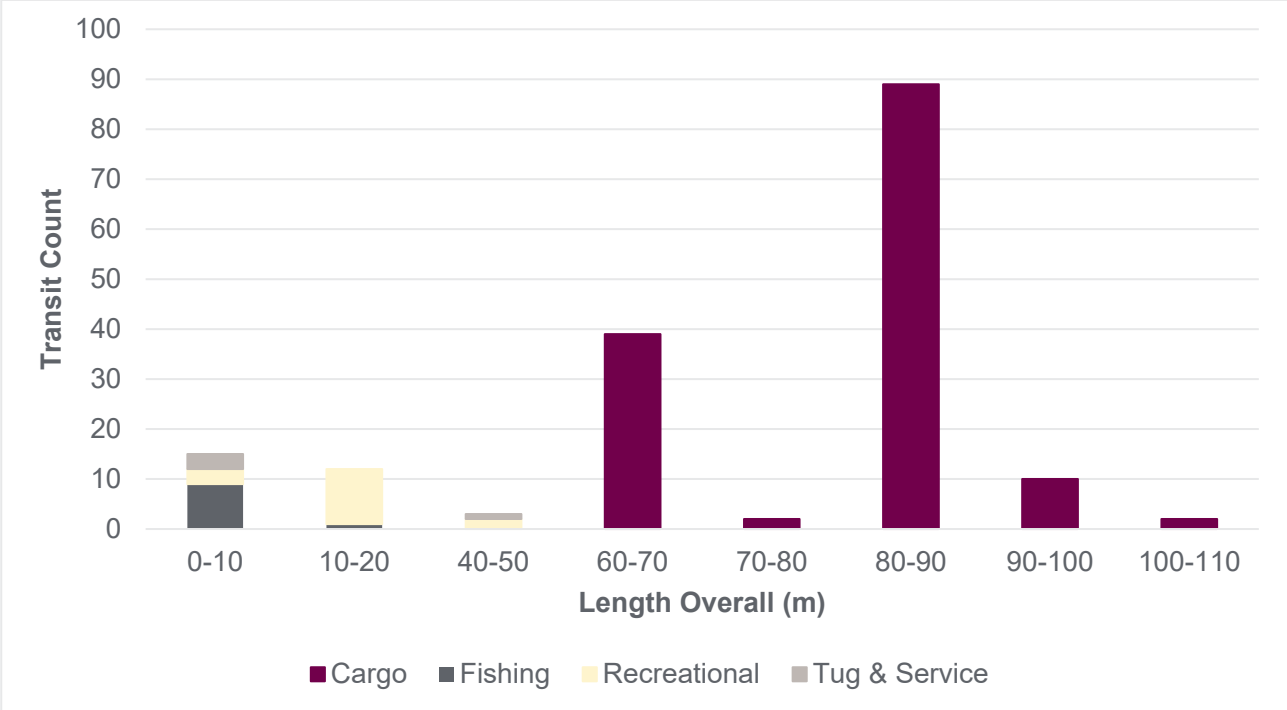


Figure 2-1: AIS transits into/out of Dundalk by vessel type and LOA (m).

.

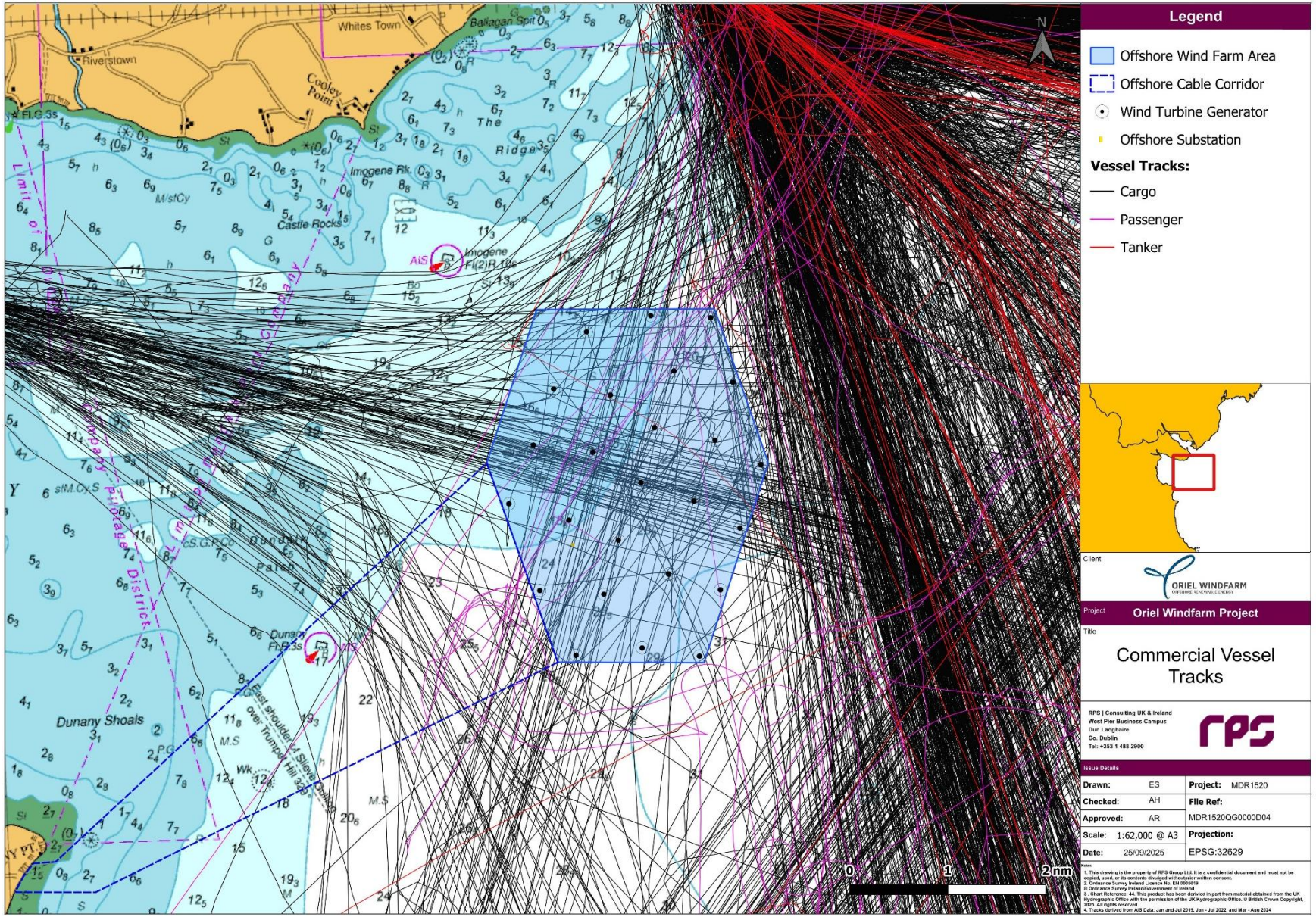


Figure 2-2: All AIS commercial vessel tracks.

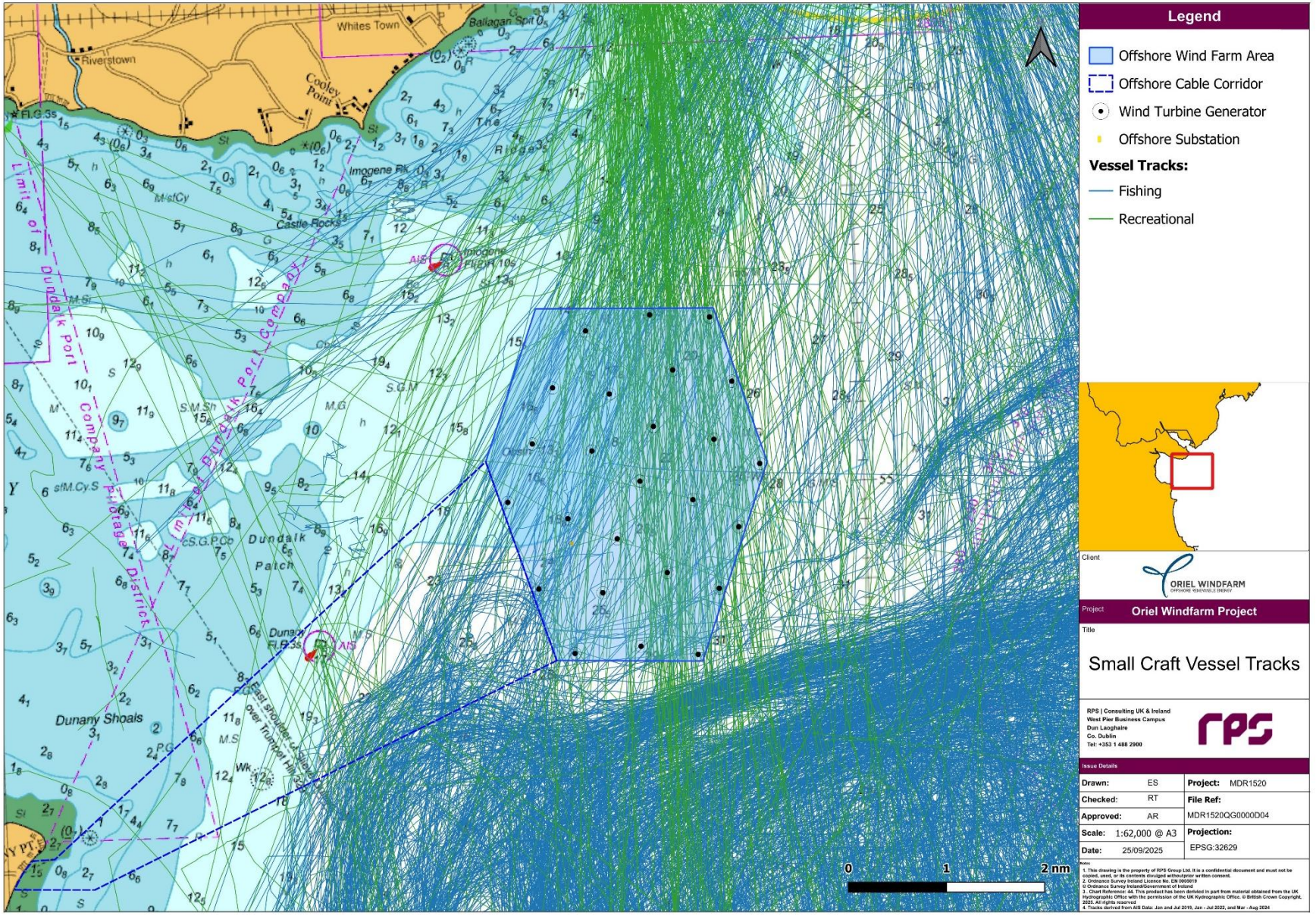


Figure 2-3: All AIS small craft tracks.

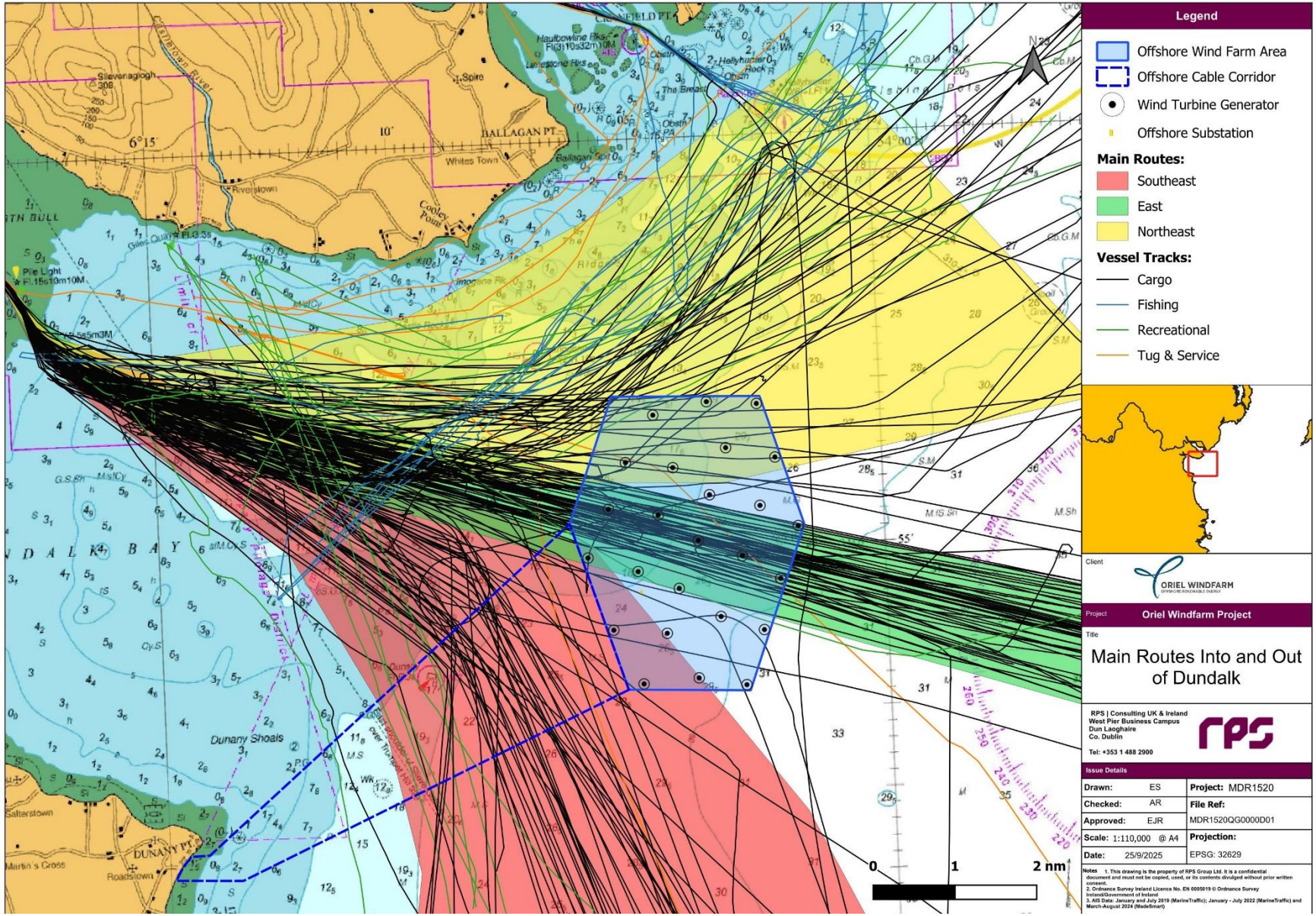


Figure 2-4: AIS vessel transits on main routes in and out of Dundalk.

Cargo vessels were the most frequent transiting vessel type in and out of Dundalk, with 142 transits (two per week) throughout the time-period, accounting for 83% of the dataset. The next most frequent vessel is recreational vessels, with 16 transits recorded (once per month), which accounted for 9.3% of all the transits in and out of Dundalk and made by nine unique vessels. Approximately 50% of these were sailing vessels, entering or leaving Dundalk from/to the southeast, while 50% were sailing vessels entering or leaving from/to the northeast. Several of these vessels entered Dundalk one afternoon and leave heading the opposite direction the following morning. Two fishing vessels (accounting for ten transits) were also observed transiting between Carlingford Lough and Dundalk, with 90% of this activity by the 7 m LOA vessel Norman Invasion. Four tug and service vessel transits were noted, two transiting to/from the southeast and two to/from the northeast. These included two SAR vessels, one pilot boat and one survey vessel. It is recognised that the number of transits of recreational and fishing vessels is underrepresented through the use of Automatic Identification System (AIS) data alone.

Vessels entering or leaving Dundalk can be generally categorised into three main routes, by the direction they transit to/from: southeast (approximately once per week), east (approximately once per week), and northeast (< 1 vessel per week), as evidenced in Figure 2-4, and is consistent with Figure 4-8 of the NRA (EIAR appendix 13-1: Navigation Risk Assessment). 73% of transits of cargo vessels were either from the southeast or east, with the remaining 27% from the northeast.

The National Ports Policy (Department of Transport, Tourism and Sport (DTTS) (2013)) defines the Port of Dundalk as a Port of Regional Significance, rather than one of the five 'Tier 1' or 'Tier 2' Ports of National Significance. Ireland's commercial shipping is concentrated around the five Ports of National Significance and, therefore, the Port of Dundalk is not considered as nationally important, but important for enabling local trade. As a result, the Port of Dundalk receives fewer transits, less tonnage, and smaller vessels, than Tier 1 and Tier 2 ports, as well as numerous other Ports of Regional Significance.

2.2.1 Approach from Southeast

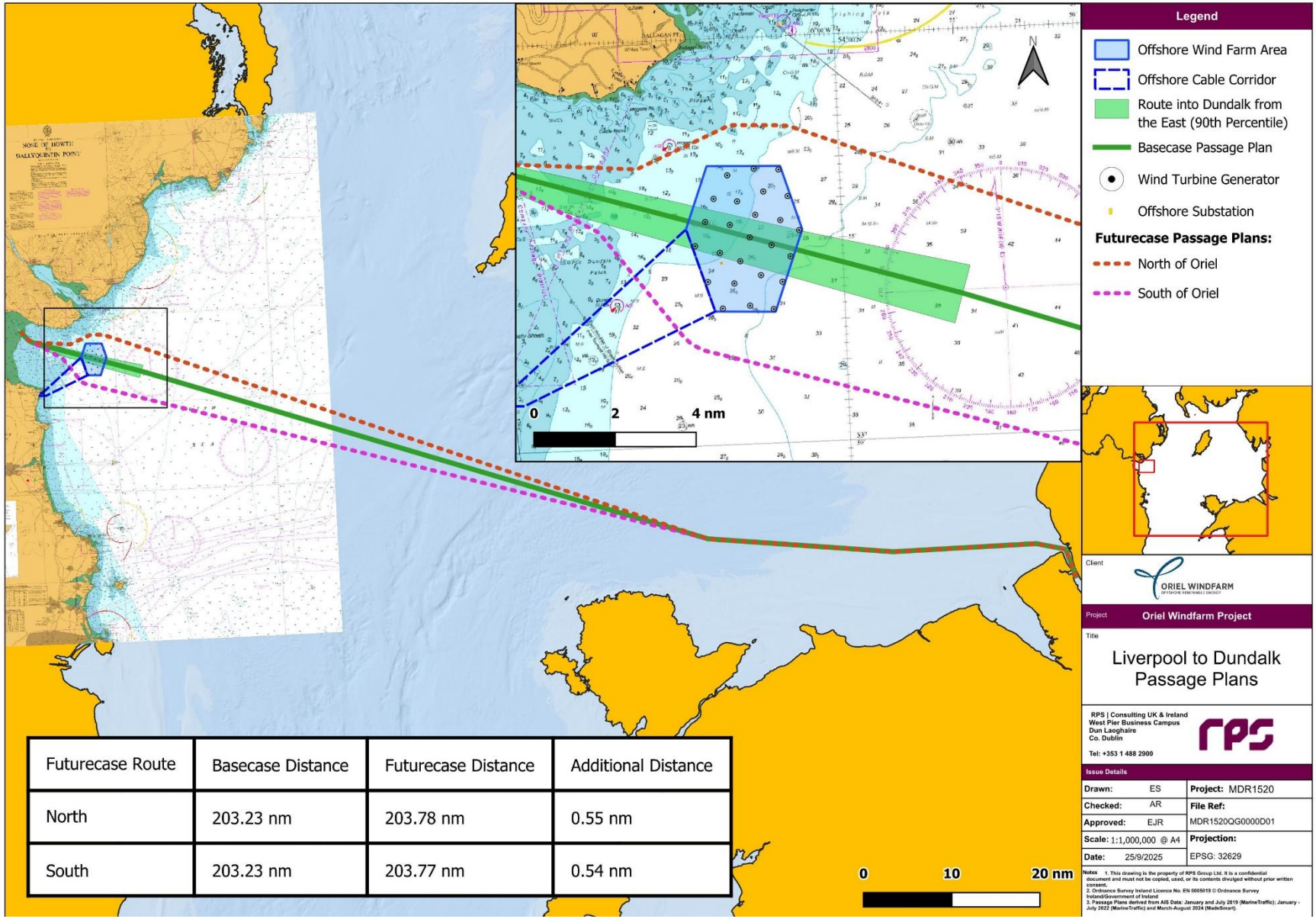
Those vessels approaching from the southeast (highlighted in Figure 2-4 in red), do so in an area of clear water approximately between the Dunany red lateral and the Project boundary. As noted in the MSO response and consistent with the findings of the NRA, for the types and volume of traffic utilising this route, the '*boundaries [of the Project] to the south and west does provide for adequate sea room…the risk is acceptable and can be managed appropriately*" (MSO, 2024). The impact on the route from the southeast is therefore considered negligible.

2.2.2 Approach from the East

The route to/from the east (highlighted in Figure 2-4 in green), which entirely passes through the Project OWF area, is a cargo route between Dundalk and Liverpool and would be required to deviate north or south of the WTGs. 53 vessel transits were observed to use this route throughout the fifteen months of data (approximately 42 transits / year). Figure 2-5 presents the current base case passage plan, and the potential north and southward deviated passage plans (with the Project in situ) along with a table of the respective additional route distances. It is concluded that a passage to the south is a more likely option for the following reasons:

- The deviation to the north is marginally longer (+0.55 nm) as opposed to a passage south (+0.54 nm);
- The passage to the south is in deeper water than to the north and therefore better aligns with established passage planning principles (see section 2.6);
- A passage to the north would necessitate multiple course changes closer to the shore than a single course change to the south of the Project placing unnecessary pressure on bridge teams; and
- Vessels passing to the south of the Project would approach from quieter waters away from the traffic entering and departing the busier harbour at Carlingford Lough.

The impact on the route from the east is therefore considered negligible.



Futurecase Route	Basecase Distance	Futurecase Distance	Additional Distance
North	203.23 nm	203.78 nm	0.55 nm
South	203.23 nm	203.77 nm	0.54 nm

Figure 2-5: Basecase and futurecase Liverpool to Dundalk passage plan.

2.2.3 Approach from the Northeast

Vessels approaching Dundalk from the northeast currently pass immediately adjacent to or intersect the boundary of the OWF area (demonstrated by the yellow route in Figure 2-4). This route is characterised as follows:

- An average of 0.13 vessels per day (less than 1 vessel per week);
    - 64% cargo vessels (once every two weeks);
    - 17% fishing vessels (once every two months), likely underrepresented in AIS data;
    - 14% recreational (once every two months), likely underrepresented in AIS data; and
    - 5% tug & service vessels (once every five months);
- 48% of vessels have LOA between 80 m and 90 m, 22% have LOA <10 m, and 12% of vessels have a LOA between 10 m and 20 m and 12% have a LOA between 60 m and 70 m; and
- 47% of vessels have a draught between 2 m and 4 m, while 33% have a draught <2 m and 17% have a draught between 4 m and 5 m.

Two options are available for vessels approaching from the northeast, either to deviate to the south of the OWF area or transit between the OWF area and the Irish coast. Passage planning principles (such as given in the International Maritime Organisation (IMO)'s 1999 Resolution A.893(21)) note the four stages of passage planning are Appraisal, Planning, Execution and Monitoring and the Planning stage notes the following:

- *6."safe speed, having regard to the proximity of navigational hazards along the intended route or track, the manoeuvring characteristics of the vessel and its draught in relation to the available water depth"*;
- *7."minimum clearance required under the keel in critical areas with restricted water depth"*; and
- *8."course alteration points, taking into account the vessel's turning circle at the planned speed and any expected effect of tidal streams and currents"*.

Therefore, the navigator of a vessel would take into account the suitability of a passage north of the OWF Area as opposed to south of the OWF Area depending on the characteristics of their vessel and the prevailing conditions. Were a Master to choose to transit north of the OWF Area following consideration of the prevailing conditions and characteristics of their vessel, the available sea room and water depths is considered sufficient for safe navigation (see section 2.3 to section 2.6).

Were a master to choose to pass south of the Project rather than north, the deviations of these vessels are considered minor. By way of example, within the historical AIS data a typical short sea shipping route was from Ayr, Scotland. A passage plan for this base case route is shown in Figure 2-6, alongside a potential deviated passage plan if those vessels were to divert round to the south of the Project. This diversion would lead to an additional 5.4 nm transit distance, which for vessels transiting at an average speed of 8.6 knots, generates an additional transit time of 38 minutes on a journey of more than 14.5 hours. Whilst this would necessitate additional fuel costs and minor delays, they are not considered likely to significantly impact the operations of Dundalk. The slight inconvenience associated with this deviation to infrequent ship calls should be considered against the significant energy and economic benefits of the Project (outlined in Section 1.2). Many of the transits identified were longer voyages and the proportional increase in steaming time is therefore substantially less.

Although the National Marine Planning Framework (NMPF) (DHLGH, 2021) notes within the Ports, Harbours and Shipping Policy 1 that a development should not interfere "with existing or planned routes used by shipping, access to ports and harbours and navigational safety", the NMPF does not provide an explicit definition of a 'route'. Logically, a busier route is more important than a less busy route and the degree of

impact should be weighted accordingly. A tier-based routing definition is provided within the UK Department for Energy Security and Net-Zero (DESNZ)'s National Policy Statement for Energy (NPS EN-3) (upon which Marine Guidance Note (MGN) 654 is based). Routes are defined as sea lanes essential to international navigation, routes that are essential to regional, national and international trade or lifeline ferries or those that are "less strategically important". Given the negligible volume of traffic bound for Dundalk from the northeast it can therefore be defined as a "less strategically important shipping route" and therefore a more pragmatic approach to route impacts should be given that considers the number of transits and deviation distance.

No concerns were raised during consultation for the Navigational Risk Assessment (NRA) regarding vessel deviations into Dundalk by Warrenpoint Harbour, Dundalk Harbour Master or Dundalk Pilots during NRA consultation and a passage to the south is therefore a credible alternative to vessels currently passing to the northeast of the Project, which was also acknowledged by the MSO in the submission (30-July-2024).

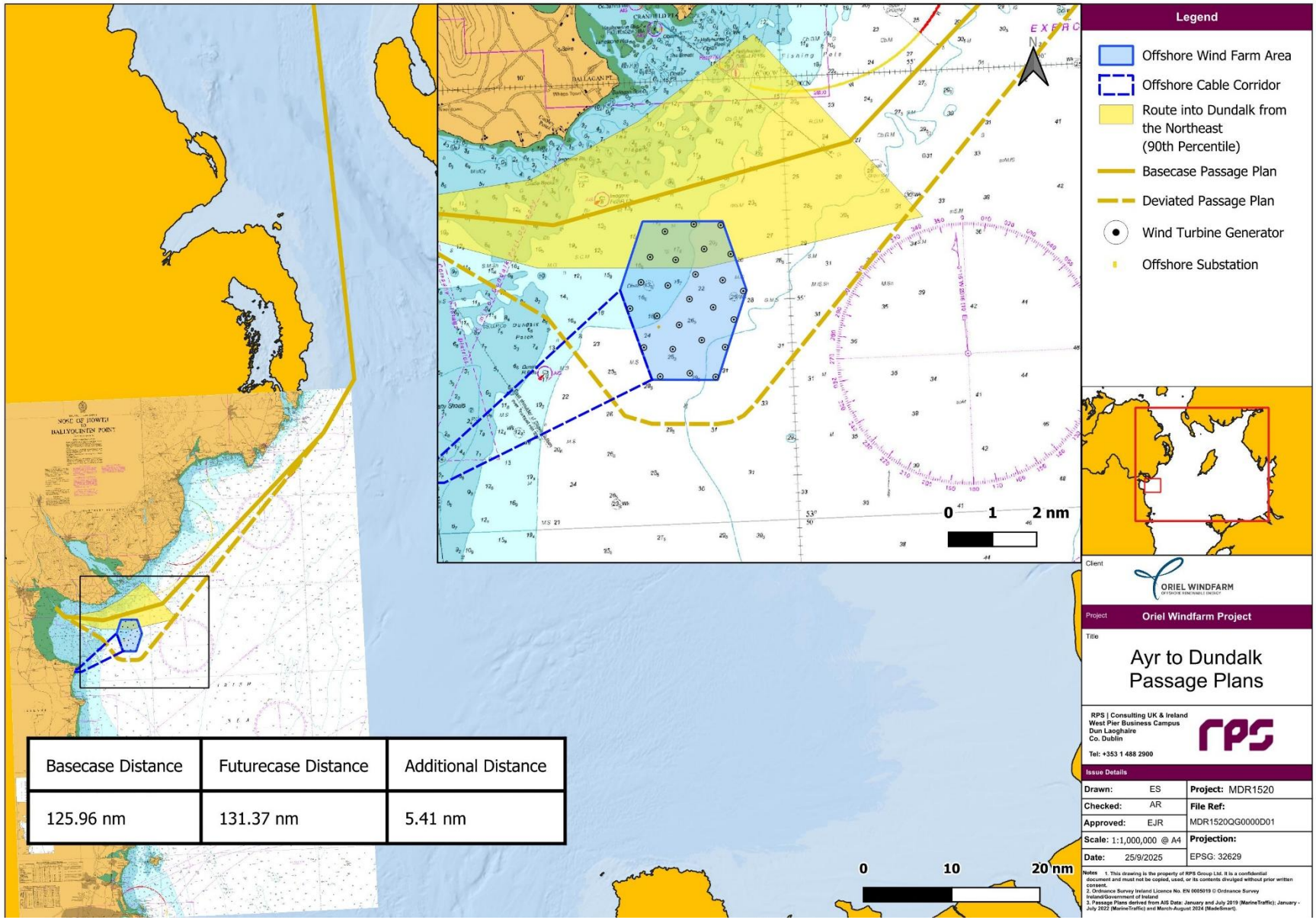


Figure 2-6: Basecase and futurecase Ayr to Dundalk passage plan.

2.3 Design Vessel Size for Dundalk

The submission by MSO states that the Port of Dundalk can accommodate vessels of up to 150 m LOA and draughts of up to 6.1 m.

Analysis of AIS data presented above and within the NRA (EIAR appendix 13-1), noted that the largest vessels recorded calling at Dundalk during that data period had a LOA of 100 m and when considering only those vessels approaching from the northeast (as defined in Section 2.2.3) it was 90 m LOA (with a 5.4 m draught). Additionally, of the 172 transits in or out of Dundalk during the 15-months of data collection, 44 (26%) of these transits (~35 transits per year) were made by vessels with a draught >4 m, accounted for by 28 individual vessels.

Analysis of data collected by the Central Statistics Office (CSO) of Ireland (2024) was used to characterise the trade of vessels calling at Dundalk since 1999 (TBA/01TBA09). This data shows that in the last 25 years, all vessels are recorded as between 100 – 4,999 gross tonnage and that since 2008, only general cargo vessels have arrived at the port. Analysis of gross tonnage and vessel dimensions for general cargo ships was undertaken for the Irish Sea. This determined that a cargo vessel of up to 5,000 gross tonnes would be expected to have a length of less than 125 m and a draught of between 5 m and 6 m providing further confidence in this finding.

Furthermore, during consultation with Dundalk pilots (12-Sep-2019) undertaken as part of the NRA (Table 1-3 of appendix 13-1: NRA Vol 2B of the EIAR), the maximum vessel size was noted as 120 m LOA and 5 m draft.

Therefore, based on the AIS analysis and long-term statistical analysis of vessel arrivals at Dundalk, a more accurate maximum design vessel size for navigating north of the Project would be a general cargo ship of 110 m LOA and 5.4 m draught. However, the most likely “large” vessel transit would be a 90 m LOA 4-5 m draught vessel. This is significantly less than suggested by the MSO of 150 m LOA and 6.1 m draught (Table 2-1).

2.4 Passing Distances from OWFs

The NRA (EIAR appendix 13-1) notes that commercial vessels would be expected to pass more than 0.5 nm from the boundary of an OWF. The submission by the MSO states that “*1.0 nm reflects best standard practice*”. The following key points are noted:

1. **Application of Guidance**:

    a. **Case by Case**: DoT guidance (DoT, 2025) does not contain any prescriptive safe passing distances from an OWF. Instead, Section 2.5.6 states that “*The assessment of the required sea room (corridor width) will be undertaken on a case-by-case basis and should take into account not only the requirements of the traffic survey but also the general location, sea area involved and nearby structures and installations*”. This includes the size, manoeuvring characteristics and volume of the vessels expected to transit the proposed lanes. Therefore, the safe passing distances will vary by the types of vessels taking that passage.

    b. **Turning Circles**: Section 2.5.9 of the DoT guidance (DoT, 2025) acknowledges that “*turning circles for vessels are typically calculated on six times the ship’s length*.” Therefore, a vessel size of 120 m LOA (as described in Section 2.3) would require approximately 0.4 nm to perform a full round turn. This is less than the minimum passing distance proposed.

    c. **Shipping Route Template**: Section 2.4 of the DoT guidance also includes a wind farm “shipping route” guidance template, whereby a passing distance of less than 0.5 nm is “Intolerable” but 0.5 nm to 3.5 nm is “Tolerable if As Low as Reasonably Practicable (ALARP)”. The DoT guidance also contains no reference as to what a “shipping route” is and therefore it is not clear on what basis the passing distances can be assessed. This is in contrary to UK guidance (MGN 654 Annex 5 [Maritime and Coastguard Agency (MCA), 2024]) which grades the impact on routes by their significance through the National Policy Statements.

d. **Permanent International Association of Navigation Congresses (PIANC) Guidance**: References to PIANC WG161 (PIANC, 2018) are made in Section 2.5.9 of the DoT guidance; a 100 m design vessel size using PIANC guidance would require 0.59 nm passing distance.

e. **Vigilance**: The DoT guidance (Section 2.5.9) also notes that "*the level of preparedness of vessels operating near OREI* [Offshore Renewable Energy Installations]*…will all vary when the vessel is on a general sea passage, as opposed to in areas of recognised constrained operation, for example port approaches and rivers*". As shown in section 2.2, vessels likely to be passing north of Project are in an area of shallow water, close to shore, and close to their port of arrival or departure and therefore a higher level of vigilance can be expected.

2. **Reference to Berwick Bank**: In their response, the MSO refer to Berwick Bank's EIA, specifically Volume 3 – Appendix 13.1 (Berwick Bank, 2023). That same report notes that "*To date, internal and external studies undertaken by Anatec on behalf of the UK Government and individual clients show that vessels do pass consistently and safely within 1 nm of established OWFs (including between distinct developments) and these distances vary depending upon the sea room available as well as the prevailing conditions."* Furthermore, Berwick Bank OWF is passed by significantly more vessels than the Project and vessels greater than 200 m in LOA, with the largest being tankers of 330 m, and therefore a greater passing distance than from this Project would be prudent.

3. **Visibility**: Section 5.5.2 of the NRA (EIAR appendix 13-1) describes "hindering the view of other vessels under way". It is noted that the Project is a relatively small development, with spacing between WTGs in excess of existing OWFs. Therefore, the visual or radar identification of targets within or emerging from the OWF will still be possible. Where vessels do emerge from the OWF, a vessel proceeding at six knots (typical of smaller recreational and fishing vessels likely to be navigating through the OWF) would still take 5 minutes to intersect the path of a commercial ship passing at 0.5 nm from the OWF, offering a reasonable time to take appropriate collision avoidance. The risks associated with Project vessels emerging from the OWF can be managed through operational guidelines, marine coordination and Navigation Safety Management System (Table 6.3 EIAR appendix 13-1).

4. **Precedent**: There is significant precedent where vessels navigate within 1 nm of an OWF, and examples amongst many others are:

    a. Barrow, West of Duddon Sands, Walney and Ormonde OWFs: a major ferry route (>4 ferry transits per day) passes between the OWFs that is 2 nm wide and therefore traffic routinely passes between two OWFs at less than 1 nm passing distance.

    b. Teeside OWF: The approaches to the River Tees, a major UK port, with significant large cargo vessel movements, is located within 1 nm of Teesside OWF.

    c. Humber Gateway OWF: The northeast to southwest (NE-SW) route to the River Humber passes within 1 nm of the Humber Gateway OWF.

    d. Aberdeen OWF: located within 1 nm of the route into Aberdeen from the north, including the Orkney/Shetland ferry.

    e. Thanet OWF: Vessels routinely pass Thanet OWF when approaching the Thames Estuary at less than 1 nm.

    f. Rampion 2 OWF: The Application for Rampion 2 (EN010117) on the south coast of the UK includes a 1.3 nm wide 3.6 nm long crossing corridor which has been agreed with local operators and the MCA as being suitable for vessels of lengths of 90 m.

Therefore, passing distances should be determined on a case-by-case basis, and it would be reasonable to assume that for the frequency and sizes of vessels likely to navigate north of the Project, a passage >0.5 nm would be both appropriate and typical, and enable safe navigation around the Project.

2.5 Depth of Water and Under Keel Clearance

The MSO response has highlighted depth constraints associated with the 10 m contour north of the Project. Based on the analysis conducted, it is argued that the 5 m contour represents a more critical depth constraint.

1. As shown in section 2.3, the overwhelming majority of transits of this passage are of vessels which draw less than 5 m.

2. Dundalk has a significant depth constraint and is not accessible at low water.

3. The table of tidal levels referred to Datum of Soundings for locations near the proposed windfarm, obtained from Admiralty Chart 44, is provided in Table 2-2, with Cranfield Point the closest site. This demonstrates that at high water (HW), there is an additional 4.3 m to 4.8 m under the keel, offering significant additional UKC.

Table 2-2: Tidal Levels referred to Datum of Soundings (from Admiralty Chart 44).

Place	Lat (N)	Lon (W)	Heights in metres above datum			
			MHWS	MHWN	MLWN	MLWS
Cranfield Point	54°01’	6°04’	4.8	4.3	1.8	0.9
Kilkeel	54°03’	5°59’	4.7	4.1	1.5	0.8
Soldiers Point	54°00’	6°21’	5.1	4.2	1.6	0.6
River Boyne Entrance	53°43’	6°14’	5.0	4.0	1.7	0.6

4. Analysis of historical transits into Dundalk (see section 2.2) do so near to HW. Figure 2-7 shows the percentage of cargo vessel transits intersecting this gate in relation to HW. The analysis indicates that 22 (67%) of the cargo vessel transits on this route did so within two hours of a High Water (HW) and 28 (85%) did so within three hours of HW. Further analysis showed that the average tidal height at these HWs was 4.6 m, with a minimum height of 2 m within three hours of these HWs.

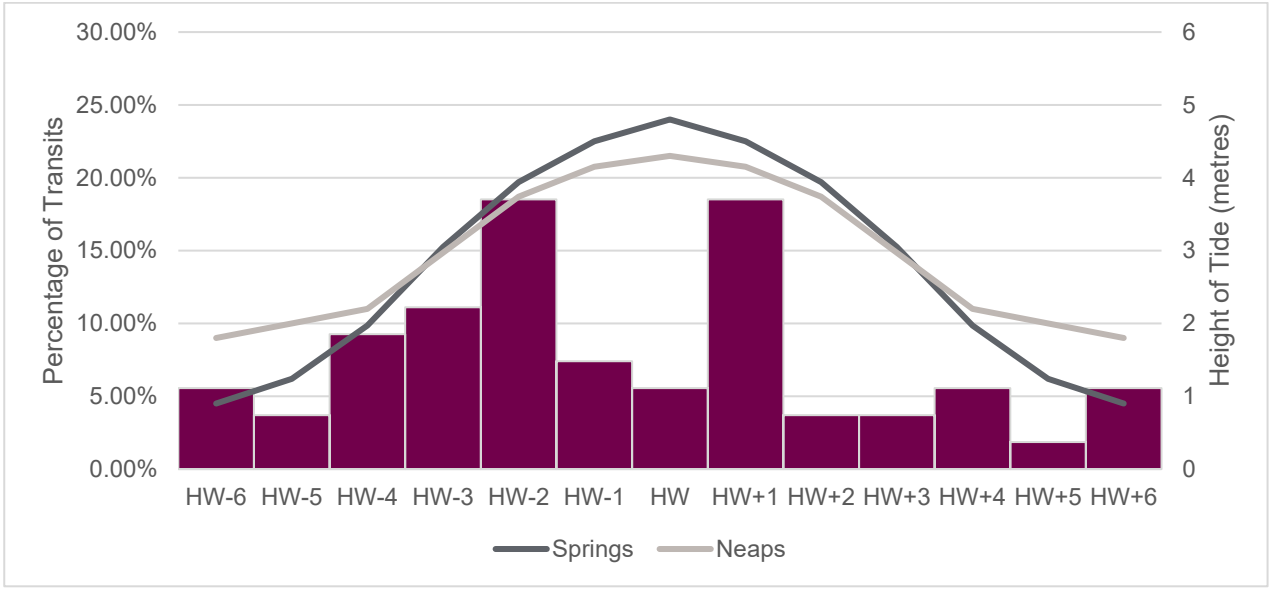


Figure 2-7: Percentage of transits intersecting a line drawn between the Ballygan Spit and the Project per hour in relation to HW (Cranfield Point).

5. There is little evidence that vessels are seeking to avoid spot depths of less than 10 m or within the 10 m contour:

    a. Figure 2-8 shows the transits of all cargo vessels north of the OWF area. Of these, 32% transit within 250 m of the 9.3 m spot depth suggesting it is not a constraint in passage planning.

    b. Figure 2-10 displays the swept path created by four of the largest cargo vessels, that were observed transiting into Dundalk. Three of these vessels were observed at their closest point to WTG ORI-A04 within 1.5 hours of HW.

6. The Admiralty Sailing Directions (NP40) note that Dundalk Bay is entered between Dunany Shoals and the dangers extending from Cooley Point, both of which are 5 m contours. In addition, the section also references Castle Rocks, a 3.7 m patch as constraints emphasising the criticality of the 5 m rather than 10 m contour.

7. It is noted that there is greater depth of water than charted to the north of the OWF area. Data from the Integrated Mapping for the Sustainable Development of Ireland's Marine Resource (INFOMAR) programme has been analysed to provide high level resolution data for the Project site and it is noted that the depths are greater than charted (see Figure 2-9):

    a. The charted 9.3 m sounding north of the OWF area is 9.75 m. WTG ORI-A05 lies over 0.9 nm from this feature.

    b. The main charted 10 m contour is approximately 80 m to 150 m further northeast than charted due north of the OWF area northwest corner.

    c. The charted 5 m contour is better aligned with the 6 m and 7 m depth soundings.

    d. WTG ORI-A04 is 1.5 nm from the 5 m contour at The Ridge and WTG ORI-A05 is 1.7 nm from the 5 m contour at The Ridge.

In summary, this analysis suggests that the 5 m contour is a more appropriate depth constraint for the vessels transiting northeast of the OWF area, which sits over 1.5 nm from the most north-westerly WTGs. Therefore, on the basis of the points above, principally that most vessels draw less than 5 m, most cargo vessels transit at HW and there is more depth of water than charted, the 5 m contour is considered the critical navigational constraint to the north of Project rather than the 10 m contour.

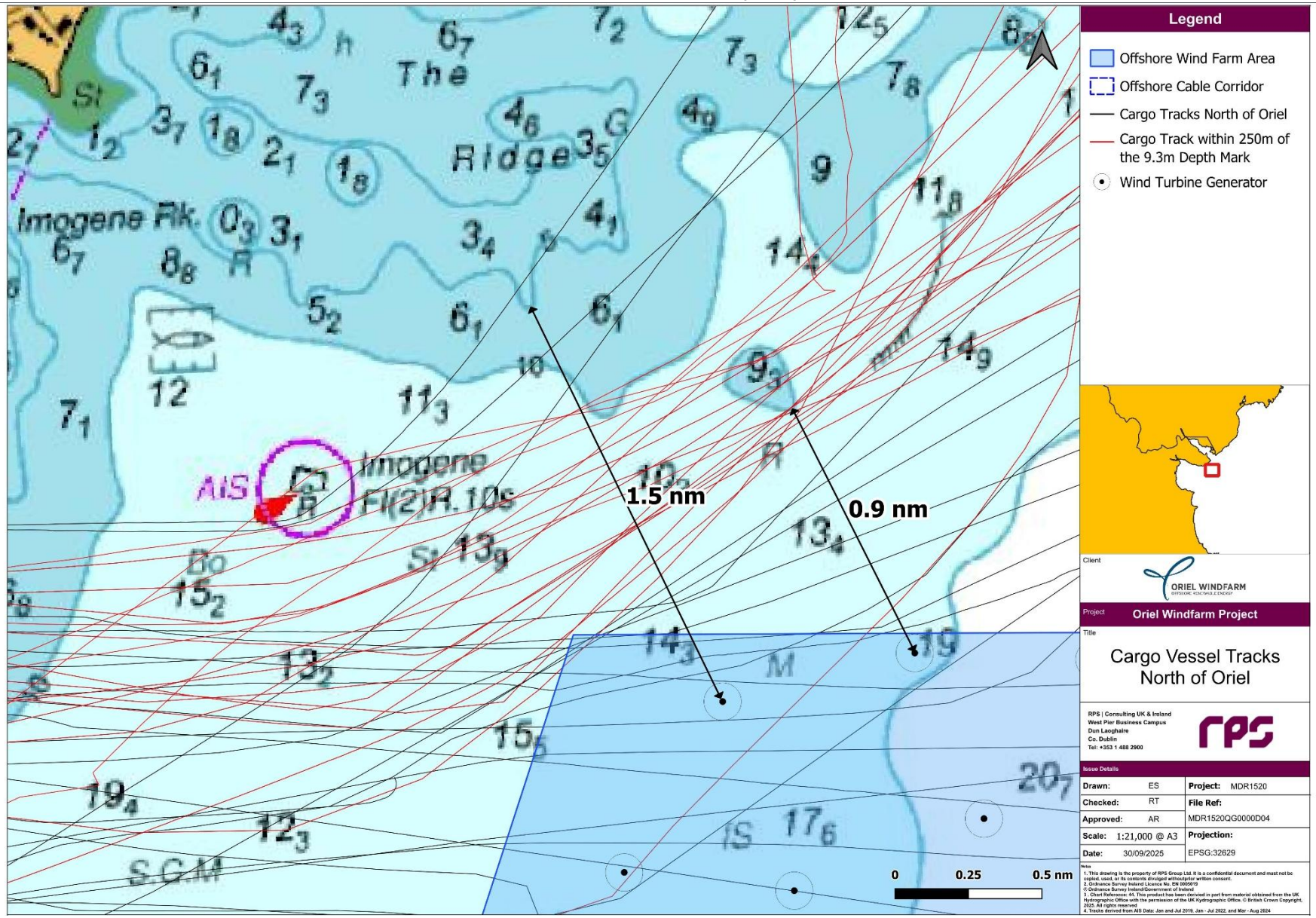


Figure 2-8: Cargo vessel tracks passing in/out of Dundalk north of the OWF Area.

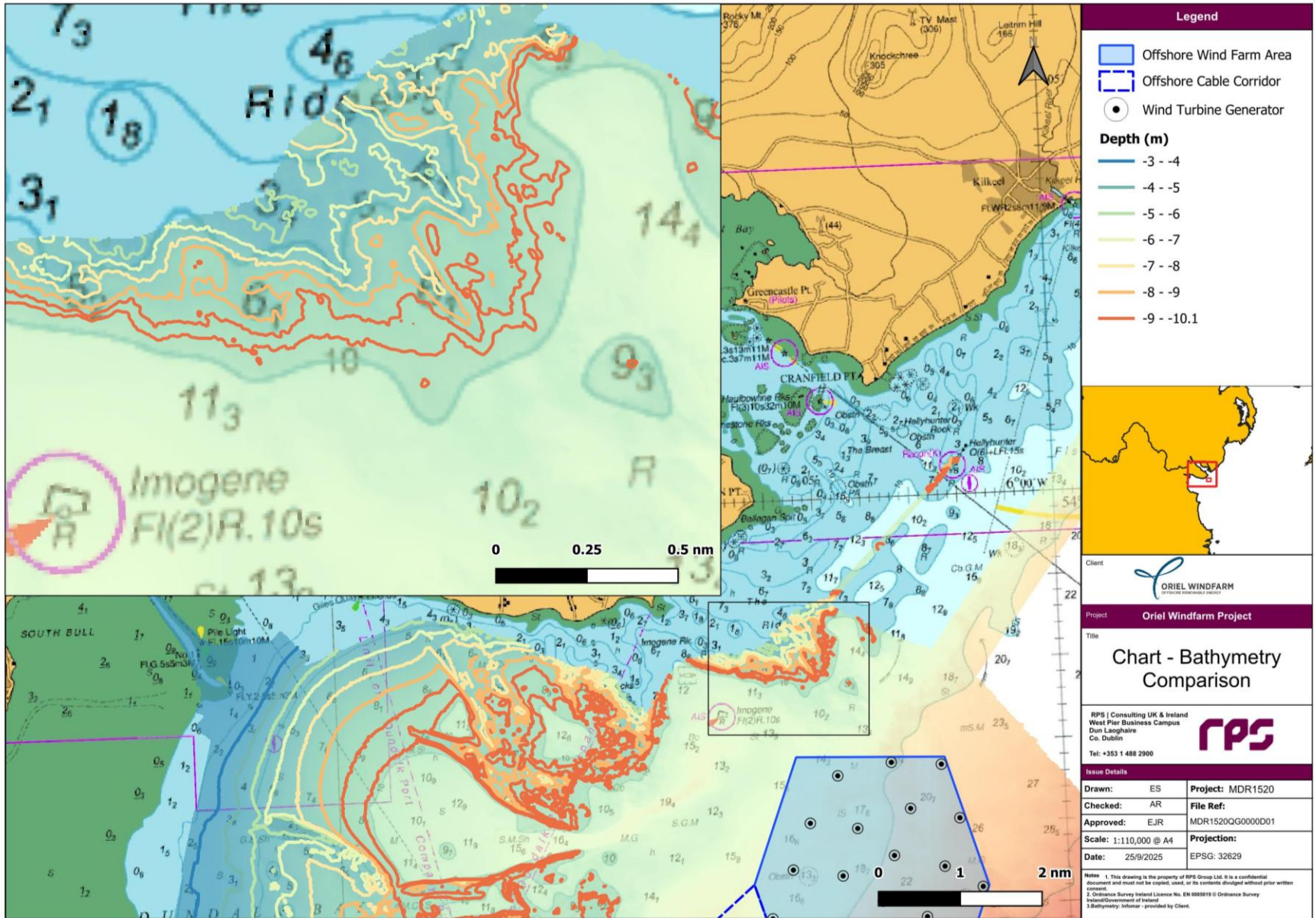


Figure 2-9: Comparison of chart and INFOMAR bathymetry data.

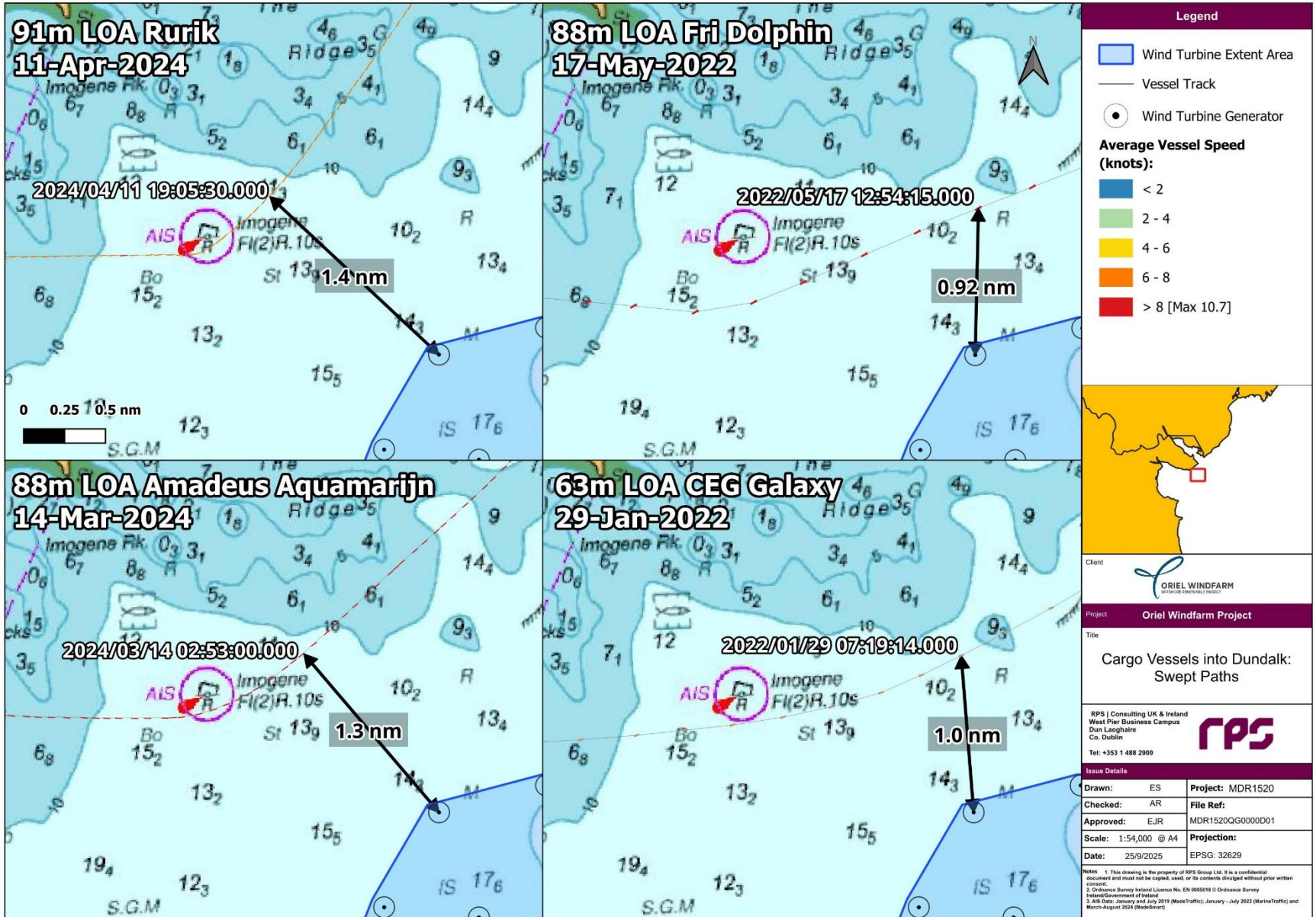


Figure 2-10: Cargo vessel swept paths to the northeast of the OWF Area.

2.6 Available Sea Room

In the previous sections, the following key points have been made:

- A minority of commercial vessels approach from the northeast into Dundalk (once every two weeks);
- These are typically small, 90 m LOA general cargo vessels with draughts of less than 4.4 m, although on occasion up to 5.4 m (one vessel in more than one year data);
- Passing less than 1 nm from an OWF is both common and compatible with guidance and good passage planning principles, particularly in constrained waters;
- Vessels navigating north of the OWF area do so with sufficient water for safe navigation; and
- The 10 m contour has little apparent influence on passage planning of commercial vessels and that the 5 m contour is the critical navigable depth.

Based on this, there is at least 1.5 nm of charted navigable water between WTG ORI-A04 and the 5 m contour south of The Ridge. The evidence presented demonstrates that this is sufficient sea room for the volume and sizes of vessels anticipated to navigate north of the Project:

- It is likely that a vessel would navigate the centre of this passage, 0.75 nm from the OWF and 0.75 nm from the 5 m contour (which would still be southeast of the 10 m contour). This is only marginally less than the desired 1 nm offsets from hazards stated by the MSO;
- As described in section 2.4, this would provide sufficient passing distance from the OWF area to perform either a full round turn or alter course to avoid another vessel;
- The volume of traffic identified north of the Project, is low, and the likelihood of two commercial vessels meeting each other is negligible (see section 2.2.3);
- During NRA consultation with Dundalk Pilots (12-Sep-2019), Dundalk Harbour Master (13-Sep-2019) and MSO (19-Sep-2019/28-Feb-2023), no concerns on navigational safety for vessels passing north of the Project were raised;
- As highlighted in the NRA (EIAR appendix 13-1), tidal streams are limited in the NRA study area and typically less than a knot even at springs. Furthermore, in strong southerly winds, consistent with the passage planning principles described above, the vessel would likely pass to the south of the Project to minimise the risk posed by the lee shore;
- As set out in section 2.4, the Project is small in size with significant spacing between WTGs which reduces the risks of unidentified small craft emerging from the OWF area and posing a risk of collision with commercial vessels navigating this passage;
- As noted in Section 2.2.3, in accordance with the Planning stage of the IMO's 1999 Resolution A.893(21), the navigator of a vessel will take into account the suitability of a passage north of the Project as opposed to south of Project depending on the characteristics of their vessel and the prevailing conditions. As demonstrated above, there is a suitable alternative option to deviate south of the Project; and
- Such channels are consistent with other passages elsewhere taken by vessels within 24 hours or arriving or departing at Dundalk during the data period:
    - Between islands in Scotland such as Islay, Jura and Scarba, which require transiting through areas < 0.5nm wide;
    - Similarly, there are cargo vessels that transit through the Sound of Mull in Scotland where there are sections <1.0 nm wide;

- Through the Kyle Rhea strait in Scotland, with sections <0.3 nm wide;
- Numerous port approaches in Ireland and the UK with c.1.0 nm and less searoom such as Shannon, Lough Foyle, Firth of Clyde and others, plus pilotage within port waters; and
- In addition, it should be recognised that the approaches to Dundalk itself are only a cable wide.

Therefore, on the basis of the points above, it is believed that there is sufficient sea room for safe navigation north of the Project for design vessels in most conditions at the discretion of the Master and is reflective of existing practice, supporting the findings of the NRA submitted by the Applicant and in accordance with the NMPF Ports, Harbours and Shipping Policy 1 and 2 (DHLGH, 2021).

2.7 Future Port Developments

Section 4.7 of the NRA (EIAR appendix 13-1) notes that the assessment did consider the potential increases in traffic associated with local port developments or wider macro-economic plans. Further detail is provided in the following section.

Dundalk: Analysis of vessel arrival data for Dundalk collected by the CSO (2024) shows that from a peak in 2006 of 672 arrivals per year (3.7 movements per day), this has decreased to approximately 100 to 150 arrivals per year (less than one movement per day) since 2011. Furthermore, consultation with Dundalk Harbour (13-Sep-2019) undertaken during the NRA highlighted there were no future plans for increase in the number of movements or a change in vessel size or trades, and that trade was declining. Consultation in 2025 also demonstrated that there were still no current plans to develop the harbour further.

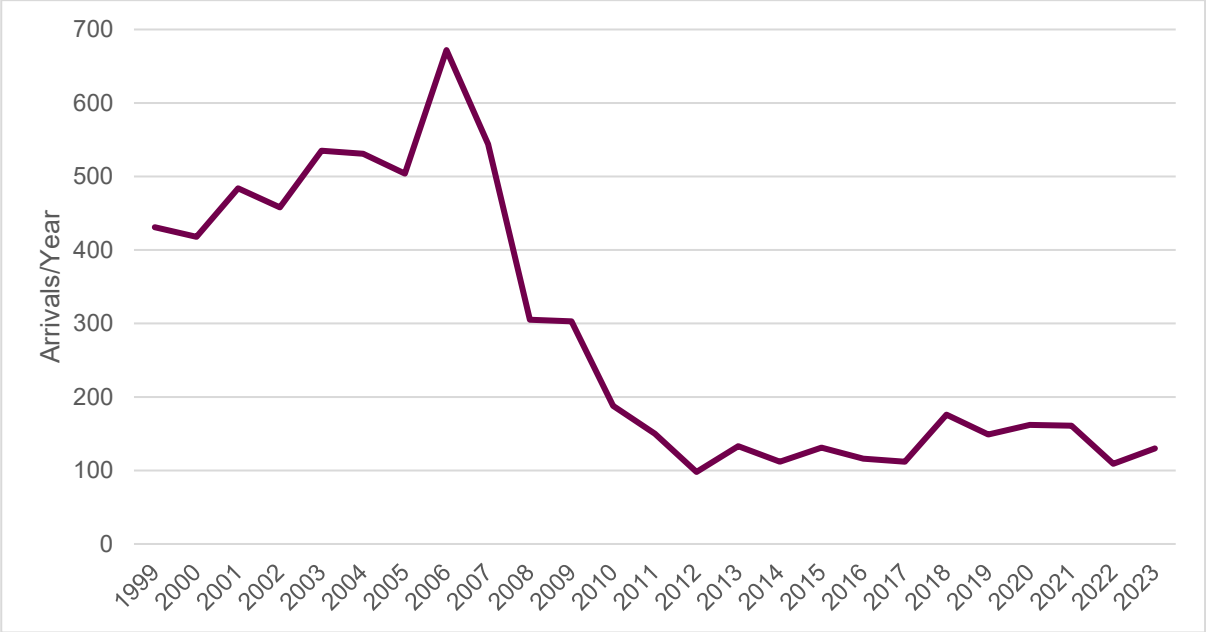


Figure 2-11: Arrivals in Dundalk per year (source: CSO TBA09).

- **Warrenpoint**: During consultation for the NRA, the IRCG (13-Sep-2019) noted that an increase in vessel movements to Warrenpoint was anticipated following the UK's departure from the EU. However, a data validation exercise conducted within the NRA using AIS data from 2022 did not identify any significant resulting increase. This is supported by analysis of CSO data since 1999 (CSO, 2024). Only those limited transits between Warrenpoint and Dundalk would pass to the north of the OWF area.

- **Greenore**: The NRA also refers to the completion of a project by Greenore Port to extend the 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. The six months of AIS data from 2024 used to inform this report suggest that no significant increase in traffic has occurred following the quay extension in 2022. As described above in section 2.3, very few vessels calling at Dundalk do so from Warrenpoint/Greenore, and these impacts are already assessed in the previous sections. As such, any increases in general trade in these ports/harbours is not considered to alter the conclusions of the assessment. Although a further development at Greenore Port is planned for construction in 2025 (completion in early 2026), this expansion is for an Operations and Maintenance Facility. As a result, this expansion is likely to cause an increase in project vessel traffic transiting between Greenore and offshore renewables projects, such as this Project and the North Irish Sea Array during their Operations and Maintenance phases. Therefore, this traffic is not constrained by a passage north of the Project as larger commercial vessels could be.

- **Drogheda**: Analysis of data from the CSO (2024) showed annual variations in vessel arrivals at Drogheda with no clear trend. Vessels navigating between Drogheda and Dundalk would pass clear to the west of the Project and it is unlikely that any routes between Drogheda and Warrenpoint would pass west and north of the Project given the passage planning principles set out in section 2.2.2 and section 2.6 and that a route to the east in deeper water is of a similar distance.

- **Bremore Port Development**: It is noted that there is a proposal for a deep-water port south of Drogheda. It is anticipated that with the exception of a possible route to Warrenpoint, all likely trade routes to this port would be clear of the Project. For a route to Warrenpoint, as noted above for Drogheda, it is unlikely these vessels would pass west and north of the Project.

- **Dublin**: The Dublin Port Masterplan 2040 could result in increases in vessels calling at Dublin and therefore on routes to/from Dublin. Developments at Dublin would not be relevant to this Project; firstly, the main commercial traffic routes in the Irish Sea from the north would pass clear to the east of the Project, given the geography of the eastern Irish coastline. Secondly, traffic between Dublin and Dundalk would pass the route to the southwest of the Project, and not the passage to the north highlighted in the MSO response.

Given the negligible impact on vessel routeing to those ports and harbours identified above for which there is known expansion plans, it is not considered that those hazards and impacts identified within the NRA would be substantially altered as a result of those expansion plans from the existing baseline traffic profile. Furthermore, the Project is not considered to significantly impede on any of the above ports existing or future development opportunities and therefore adheres to the NMPF's Ports, Harbours and Shipping Policy 2 (DHLGH, 2021).

2.8 Mitigation

2.8.1 Standard Mitigation Measures

Within the NRA (EIAR appendix 13-1, volume 2B) a number of key mitigation measures are proposed which would manage the risk posed to vessels navigating north of the Project. These are described in Table 2-3. During consultation with Dundalk pilots (12-Sep-2019), Dundalk Harbour Master (13-Sep-2019) and MSO (19-Sep-2019/28-Feb-2023), no requirement for further risk controls was identified.

Furthermore, the Commissioners of Irish Lights (CIL) state in their response to the statutory consultation on the Oriel Wind Farm Project application that "*Irish lights has been actively engaged with the Oriel Windfarm project team through several meetings prior to submission of the planning application and is generally satisfied with the position, layout and proposed mitigation measures included in the development consent application documents.*"

Table 2-3: Summary of key relevant mitigation measures in the NRA (appendix 13-1, 2024).

Number	Risk Control
1	Promulgation of Information – including Notice to Mariners
2	Continuous Watch by Very High Frequency (VHF)
4	Aids to Navigation installed on the OWF
5	Vessel Traffic Monitoring by AIS, VHF, Closed-Circuit Television (CCTV) and other means
6	Safety documents (Emergency Response Cooperation Plan (ERCoP) / National Strategy for Maritime Security)
7	Guard Vessels
9	Vessel Compliance with Standards
12	Marine Coordination
14	Charting

2.8.2 Further Mitigation Measures

To further support maritime safety, it may be suitable for updates to be made to the appropriate Admiralty Sailing Directions (NP40) for vessels bound for Dundalk. At present the Sailing Directions note that Dundalk Bay is entered between Dunany Shoals and the dangers extending from Cooley Point. A note could be added that recommends deep draught vessels bound for Dundalk pass to the south of the Project. In addition, Notice to Mariners will be prepared to ensure vessels approaching Dundalk are aware of the works associated with the Project and vessel pre-arrival information will be issued to vessels bound to Dundalk that could provide further routeing guidance.

During consultation with the CIL (19-Sep-2019/21-Nov-2022) undertaken as part of the NRA (Table 1-3 of EIAR appendix 13-1, volume 2B), it had been discussed whether there would be benefit in relocating the Imogene red lateral mark. Given the discussions above noting the availability of suitable depths of water up until Castle Rocks and The Ridge, the presence of this buoy at its current position following construction of the Project (subject to consent) acts as an artificial constraint on vessel movements, reducing the sea room available. As noted in section 2.3, historical movements of vessels in excess of 4.0 m draught have crossed the five-metre contour, passed into deep water to pass south of Imogene before crossing the 5.0 m contour on entry into Dundalk. Therefore, the position of this buoy in more than 12 m of water would serve little benefit in keeping vessels from grounding hazard.

The Applicant therefore proposes alterations to the aids to navigation, as presented in Figure 2-12, subject to agreement with CIL. This includes replacing the Imogene red lateral mark with either one or two south cardinal marks located at The Ridge and/or Castle Rocks.

In the existing position, the Imogene buoy would compress vessels to a narrow passage that requires an alteration of course between itself and the closest WTG, whilst not marking the areas of shallows to the north of the WTGs. Relocating the buoy further northeast (as shown in Figure 2-12) would better manage the flow of traffic and mark the narrowest point of the passage. Given this buoy would mark a specific shallow, it is proposed that a South Cardinal would be more appropriate than a red lateral. Specific positioning and characteristics would be agreed with CIL.

As a result of the low traffic volume and proposed mitigation, the Applicant considers that the MSO's position that the three northeasterly WTGs (ORI-A04, ORI-A05 and ORI-B05) should be relocated to increase sea room is not considered necessary or proportionate to reduce the risks to ALARP.

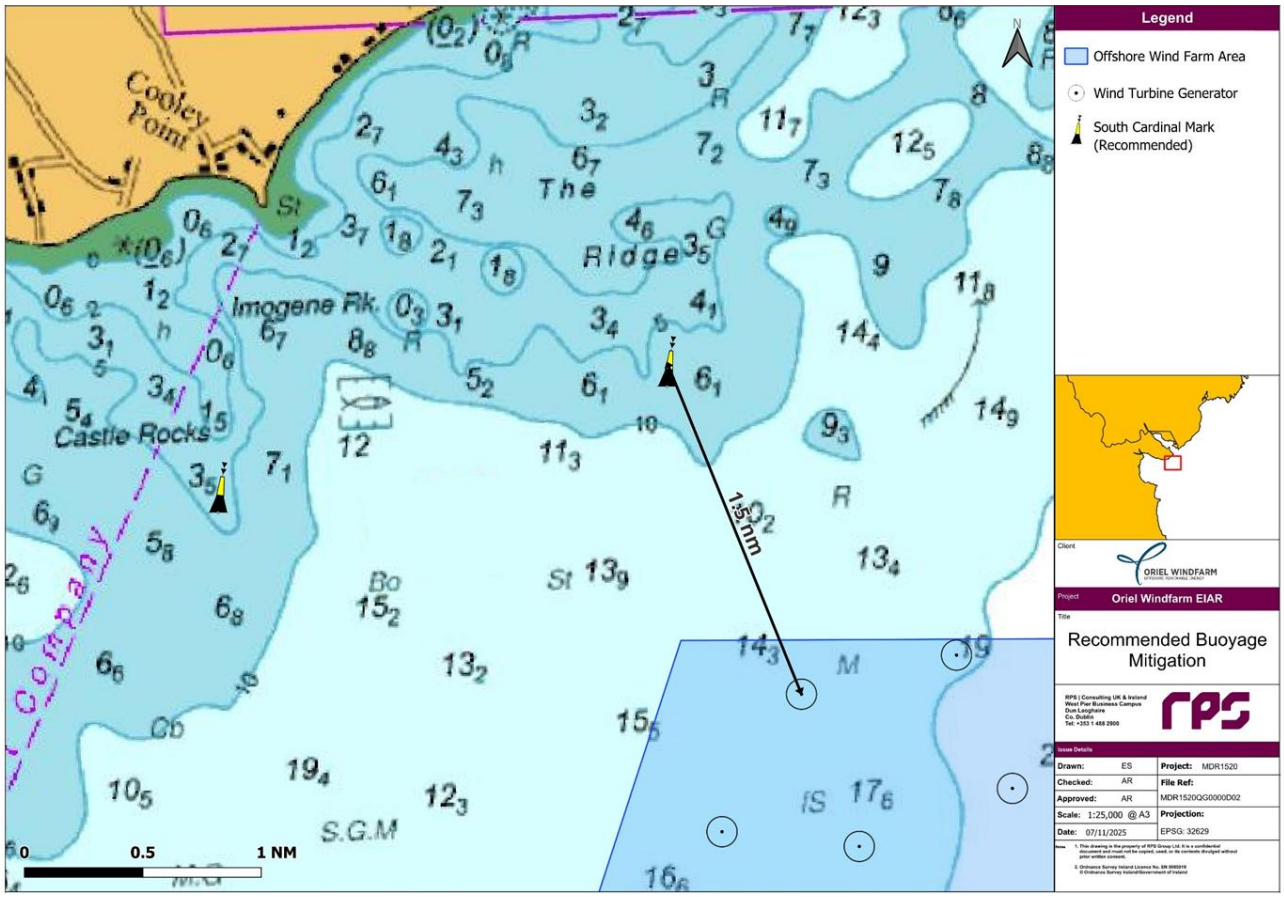


Figure 2-12: Recommended buoyage mitigation.

2.9 Summary

In summary, the evidence presented above supports the conclusion reached within the appendix 13-1: Navigation Risk Assessment (EIAR volume 2B).

1. No concerns have been raised on the impact of small craft routeing or for commercial shipping approaching Dundalk from the east or south.

2. The assessment has shown that there are very limited numbers of shipping movements into the Port of Dundalk (once every two weeks) from the northeast, and that this route is therefore "less strategically important" and of low significance. This minor impact should be considered against the significant benefits of the Project.

3. AIS data and long-term statistical analysis of vessel arrivals at Dundalk suggest a more accurate maximum design vessel size for navigating north of the Project would be a general cargo ship of 100 m LOA and 5 m draught, significantly less than claimed by MSO.

4. It is considered acceptable and consistent with guidance to assume that vessels of this nature could within 1 nm of a windfarm and there is considerable precedent for operational OWFs where this is the case.

5. An alternative passage is available to enter the Port of Dundalk around the south side of the Project, which results in a minor extension to a typical transit plan for vessels coming from the north into the Port.

6. The 5 m contour is a more critical navigational constraint to the north of the OWF Area rather than the 10 m contour, providing at least 1.5 nm of sea room from the most northerly WTG.

7. Should a Master choose to transit to the north of the Project, there is sufficient sea room for the volume and types of traffic anticipated to be navigating this passage without the need for amendments to the Project design, such that the Project does not result in a significant impact to ships transiting into Dundalk.

8. There is no evidence that proposed future expansions would aggravate the impacts assessed in the NRA.

9. A number of key mitigation measures (including promulgation of information, safety documents, and aids to navigation) are proposed which would manage the risk posed to vessels navigating north of the Project. The loss or relocation of the 3x northeastern WTGs is disproportionate for the volume and sizes of vessels affected in the context of the significant benefits the Project will bring to meeting the energy needs for the Republic of Ireland.

10. Consultation with key stakeholders, including Dundalk pilots, Dundalk Harbour Master and MSO did not raise concerns on navigational safety and no further risk controls were proposed.

11. Therefore, the risk posed by the Project to navigational safety is managed to ALARP and is therefore Tolerable, in compliance with the NMPF Ports, Harbours and Shipping Policy 1 and 2.

References

Berwick Bank (2023). Volume 3 – Appendix 13.1 Navigational Risk Assessment. Available at: https://berwickbank-eia.com/.

CSO (2024). Statistics of Port Traffic Q4 and Year 2023. TBA09: Number of vessel arrivals by size class, port and year.

DESNZ (2023) National Policy Statement for Renewable Energy Infrastructure, Available at: https://www.gov.uk/government/publications/national-policy-statement-for-renewable-energy-infrastructure-en-3

DECC (2025) Climate Action Plan 2025

DoT (2025). Marine Navigational Safety & Emergency Response Risk of Offshore Renewable Energy Installations.

DTTS (2013) National Ports Policy. Available at: https://assets.gov.ie/11557/277d22d364fe4c13be390493282c0557.PDF

DHLGH (2021). NMPF (2021). National Marine Planning Framework. Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/139100/f0984c45-5d63-4378-ab65-d7e8c3c34016.pdf#page=null

IMO (1999). Resolution A. 893(21). Guidelines for Voyage Planning. Available at: https://wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/AssemblyDocuments/A.893(21).pdf

MCA (2021). MGN654. Available at: https://www.gov.uk/guidance/offshore-renewable-energy-installations-impact-on-shipping.

MCA (2024). MGN654 Annex 5. Available at: https://www.gov.uk/guidance/offshore-renewable-energy-installations-impact-on-shipping. Oriel Wind Farm Project (2024). Planning Application. Available at: https://www.pleanala.ie/en-ie/case/319799

PIANC (2018). MarCom WG Report No. 161: Interaction Between OWFs and Maritime Navigation.

Rampion 2 (2024) Deadline 1 Submission – 8.32 Applicant's Response to Issues Raised at Procedural Deadline A (REP1-034). Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010117/EN010117-001005-Rampion%20Extension%20Development%20Limited%20-%20Applicant%E2%80%99s%20Responses%20to%20Issues%20Raised%20at%20Procedural%20Deadline%20A.pdf

SEAI Wind Atlas (2003). Available at: https://www.seai.ie/renewable-energy/wind-energy/wind-atlas-mapScottishPower Renewables (2025). West of Duddon Sands OWF. Available at: https://www.scottishpowerrenewables.com/pages/west_of_duddon_sands.aspx

SEAI Wind Atlas (2003). Republic of Ireland – Wind Atlas

The Planning Inspectorate (2016). Examining Authority's Report of Findings and Conclusions and Recommendation to the Secretary of State for Energy and Climate Change.

UKHO (2023). ADMIRALTY Sailing Directions, NP40: Irish Coast Pilot. 22nd Edition.

United Nations (2015). United Nations Sustainable Development Goals